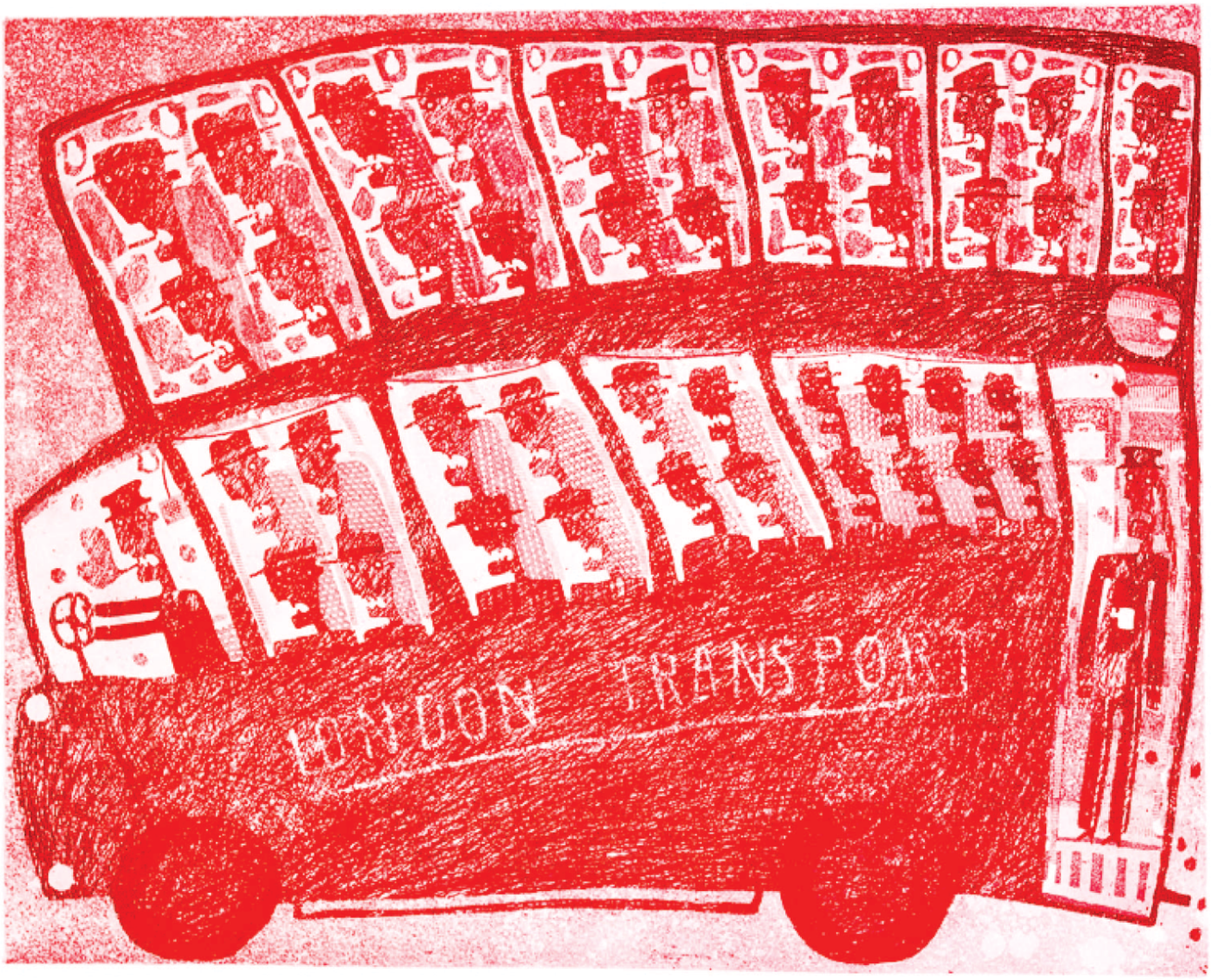

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A Path to Enhance University Relevance and Competitiveness in Developing Countries

Serwan M J Baban, The Presidency of Kurdistan Region, Iraq

The European Conference on Education 2023
Official Conference Proceedings

Abstract
Higher Education Institutions attempt to remain relevant and competitive through modernizing their teaching, research, and consultancy as well as engaging effectively with society, government and the private sector at all levels. However, attaining these aspirations is a challenge due to multiple issues which include fluctuations in student enrolments, market influences and the strains to fulfil public expectations. Managing these interlocked issues successfully will require setting the future plans of the Institution based on its assets, markets, political and economic issues, customers and competitors. The plans will need to clearly show direction, create measures for success and drive key decisions. This paper presents an interactive process for planning in higher education and developing a practical strategic plan as a road map to determine what an institution aims to become in the future. Hence, providing a framework to facilitate an institution's vision, mission, values, goals, and strategies to remain relevant and competitive. In addition to managing the implementation procedure to successfully realize the declared objectives.

Keywords: University, Challenges, Relevance, Competitiveness, Strategic Plans, Developing Countries

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1. Introduction

Higher Education Institutions endeavour to remain relevant and competitive by continuously raising their reputations in terms of teaching, research, and consultancy as well as engaging effectively with society, government and the private sector at all levels. However, due to multiple external and internal issues they often face significant challenges in attaining these aspirations (Baban, 2017, 2023). The challenges often include:

i. Fluctuations in student enrolments, the change in student demographics and associated funding irregularities.

ii. Market influences driven by the threat of competition has led to the emergence of higher education as a business. As a result, institutions have been under pressure to expand rapidly and redefine their roles and vision to match the new reality (Newman and Couturier 2002).

iii. The pressures to meet public expectations and the obligations to become more transparent and accountable in the new competitive environment (Moja, 2008). Therefore, the "business as usual" approach became less and less acceptable from the public perspective (Taylor et al., 2008).

iv. Meeting the demands made by accrediting bodies, these bodies, responding to external demands for accountability through the development of standards for assessment and learning outcomes, started to assert that HEIs should have a strategic plan and an assessment plan in order to meet accrediting requirements (Baban, 2018a).

It has been recognised that these challenges can often be handled successfully through good governance, effective management practices and resourceful planning; these will result in university aligning its decisions with its mission and goals, while addressing risk assessment and risk management and considering the needs and expectations of its internal and external constituents (Baban 2018a). In other words, to enable the organisation to determine what it intends to become in the future and the path to realise its aspiration.

Success in carrying out effective governance, management and planning responsibilities to remain both relevant and competitive often depends upon observing the principles of good governance, accountability and inclusiveness, having a culture of openness and integrity and finally being steered by organisation believes and values in its actions and decision-making (Biggs, 2001; Biggs and Tang, 2007; Baban, 2017, Baban 2018b, 2023).

2. Strategic Planning in Higher Education

Strategic planning in higher education emerged in the 1970's and 1980's and has been steadily evolving since as a response to various external and internal challenges facing higher education intuitions (Chaffee, 1984; Gumport and Sporn, 1999; Hinton, 2012).

Crisp (1991) defines strategic planning in higher education as "the set of activities designed to identify the appropriate future direction of a college and includes specifying the steps to move in that direction."

Essentially, strategy involves setting the future plans of the Institution, but it requires a comprehensive understanding of the Institution's resources (such as cash, assets and employees), it's environment (such as markets, political and economic issues, customers and competitors) and exactly what the Institution's stakeholders (anyone with an interest in the business, such as shareholders, staff, customers, government, etc.) expect of the Institution.

Consequently, strategic planning is a tool for developing a road map to determine where a university is headed over a specified time frame and the process by which it will realise its goals and objectives. Consequently, there is wide consensus that strategic planning, if developed and implemented properly, will offer universities a solid road map to progress and to successfully serve the community (Hinton, 2012; Baban, 2017, 2023). More specially, having an effective a strategic plan will:

i. Provide direction: One of a strategy's main advantages is the direction it provides for the Institution. By laying out a well-thought-out plan, the institution will be sure that everyone is working toward the same objectives and will give staff members a sense of shared responsibility.

ii. Establishes a measure for success: by enabling organisations to compare their growth and performance to predetermined objectives.

iii. Increases adaptability: In the current innovation-focused society, Institutions need to be responsive to change. An effective business strategy will allow Institutions to predict and meet the changing demands of the current market.

iv. Enhances adaptability: Institutions must be flexible to change in the modern, innovation-focused society. Institutions will be able to anticipate and meet the shifting demands of the present environment with the help of an effective business plan.

As a consequence, strategic planning has emerged as an effective tool for developing and implementing a proactive and flexible stance whilst operating in a fluctuating environment (Baban 2018b, 2023). It follows that strategic plans were viewed as pathways for formulating institutional mission and vision, prioritising resources, and promoting organisational focus.

Contemporary strategic plans have multiple components and each component serves a specific purpose. These components are planning tools used either separately or in groups, the planning process is tasked with ensuring that these individual components are aligned with each other and mutually supportive.

Strategic planning can be developed with two focuses, first a focus on internal pressures, bases strategic planning on institutional values, and is purely practical, seeking to assist the university to run efficiently and effectively (West-Burnham, 1994; Larsen and Longfield, 2005). The other focus is related to positioning the university in relation to its external environment, emphasising planning in response to financial changes, government regulations, changes in the student market, competition from other universities, emerging technologies, or international pressures (Gosport and Scorn, 1999; Bayenet et.al., 2000).

In terms of process, strategic planning will need to examine the recent history of the institution as well as the changing internal and external circumstances (Baban, 2018a;

2018b). In addition to developing comprehensive strategies, and detailed action plans for the core activities of teaching and learning, research, consultancy and community service (Fig 1).

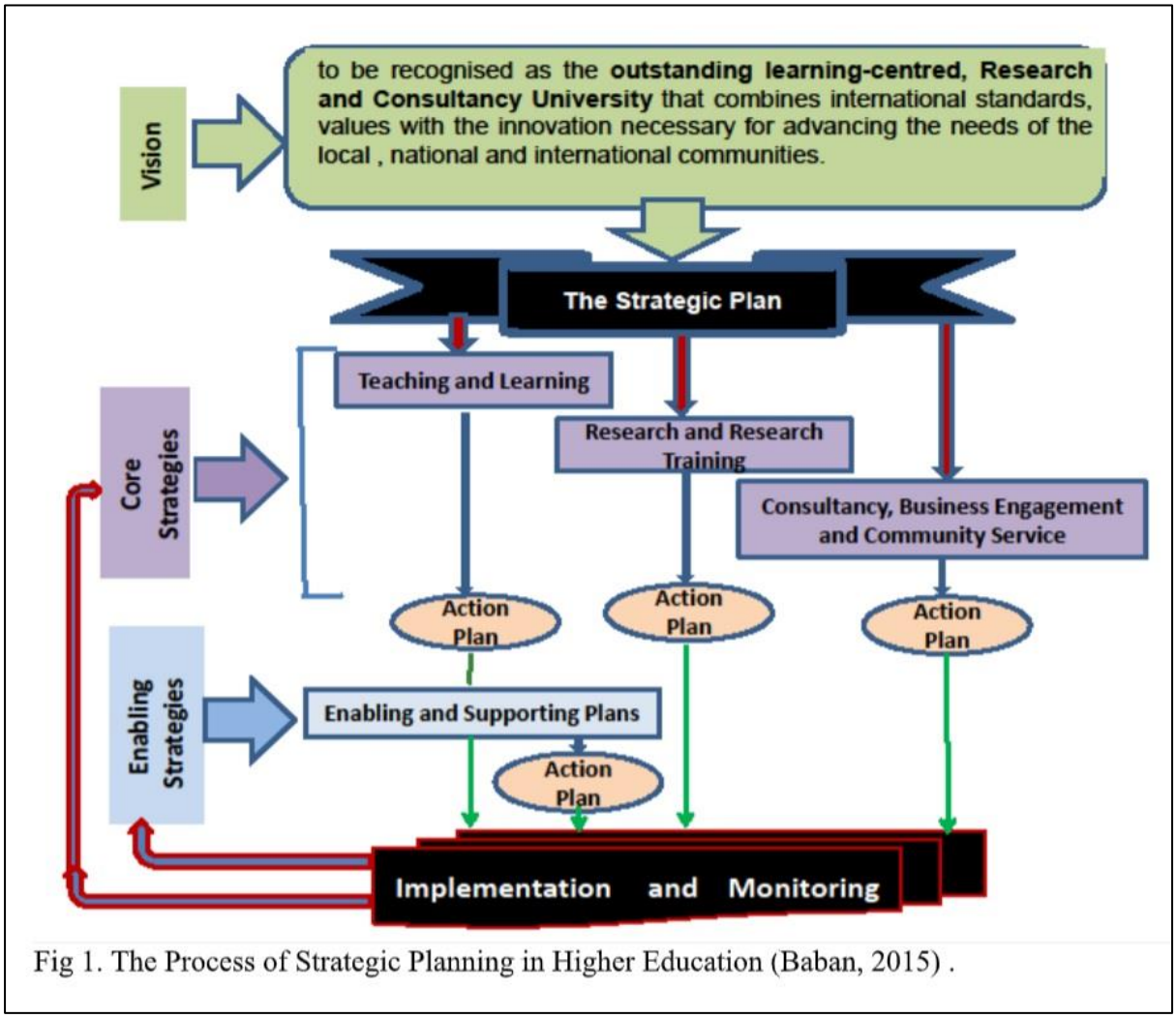

Fig 1. The Process of Strategic Planning in Higher Education (Baban, 2015) .

These supporting documents will provide specific points of reference and guidance in the planning process and during the implementation period. The process will lead to assessments of institutional strengths and weaknesses and determination of how to capitalise on strengths and to articulate a vision for the organisation's future and determine the necessary priorities, procedures, and operations to achieve that vision.

The vision must be based on the values of those involved in the process and will have a stake in the achieving the vision. The collective institutional vision is then translated into a mission statement and goals. Then after, the planners need to articulate practical strategies for achieving the goals as well as addressing goal measurement which involves articulation of objectives (the short-term conditions needed to achieve desired conditions for a particular goal), indicators (the quantifiable measures of progress; they provide numeric assessment of the desired conditions of well-being for a particular goal) and benchmarks (the target levels of performance expressed in measurable terms and specified time frames, against which actual achievement is measured).

The planning process will also provide an interactive platform for all relevant staff at the institution to develop and document a collective vision, values and mission statements (Baban, 2015).

2.1 Definitions and Terms

Developing and implementing a strategic plan requires clear definitions for the essential terms and concepts from the Higher Education Management and Governance perspective. The following represents some of the key definitions and terms;

i. Vision Statement

The vision statement is the expression of institutional aspiration, and is based on analysis of the institution's environment. It is a motivating and ambitious statement about what the university would like to achieve or accomplish in the mid-term or long-term future. It should challenge and inspire staff, students and all other stakeholders. It is intended to serve as a guide for deciding current and future courses of action.

A vision statement describes the University as it would appear in a future successful state. It should essentially answer the question: If the organisation were to achieve all of its strategic goals, what would the University look like a number of years from now?

ii. Mission Statement

The foundation of any strategic plan is the institutional mission statement. It is a written declaration of the University's core purpose and focus that normally remains unchanged over time. It describes the University's overall intension, reason for existence and what it does at the levels of University, College and Department (Baban, 2018a, 2018b, 2023). Hence, this statement needs to be brief and clearly explain why the institution exists and what its operations are intended to achieve.

The mission statement supports the vision and serves to communicate purpose and direction to staff, students and all other stakeholders. More specifically, effective mission statements should:

1. Serve as filters to separate what is important from what is not.

2. Clearly state which markets will be served and how.

3. Communicate a sense of intended direction to the entire organization.

Hence, a mission is different from a vision in that the former is the cause and the latter is the effect. Furthermore, a mission is something to be accomplished whereas a vision is something to be pursued for that accomplishment.

iii. Values

Values Statement should explain what the institution stands for and the way in which it intends to conduct its activities. Therefore, the values statement should declare, "These are

the characteristics we believe are important in *how* the institution will work to achieve its goals."

iv. Goal

Goal is the precise final outcome toward which the plan is directed. It is the general statement of a long-range purpose that should directly address needs and is outcome and not process oriented. Therefore, the university goals need to clearly identify the aspirations in a tangible, achievable and measurable outcome(s) that can be reasonably expected at the end of the planning period.

Hence, the strategic plan's broad goals should guide the process. Top-down guidance on vision, mission, and goals, is necessary, especially given the decentralised structure of many universities. However, given the structure of universities, bottom-up planning is also an essential requirement to ensure comprehensive participation in and ownership of the developed strategic plans.

v. Objective

Objective is a statement of the results to be achieved based on specific time frames, method of measuring the results, and criteria for successful achievement. Hence, objectives should be stated in ways that clearly describe what will be accomplished and how it will be achieved. Furthermore, objectives state results, not activities and when accomplished it will lead to the goal.

2.2. SWOT Analysis

This analysis can be viewed as an initial decision-making tool for evaluating the institution's internal strengths and weaknesses, its opportunities for growth and improvement, and the threats the external environment presents to its survival (Cheng-lin H and Chen Jian W., 2016). It is a planning instrument that involves specifying the objective of the organisation and identifying the internal and external factors that are favourable and unfavourable to achieve that objective (Dyson, 2014).

In the context of developing and implementing a strategy for a university, it can be briefly conceptualised as:

- Strengths: characteristics of the University that give it an advantage over others universities at present time.
- Weaknesses: characteristics that place the University at a disadvantage relative to other Universities at present time.
- Opportunities: elements that the University could exploit to its advantage at present and in the future.
- Threats: elements that could cause difficulties and challenges for the University at present and in the future.

This analysis in practical terms is conducted through:

1. The collection and evaluation of key data (academic programs, enrolment and student success, governance, management, finances, operations, and processes), then assessing the institutions capabilities in these areas.

2. Sorting the four categories of data: strengths, weaknesses, opportunities, and threats. Strengths and weaknesses generally stem from factors within the organization, whereas opportunities and threats usually arise from external factors.

3. Developing a SWOT matrix for different governance and management options under consideration. Then an expert panel will need to complete a separate SWOT matrix for each alternative.

4. Incorporating the SWOT analysis into the decision-making process to determine which governance and management options best meets the organization's overall strategic plan.

3. An Interactive Bottom-Up Approach for Developing a Strategic Plan for a Higher Education Institution

This process amongst other issues will require growing and obtaining collective intuitional understandings and agreements on the vision, core values and operating principles as well as priority and accountability issues (Dyson, 2004). More specifically;

3.1. Institutional Agreements

An essential first step for strategic planning is obtaining institutional agreements on the following concepts and principles (Baban, 2015, 2017, 2023):

i. **Organizational Core Values and Operating Principles.** These are the beliefs and principles that guide the organization; these should be shared and strongly held values by senior management and staff.

ii. **Vision for the Target Community.** This is the University's image of what the community it serves would be like if the values and operating principles were shared and practiced by all involved.

iii. **Mission.** This is the University's public statement of the contribution it promises to make to help accomplish the community vision.

3.2. The Planning Process

Once, a collective institutional view is developed and agreed upon, the planning process can proceed through determining the following steps:

i. **The Current Status.**
Conducting external and internal assessments to attain a clear understanding of the current status, the university's competencies and how, in reality, the university, at present, appears to students, staff and employers within the ongoing competitive Higher Education environment.

ii. **Priority Issues.**
The priorities will set the strategic direction of the University and define the mission (markets, customers, products, etc.) and vision (conceptualization of what the university's future should or could be).

iii. **Expected Objectives.**
Defining what must be achieved, the expected objectives that clearly state what the University must achieve by the end of the planning period to deliver the priority issues.

iv. **Accountability.**
Identifying and naming the responsible staff for implementing the action plans and associated budgets within agreed specific time frames. This will require clearly communicating the processes involved, step by step, such as who will allocate time, and provide human capital, and funds to address the priority issues.

v. **Reviews.**
The University should scheduleregular formal reviews of the process, to ensure that the plans perform to the required standards and within the specified timeframes. This is also essential for evaluating the outcomes and refining the plans as necessary.

3.3. An Interactive Process for Developing a Strategic Plan

The following represents a participatory and an interactive Process for developing the strategic plan. The process consists of seven tasks aimed at collecting information from all relevant staff at various University, College and Department levels (Cheng-lin H and Chen Jian W., 2016). These tasks can only be successfully executed after establishing institutional agreements on the fundamentals such as goal, core values and operating principles.

Task 1: Define or Review the Organization's Vision, Mission and Values

Develop consensus on why the organization exists, what goals or outcomes it seeks to achieve, what it stands for, and whom it serves.

Outcomes From Task 1:

1.1. Vision:

i. Based on institutionally agreed values, concepts, definitions and your own experience, list five points best defining the vision for the University as a national/international university.

ii. Develop and provide this information at one of the following levels as appropriate: University, College (specify) or Department (specify).

1.2. Mission:

i. Based on institutionally agreed values, concepts, definitions and your own experience, list five points best defining the Mission for the University.

ii. Develop and provide this information at one of the following levels as appropriate: University, College (specify) or Department (specify).

1.3. Values:

i. Based on institutionally agreed values, concepts, definitions and your own experience, list five points best defining the values for the University.

ii. Develop and provide this information at one of the following levels as appropriate: University, College (specify) or Department (specify).

Task 2: SWOT (Strengths, Weaknesses, Opportunities, Threats) Analysis

The University has aspirations to become international and competitive at regional, national and international levels.

Given the common perceptions, development history and current practices it is critical to focus on quality, relevance, internationalisation, accreditation, graduate profile/employability (preparing graduates for the new realities of nation building, wealth creation, market demands and competition).

Outcomes From Task 2:

i. Given the new realities and aspirations of the University and based on institutionally agreed values, concepts, definitions and your own experience, perform SWOT analysis for The University.

ii. Develop and provide this information at one of the following levels as appropriate: University, College (specify) or Department (specify).

Task 3: Developing the University Graduate Profile

The University graduates will leave the institution with specific knowledge and expertise in their chosen discipline as well as the necessary skills to succeed in a competitive environment and to make tangible contributions to the development regionally, nationally and internationally. Furthermore, the University aims to prepare graduates to become active global citizens and leaders, attuned to cultural diversity to benefit from employment opportunities regionally, nationally and internationally.

Outcomes From Task 3:

i. Based on institutionally agreed values, concepts, definitions and your own experience, list five points best defining the knowledge and skills of the University graduatesbased on Market needs, this will be the ‘The Brand’ and the Profile of all university graduates.

ii. Develop and provide this information at one of the following levels as appropriate: University, College (specify) or Department (specify).

Task 4: University Core Functions: Teaching and Learning

University Teaching and Learning will be centred on the preparation of a distinctive university graduate who will leave the University with the knowledge, skills and the intellectual curiosity required for development regionally, nationally and internationally.

Realising this graduate profile which has a focus on employability skills necessitates addressing the following aspects of undergraduate education at the University.

Outcomes From Task 4:

i. Based on institutionally agreed values, concepts, definitions and your own experience, list five points best defining the Teaching and Learning aspects of curriculum development, learning and teaching quality for the University.

ii. Develop and provide this information at one of the following levels as appropriate: University, College (specify) or Department (specify).

Task 5: Research and Research Training

Research is the systematic generation of new knowledge, development of new ideas and experimentation with new techniques. These activities inform student learning and provide an intellectual platform for engagement with Business, Government and the wider society.

The quality and impact of its research is what will bring the international recognition that it needs to increase its effectiveness in accessing funds in today's competitive international environment. It is research that will contribute to the rejuvenation of teaching programmes and enhance their quality and relevance, and that will enable the University to continue to set and lead the standards of scholarship regionally, nationally and internationally.

If the University is to become a major contributor to economic, social and cultural development, then, this critical function must be expanded and strengthened in order to become a more research driven institution.

Outcomes From Task 5:

i. Based on institutionally agreed values, concepts, definitions and your own experience, list five points best defining the requirements for making The University a successful Research and Research Training institution.

ii. Develop and provide this information at one of the following levels as appropriate: University, College (specify) or Department (specify).

Task 6: Consultancy, Business Engagement & Community Service

The university as a national/international entity needs to contribute to the key drivers of competitiveness and economic growth and development in the region, country and internationally through knowledge generation and use, innovation, invention and technology transfer to business and industry. This contribution is best achieved through;

Outcomes From Task 6:

i. Based on institutionally agreed values, concepts, definitions and your own experience, list five points best defining the requirements for making The University a successful player contributing to the key drivers of competitiveness and economic growth and development regionally, nationally and internationally.

ii. Develop and provide this information at one of the following levels as appropriate: University, College (specify) or Department (specify).

Task 7: The University in 2030

Once the agreed vision has been realised in 2030, it is hoped that The University will become the preferred destination for students and the first choice for employers.

Outcomes From Task 7:

i. Based on institutionally agreed values, concepts, definitions and your own experience, list five points best defining The University in 2030as a national/international university.

ii. Develop and provide this information at one of the following levels as appropriate: University, College (specify) or Department (specify).

4. The Implementation Plan

The implementation plan is the means of turning goals and objectives into a working plan.

There are a number of prerequisites that reinforce implementation and ensure a successful outcome; these include (Baban 2017, 2018a, 2018b, 2023):

1. Assignment of responsibility, deadlines and identification of measures of completion and documentation. Therefore, it is necessary to identify one person to be accountable for the implementation of a specific action into competition, a person to monitor the implementation of the specific action, a date by which the action is expected to be completed, and what measures will be used to define success in the implementation of the action.

2. Figure 2, represents a basic implementation plan for a Higher Education institution's priority, containing clearly defined actions, implementation and monitoring responsibilities as well as the deadlines for delivering the actions (Baban, 2015).

3. Strengthen the participation and capacity of planners and implementers. This is necessary to enable the organizational units to successfully fulfil their role in strategic planning process and it can be achieved through creating a diverse leadership team with deep organisational knowledge, a variety of perspectives, and an understanding of decision-making powers and boundaries.

4. Conducting a semi-annual review. This review necessary to transparently manage the goals of the strategic plan.

5. The implementation plan should be flexible in its formation; hence it can be easily adjusted to respond to concerns about the planning process as well as the internal and external changes that will occur within the duration of the strategic plan.

6. Universities in their early years of strategic planning, especially those embarking on strategic planning for the first time need to be mindful of financial limitations and establish goals and action plans reasonably feasible in regard to both human and financial.

Teaching and Learning Priorities				Dates			
Priority: Curriculum Development and Renewal							
	Actions	Implementation	Monitoring	Sept	Oct	Nov	Dec
1.1.	**Staff Development**						
A	Staff Training on graduate Profile, Curriculum Development and Program Benchmarking	Head of Dept.	L & T Unit				
B	Training in Class administration	Head of Dept.	L & T Unit				
C	Training in preparing course handbooks	L & T Unit	Head of Dept.				
D	A development strategy to introduce staff to in new learning methods and technologies.	L & T Unit	Head of Dept.				
1.2.	**Curriculum Development**						
A	Prepare graduates for professional Practice and fulfilled the University's graduate attributes.	Dept. Scientific Cttee	Univ. Council + L & T Unit				
B	Form a Curriculum and Renewal Committee.	Head of Dept.	Dept. Council				
C	Embed Graduate Attributes into coursework, including assessment, design, teaching and evaluation.	Dept. Scientific Cttee	Univ. Council + L & T Unit				
D	Examination of Core courses with a particular focus on learning to the graduate profile and market needs.	Dept. Scientific Cttee	Univ. Council + L & T Unit				
E	Committee evaluating (Benchmarking) of complete curriculum internally and with other relevant University.	Dept. Scientific Cttee	Univ. Council + L & T Unit				
F	Department council approval of curriculum.	Dept. Council	Head of Dept.				
G	University Council approval of curriculum.	University Council	Univ. Council + L & T Unit				

Fig 2. The implantation plan for an identified priority with a university teaching and learning plan (Baban, 2015).

5. Conclusion

The purpose of an organization defines why it exists in a specific environment and what it is intended to do. Higher Education Institutions (HEI's) are the engines of social and economic development in their host communities. Hence, to remain relevant and competitive, HEI's need to evolve continuously and to operate in the context of serving their stakeholders, host environment and to contribute effectively towards national social and economic development. Evidently, these aspirations can be achieved via strategic planning which can provide a framework to facilitate institutions vision, mission, values, goals, and strategies.

This paper presents an interactive process for planning in higher education and developing a practical strategic plan as a road map to determine what an institution aims to become in the future. Hence, providing a framework to facilitate an institution's vision, mission, values, goals, and strategies to remain relevant and competitive. In addition to managing the implementation procedure to successfully realize the declared objectives. The process was derived through several tasks. The tasks can only be successfully executed after establishing

institutional agreements on the intuition's operating principles and fundamentals such as vision, mission, values and goals. Hence, the paper advocates establishing collective institutional agreements on the intuition's operating principles, priorities and fundamentals to allocate and ensure the availability of all the necessary resources when they are needed at university, college and department levels. Hence, the leadership should focus on aligning the necessary human, financial and physical resources allocations and cultivating new resources to support the key teaching and learning priorities in the university strategic plan. The paper also proposes an implementation procedure to manage the delivery of declared learning and teaching priorities and objectives.

Experience shows that many HEI plans express worthwhile goals and sensible strategies to achieve those goals, but they fail because resource allocation is not aligned to the key priorities in the strategic plan. As a result, organizations continue on their previous path based on traditional allocation of resources, rather than realigning resources and cultivating new resources that support their strategic plans. Therefore, the process must start with a clear understanding of the motivation for planning, ensure the availability of all the necessary resources, and the leadership must maintain a focus on the strategic plan's broad goals, because many plans become hindered by long lists of actions and indicators that draw the organization's focus away from its major goals.

Ensuring success requires engraining middle management and staff throughout the planning process so they develop the capacity and understanding required to implement the plan. At the same time, wide input from multiple constituencies must be formed into a coherent plan that is aligned with the institution's major goals.

The Strategic planning process and associated procedures can help guide senior management, as well as empower middle managers, while aligning their everyday activities to the institution's broad aims. Furthermore, it can also advance evidence based decision-making and lay the foundation for performance measurement, which allows leaders to monitor progress, detect deviations from the plan and correct them, and make resource allocation decisions in accordance with clearly defined goals. Additionally, strategic planning process can be used to measure institutional effectiveness including all important activities and is heavily linked to the process of decision making including the budget process and allocation of resources.

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Child Q: A Case Study of the Adultification of Black Girls in Schools

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Abstract
Sylvia Ikomi is an early career researcher who is completing an Economic and Social Research Council Stuart Hall Foundation 1 + 3 PhD studentship in education at the University of Leeds. In 2022 the news of the strip searching of a Black secondary school girl (now referred to as Child Q) in a school/academy in London appeared in the news headlines. Child Q's school/academy called the police concerning an issue of potential drug possession by Child Q. She was subjected to a traumatic intimate strip search by police officers, whilst menstruating, in the absence of an Appropriate Adult and without her mother being informed (The City of London and Hackney/CHSCP, 2022, p.2). This incident has led to a wider public discussion about the adultification of Black girls. Whilst a significant amount of coverage has been given to the police's role in the case of Child Q, this article explores the role of Child's Q's school/academy and how its actions leading up to and on the day of this incident are arguably demonstrative of the wider issue of the adultification of Black girls in schools and academies. This case study helps readers to answer the question how do teachers' adultify Black girls through their discourse? This is done through an analysis of the case of Child Q and the wider academic literature on this topic. The article is approached from the perspective of inferences that can be made from the facts that were published in the Independent Child Commissioner's report through a critical discourse analysis with a conclusion that society's adultified discourse about Black girls can put Black girls in a position in which they require safeguarding from their safeguarders.

Keywords: Black Girls, Adultification, Safeguarding

Note from the Author: This article contains some graphic detail that some readers may find to be distressing.

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The Strip Searching of Black Children

In early 2022 the news of the strip searching of a Black secondary school girl (now referred to as Child Q) in London appeared in the news headlines. Child Q's school/academy called the police concerning an issue of potential drug possession by Child Q. She was subjected to a traumatic intimate strip search by the attending police officers, whilst menstruating, in the absence of an Appropriate Adult and without her mother being informed (The City of London and Hackney Safeguarding Child Partnership/CHSCP, 2022, p.2). This appalling incident led to a demonstration calling for the prosecution of the police officers that were involved and has led to a wider public discussion about the adultification of Black girls. Adultification is defined as a two-fold process: "a process of socialization, in which children function at a more mature developmental stage because of situational context and necessity" (Burton, 2007 as cited by Georgetown Centre on Poverty and Inequality, 2017, p.4). An example of this is when a child who is dealing with an alcoholic parent experiences a reversal of roles in which they are forced to act as the responsible adult in the relationship (Burton, 2007, p.339). It is also "A social or cultural stereotype that is based on how adults perceive children…in the absence of knowledge of children's behaviour and verbalizations" (Goff et al., 2014 as cited by Georgetown Centre on Poverty and Inequality, 2017, p.4). Child Q's case will be explored through the lens of the latter.

The Children's Commissioner for England (Dame Rachel de Souza) obtained data from the Metropolitan Police confirming that "650 children aged 10-17 were subjected to a strip search from 2018 to 2020" and that "75% were aged 16-17 and 25% were aged 10-15" (Children's Commissioner, 2022, p.10). The data shows that 58% of the children "were Black" (377 out of the 650), "20% were White" (130 out of the 650), "16% were Asian, 5% were 'other' ethnicity and 2% did not have their ethnicity recorded" (Children's Commissioner, 2022, p.10). The Commissioner states that she is "deeply concerned that the MPS has been strip searching children as young as 10 on an almost daily basis" (Children's Commissioner, 2022, p.13). There appears to be a racial element involved in the high rate of Black children contained in the figures and there is an issue of the adultification of children that requires urgent attention. The arguably racialized nature of Child Q's experience is highlighted in her mother's submission that she believes that she was being judged 'for having a "head of locks" (CHSCP, 2022, p.15).

Whilst a significant amount of coverage has been given to the role of the police in the case of Child Q, this article explores the role of Child's Q's school/academy and how its actions leading up to and on the day of this incident are arguably demonstrative of the wider issue of the adultification of Black girls within the education system.

The Independent Child Safeguarding Commissioner's Report

The City of London and Hackney's Safeguarding Children's Partnership's Independent Child Safeguarding Commissioner published his report in March 2022. It is acknowledged that the City of London and Hackney Independent Child Safeguarding Commissioner states the following in the report: "Whilst taking account of interviews and written statements, the review does not draw any firm conclusions about each event in question. Some remain subject to investigation as part of ongoing complaints" (CHSCP, 2022, p.8) the writer of this article applies the same approach. It is acknowledged that the school/academy and teachers concerned may feel that there is an additional context and specifics in this case that contributed to them making the decisions that they made. It is acknowledged that this article

will not have this information and will be limited to the facts as outlined in the Independent Child Safeguarding Commissioner's report. In relation to the personal circumstances of Child Q, the report states that "Beyond the immediate events of the strip search at school, the review has kept information relating to the background and context of Child Q's lived experience to a minimum. The reasons for this are three-fold. Firstly, to protect Child Q's identity and that of her family, secondly, to allow for the report's publication and thirdly, because the review considers much of this information to be largely irrelevant" (CHSCP, 2022, p.6).

The Safeguarding Commissioner's report references the fact that someone known to Child Q had been suspended from her school/academy for being in possession of drugs (CHSCP, 2022, p.9). Her school/academy states that her association with this student combined with other observations that teachers had made; and a believe that she was smelling strongly of cannabis led to its concern that she was in possession of drugs on the day the police were called (CHSCP, 2022, p.9).

The Safeguarding Commissioner was unable to reach a conclusion on whether the teachers knew that Child Q would be strip searched by the police due to "inconsistencies in the accounts of those involved" (CHSCP, 2022, p.8).

The writer of this article does not claim to know exactly what the teachers were thinking when engaging in the actions that were outlined in the report.

Methodology

The Safeguarding Commissioner's report includes statements from interviews with Child Q and her relatives and the staff at her school/academy. This article is approached from the perspective of inferences that can be made from the facts that were published in the Independent Child Safeguarding Commissioner's report, with a key focus on an analysis of the most salient discourse within the review pertaining to the adultification of Child Q. A broad approach is used for the discourse analysis that is applied for the purpose of this article, for example, it excludes an analysis of the grammar, syntax and phonology of the discourse and centres on the rhetoric that is reflected within the discourse. Norman Fairclough argued that "sociolinguistics is strong on 'what' questions'…but weak on 'why' and 'how'" (Fairclough, 1989, p.8). In consideration of this, the analysis of the discourse within the report is supported by an exploration of its connection to the wider academic literature on the adultification of Black children within schools.

The Adultification of Child Q in Her School/Academy

Child Q's denial of drug use was ignored by her teachers who searched her bag, scarf, shoes and blazer (CHSCP, 2022, p.2) and did not find any drugs. The Child Safeguarding Practice Review Panel "held a firm view that had Child Q not been Black, then her experiences are unlikely to have been the same" (CHSCP, 2022, p.33). The Safeguarding Commissioner dedicated a section of his report to the issue of adultification, applying the findings of Georgetown Center on Poverty and Inequality's report *Girlhood Interrupted: The Erasure of Black Girls'* and Jahnine Davis' and Nicholas March's 2020 study of the issue of safeguarding whilst adultifying Black boys *Childhood* (CHSCP, 2022, p.34). The Safeguarding Commissioner's report applied information from a letter that Child Q's aunt wrote to the reviewing panel that stated that "The family do not believe that the officers

would have treated a Caucasian girl child who was on her monthly period in the same way" (CHSCP, 2022, p.15). "Child Q was made to take her pad off, something so personal and exposed in such a way to strangers" (CHSCP, 2022, p.15). "She was made to bend over spread her legs, use her hands to spread her buttocks cheek whilst coughing." "She was not permitted to use the toilet despite asking" (CHSCP, 2022, p.15). This traumatic process has had a severe impact on Child Q. The juxtaposition of her status as a child and the adult experience that she was subjected is highlighted in her statement:

- "Someone walked into the school, where I was supposed to feel safe, took me away from the people who were supposed to protect me and stripped me naked, while on my period" (CHSCP, 2022, p.11).
- "… On the top of preparing for the most important exams of my life. I can't go a single day without wanting to scream, shout, cry or just give up." "I feel like I'm locked in a box, and no one can see or cares that I just want to go back to feeling safe again, my box is collapsing around me, and no-one wants to help" (CHSCP, 2022, p.11).
- "I don't know if I'm going to feel normal again. I don't know how long it will take to repair my box. But I do know this can't happen to anyone, ever again" (CHSCP, 2022, p.11).
- "All the people that allowed this to happen need to be held responsible. I was held responsible for a smell" (CHSCP, 2022, p.11).

Child Q's mother states that:

- "Child Q is a changed person. She is not eating, every time I find her, she is in the bath, full of water and sleeping in the bath. Not communicating with us as (she) used to, doesn't want to leave her room, panic attacks at school, doesn't, want to be on the road, screams when sees/hears the police, and we need to reassure her" (CHSCP, 2022, p.12-13).
- "We try to get her to do things and reassure her. Child Q is not the same person. She was a person who liked to be active and get into things. Not now, she has changed. She comes home, goes upstairs in the bedroom and closes the bedroom door. Saying she is doing mock exam studies, she just locks off, saying 'leave me alone.' When sleeping, (she is) screaming in her sleep, I have to watch her" (CHSCP, 2022, p.13).
- "She is now self-harming and requires therapy. She is traumatised and is now a shell of the bubbly child she was before this incident" (CHSCP, 2022, p.15).

The Safeguarding Officer that was involved in the school/academy's decision to contact the police states that:

> In my experience with police [at her previous schools], where there has been a suspicion of carrying drugs or a weapon, and police found it necessary to conduct a search, it would only be a 'pat down.' I have known drugs to be found in socks or a waistband as I had witnessed that before, twice in my career. I have never known any more than that on site or known a student to be taken off site. (CHSCP, 2022, p.22)
>
> I am an experienced Designated Safeguarding Lead with over 6 years' experience of safeguarding and liaising with the police to support young people. I have never known, nor would I condone a strip search of a young person on a school site. (CHSCP, 2022, p.22)

The Safeguarding Officer's reference to being accustomed to police 'only' giving a student a "pat down" indicates a lack of a full appreciation that after searching Child Q's bag, scarf and shoes and finding no drugs, and even in the absence of taking these steps, this would be a disproportionate response to a suspicion of drug use that would serve to traumatize Child Q rather than supporting her. Her reference to her experience of working with the police in instances in which a 'pat down' would take place as working "with the police to support young people" reflects a lack of full appreciation (even at this investigatory stage of the matter) of the active harm that this approach causes (in scenarios like Child Q's) rather than the safeguarding that the statement is intended to reflect. Unfortunately, Black children's characteristic as Black often contributes to an oxymoronic situation in which they can require safeguarding from the very teachers who are meant to safeguard them.

The Independent Child Safeguarding Commissioner found that Child Q's school/academy did not sufficiently approach its situation with her through the lens of its duty to safeguard her (CHSCP, 2022, p.24 and p.34). The detail of the breakdown in communication between Child Q and her school/academy that culminated in the school/academy calling the police is outlined in the report in a series of events that took place prior to the police being called. Child Q's adultification is arguably reflected in these events.

A Critical Learning Incident

A key incident that occurred prior to the police being called was Child Q's mother receiving a telephone call from the school/academy in which it raised a concern about her turning up to the school/academy with red eyes and being "intoxicated" as a result of suspected drug use (CHSCP, 2022, p.9). Her mother explained that she had stayed up all night anxious to do well in the exam that she had the following morning and that was why her eyes were red. The school/academy's incident log of the call states that her mother was warned that "… if this behaviour continues or that if she is found with weed/drugs on her she will not be able to continue her place with [the school]" (CHSCP, 2022, p.10). This telephone call was a critical learning incident in this matter. Child Q was also anxious about maintaining her exams on the day that the police were called and referred to her exams as "the most important exams of my life." Child Q's aunt's statement reflects the wider context of this, she describes her niece as a former school prefect and high achieving student (CHSCP, 2022, p.14). It is understandable for a child with this academic background to be particularly anxious about her exam performance. Child Q would have benefited from the school/academy treating this conversation with her mother as a critical learning incident and changing its approach to handling this matter. Her anxiety could have been acknowledged and handled with supportive pastoral care. It is possible that some of the teachers in Child Q's school offered this. This article does not proport to contain a record of Child Q's relationship with all the teachers in her school/academy, it is appreciated that there are different dynamics in the relationship that students have with different teachers and that their dealings with a few teachers does not define the entirety of their education experience in a school or academy. However, the fact remains that the handling of this telephone conversation and the follow-up steps taken by the school/academy in a more sensitive and constructive fashion could have prevented the continued deterioration of relations between Child Q and her school/academy.

The Case of Child Q and the Wider Academic Literature on the Adultification of Black Girls in Schools

George Town Centre on Poverty and Inequality's 2017 study on the adultification of Black girls comprised of 325 members of the general public in the United States of America being surveyed on their views on Black girls under the guise of a study about children's development in the 21st century (Georgetown Center on Poverty and Inequality, 2017, p.7). 74% of the survey participants were white, 62% of them were female, 69% of them held a qualification beyond a high school diploma and 39% of them were between the ages of 25 and 34 (Georgetown Center on Poverty and Inequality, 2017, p. 7). The survey results revealed that "across all age ranges, participants viewed Black girls collectively as more adult than white girls. Responses revealed that participants perceived Black girls as needing less protection and nurturing than white girls, and that Black girls were perceived to know more about adult topics" and to be "more knowledgeable about sex than their white peers" (Georgetown Center on Poverty and Inequality, 2017, p. 8). This adultification applied from the Black girls that were referenced as being aged 5 (Georgetown Center on Poverty and Inequality, 2017, p. 8) to between the ages of 15 and 19 years old.

Georgetown Centre on Poverty and Inequality's research participants concluded that Black girls are more independent (Georgetown Center on Poverty and Inequality, 2017, p.1). Within a school context, this perception could lead to a lack of guidance and mentoring being given to Black girls (Georgetown Center for Poverty and Inequality, 2017, p.1) For Child Q, a view of her as being independent may have contributed to the lack of a supportive approach to support her through her exam anxiety and the failure to consider calling her mother prior to the police strip searching her.

Georgetown Centre on Poverty and Inequality's research respondents also concluded that "black girls need to be supported less" (Georgetown Center for Poverty and Inequality, 2017, p.1). Within a school context: teachers' focus may be on punishing vulnerable Black girls rather than supporting them. The school/academy's response during and following its telephone conversation with Child Q's mother could be reflective of this. The idea of Black girls needing to be supported less could be reflected in the way the school/academy treated Child Q following the traumatic strip searching that she was subjected to. Her mother states that she "was asked to go back into the exam without any teacher asking her about how she felt knowing what she had just gone through" (CHSCP, 2022, p.13). It is acknowledged that this is her mother's perspective and that the school/academy may have a different perspective. Due to the trauma that Child Q was dealing with it would be unreasonable to expect her to remember everything that everybody around her said to her after the strip search.

George Town Centre of Inequality's respondents stated that Black girls "need to be comforted less" (Georgetown Center on Poverty and Inequality, 2017, p.1). Within a school context this perception could manifest in a breakdown in communication in which a child's anxiety that requires comforting is ignored or regarded as anger or aggression and punished. Child Q required comforting over her exam anxiety (especially in the context of her being a former school prefect who was a high achieving student), but the focus was on discipling her to the point of potentially criminalizing her.

The high-profile nature of the *Black Lives Matter* movement coupled with contemporary issues of the institutional racism within the police means that most people are aware that

Black people are arguably more vulnerable to unfair treatment from the police. The aforementioned statistics on the percentage of Black children that were strip searched between 2018 and 2020 is indicative of this. The school/academy appeared to disregard this in its decision to call the police. It was her teachers' job as the responsible adults to assess and weigh the possible consequence of their actions before taking them, instead Child Q was left to go unaccompanied into a room with police officers and to essentially protect herself from any wrong treatment. The Safeguarding Commissioner makes a reference to a member of staff following Child Q when she was being taken to another office, not in order to support her or to supervise her encounter with the police but rather "to make sure that Child Q didn't attempt to dispose of anything in her possession" (CHSCP, 2022,p. 9). This reflects the adultification of Child Q and the handling of her as a criminal that needed to be caught rather than a traumatized child who was not in possession of drugs. The Safeguarding Commissioner refers to the teachers not being adequately informed of the need for an Appropriate Adult to be in the room with Child Q and the attending police officers (CHSCP, 2022, p.9). If they as adults (including school designated safeguarding leads) were vulnerable to malpractice that could arise from their lack of knowledge about the police procedure in these circumstances, why would they imagine that a child would fare better than them and would not also be vulnerable to this lack of information and potentially exploited by the police officers? This harrowing and intrusive search was wrongly conducted as though Child Q was guilty of a crime despite the Safeguarding Commissioner concluding that ''there is no evidence that Child Q was resistant to the search undertaken by school staff or that there were any indicators in her behaviour that she might be hiding drugs on her person" (CHSCP, 2022, p.9). It is accepted that the school/academy may have a different perspective on this statement. However, the fact remains that Child Q situation was dealt with in a disproportionate manner.

Georgetown Centre on Poverty and Inequality's respondents concluded that Black girls know more about adult topics (Georgetown Center on Inequality and Poverty, 2017, p.1). Within a school context: studies show that Black girls can be regarded as being deliberately sexually provocative in their dressing when some of them are just more physically developed than their peers (Andrew et al, 2019, p.2534) and the adultification bias of the teacher is being projected onto them. A perception of Black girls knowing more about adult topics could have contributed to the school/academy's persistent view that Child Q was in possession of drugs and attending the school/academy under the influence of drugs. It could also have led to a perception of Black girls as being more accustomed to dealing with the police in a way that would not lead to a sense of a need to protect Child Q when considering whether to call the police. A sense of her innocence as a child that would be overwhelmed by police involvement may have been more heightened in the teachers had they been deliberating on what to do with a white girl that they felt was in possession of drugs or under the influence of drugs. The sense of the disproportionate nature of the steps being taken may also have been heightened in the teachers had Child Q not been Black. Georgetown Centre on Poverty and Inequality's research participants believed that Black girls know more about sex. Within a school context: this can lead to a lower standard of safeguarding being applied when Black girls are displaying the signs of being abused (Andrew et al, 2019, p.2534) or a failure by schools/academies to identify the signs that a Black girl has been subject to a form of adultification that Linda Burton calls mentored precocious knowledge (Burton, 2007, p.336) due to being groomed by an adult. This underscores the importance of the Safeguarding Commissioner's findings of an issue of a safeguarding approach that sought to punish a child that was suspected of drug use rather than supporting her, underpinned by her "being seen as 'the risk' as opposed to being 'at risk'" (CHSCP, 2022, p.24).

City and Hackney's Child Safeguarding Practice Review Panel concluded that: 'We noted your decision to carry out a local child safeguarding practice review (LCSPR) but would encourage you to think carefully about whether one is necessary as we felt that this case was not notifiable and did not meet the criteria for an LCSPR' (CHSCP, 2022, p.3). Whilst this statement may have been made due to issues with the wording of the guidance for the escalation process, it does still raise a concern and could be indicative of a broader systematic safeguarding issue for cases of this nature.

The breakdown in communication between Child Q and her school/academy (as outlined in the Safeguarding Commissioner's report) highlights significant issues with the adultification of Black girls in schools/academies that lead to a conclusion that it cannot be assumed that schools/academies are truly safe spaces for Black girls.

Conclusion

The discourse analysis of the review into Child Q's academy's conduct, coupled with the wider academic literature on detrimental views that members of society often hold about Black girls, reflects the adultification of Black girls in school as an intensified embodiment of society's adultification of Black girls on a macro level. An assumption that teachers are exempt from these views due to nature of their job is problematic. Future research on this topic will benefit from a greater application of discourse analysis of social discourse in this area on a micro and macro level and an exploration of the relationship between the two.

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Teaching and Learning Process and Information and Communication Technologies From the Remote Perspective

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Abstract
This article reports the experience of the pedagogical consultants responsible for the curriculum development of Senac São Paulo courses when facing the emergency need to maintain the pedagogical process in their schools in the face of the Covid 19 pandemic. The urgent adjustment to distance education resulted in the improvement of the process and the adoption of new teaching and learning strategies mediated by technologies. The processes for preparing and providing guidelines for professional education courses were also readjusted. Thus, a bank of teaching-learning strategies linked to digital resources was developed, categorized, and identified by their didactic-pedagogical potential, having as intersection a didactic planning based on learning objectives based on Bloom's taxonomy (revised), given its convergence with the competency approach adopted by Senac. Methodologically, a relationship was established between connectivity and digital networks and digital evolution in school environments, culminating in new paradigms and processes of educational communication and new trends in teaching and learning. As a result, teachers adhered to the use of digital tools in their practices, transposing face-to-face classroom methodologies and practices to online media, whose criticism was the use of ICTs in an instrumental way, reducing methodologies and practices to teaching only transmissive. There was recognition of the insertion of technology as a facilitator of the educational process in a non-palliative way and the development of a web curriculum, now and fully, carried out in contexts of ubiquity.

Keywords: Technologies, Education, Teaching-Learning Strategies, Bloom Taxonomy

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Introduction

This article reports the experience of pedagogical consultants when faced with the emergency need to maintain the pedagogical process in their schools in the face of the Covid 19 pandemic. Thus, a bank of teaching-learning strategies linked to digital resources was developed, categorized, and identified by their didactic-pedagogical potential, having as intersection a didactic planning based on learning objectives based on Bloom's taxonomy (revised), given its convergence with the attitudinal approach adopted by the institution. Methodologically, a relationship was established between connectivity and digital networks and digital evolution in school environments, culminating in new paradigms and processes of educational communication and new trends in teaching and learning.

The Bank of Teaching-Learning Strategies

Proposing a series of digital resources that would facilitate a clear and dynamic choice according to the learning objectives, in a structured way (1), was a great challenge.

Thus, the bank of strategies offers digital tools and resources for the teaching and learning process at different levels of Bloom's taxonomy. For us, linking Bloom's Taxonomy to digital resources without linking the didactic resource to a pedagogical intention can make the pedagogical mediation lose meaning throughout this process.

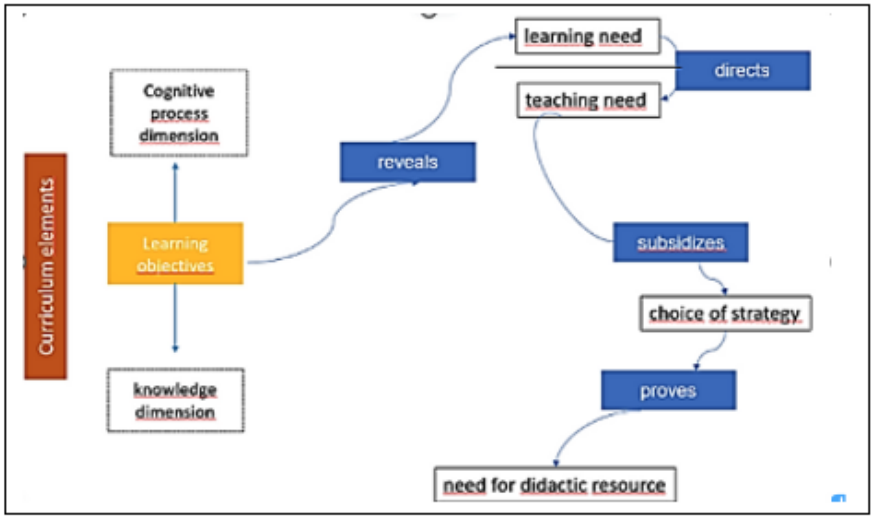

Figure 1. Logic used for the construction of the strategy´s bank

The Strategies Bank is made up of two menus, namely: search by strategy and search by objective. Both contemplate a teaching and learning strategy, with a brief explanation of its concept, the presentation of the learning objectives related to it, the resources and its pedagogical didactic potential, the name of the tool, web address, description of this tool, purpose, deliverables or final products that the tool delivers and the type of access. There are two ways to use it, the first being the choice of strategy. The starting point of the research is the teaching and learning strategy (Figure 2). The teacher selects the strategy he intends to use and for it the learning objectives, the digital didactic resources, the potential of this resource and the technological tools are listed.

Figure 2. Use of the strategy bank for choosing the mediation strategy

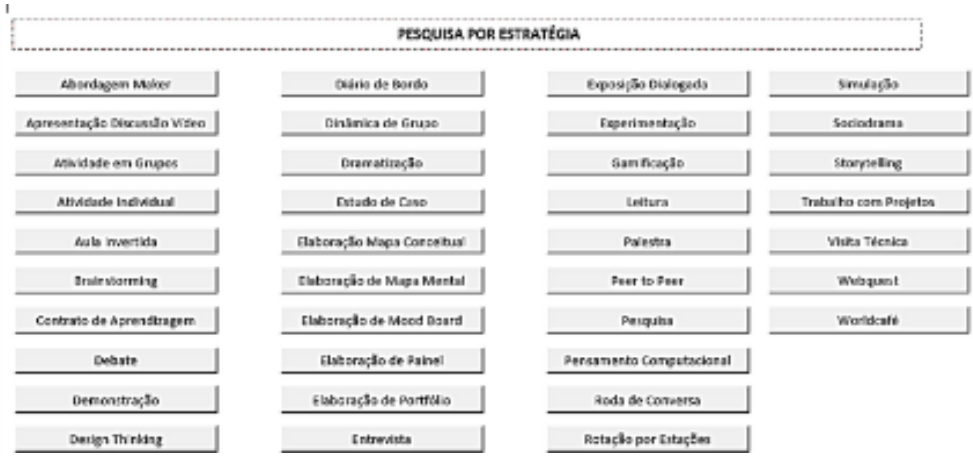

Figure 3. Search for strategy

The other possibility is to search by learning objective (Figure 3). For this choice, the teacher selects the objective and for this the teaching and learning strategies, the digital didactic resources, their potentialities and the technological tools are mapped.

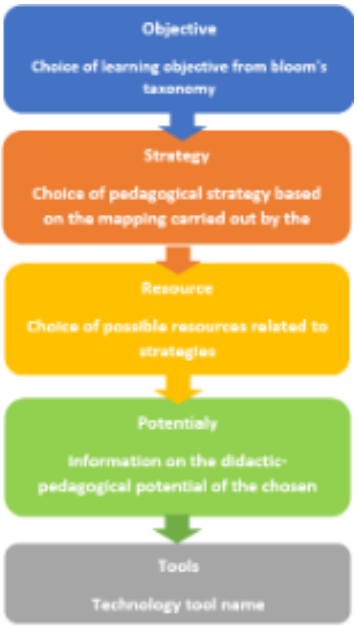

Figure 4. Use of the bank of strategies for choosing the learning objectives

The Bank has a wide variety of teaching and learning strategies mapped after mapping the pedagogical consultants throughout the mediation processes carried out in the design of courses and the strategies described in the literature. Still, about technological tools, it encompasses countless possibilities, free and paid, which allow, within the purpose for which they are proposed, the final delivery of a product.

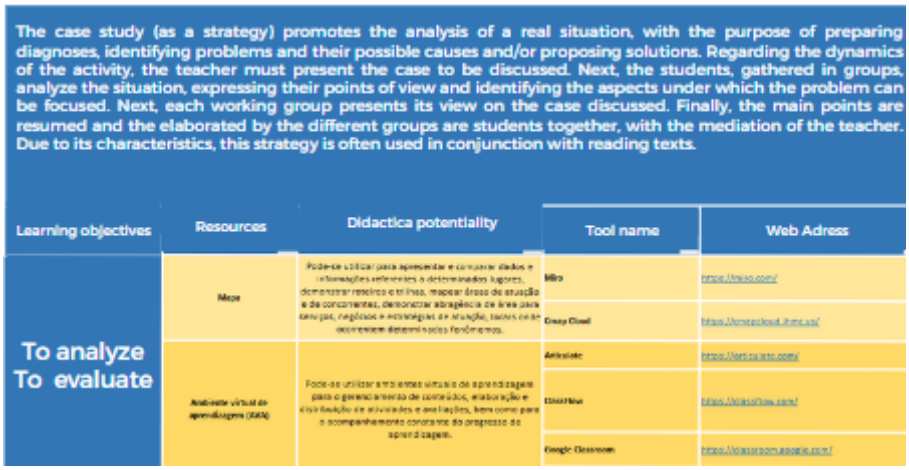

Figure 5. Vision of the choice of a strategy, the possible objectives to be achieved and the suggestion of corresponding digital resources

Conclusion

As a result, teachers adhered to the use of digital tools in their practices, transposing face-to-face classroom methodologies and practices to online media, whose criticism was the use of ICTs in an instrumental way, methodologies and practices to purely transmissive teaching. There was recognition of the insertion of technology as a facilitator of the educational process in a non-palliative way and the development of a web curriculum, now and fully, carried out in contexts of ubiquity.

It is important to point out that we find, in the literature, the articulation between the various digital resources widely disseminated on the internet and Bloom's Taxonomy, in a direct way. The option to carry out a triangulation between learning strategies, Bloom's Taxonomy and digital resources, came from the budget that the resource, by itself, without being mainly linked to a pedagogical intention, can be emptied, still considering of paramount importance the mediation in this pedagogical process.

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Enhancing Student Learning Outcomes in Educational Measurement and Evaluation: Integrating Blended Learning Approaches and Concept-Based Instruction

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Abstract
The development of student learning outcome should possess effective learning experience in which the directly effective approaches. This study investigates how blended learning approaches and concept-based instruction affect to students' educational measurement and evaluation capability. The research method is deemed as one-group pretest-posttest experimental design which a treatment is implemented into group of college students for 45 hours and a dependent variable is measured before and after the treatment is implemented. Participants included 56 college students that were drawn by using cluster random sampling technique from student who enrolled the educational measurement and evaluation course at Lampang Rajabhat university, Thailand. Data were collected by using the Educational Measurement and Evaluation Test (EMET). Test was based on the curriculum guideline that measured five knowledge domains consist of setting goal of measurement and evaluation, designing a measurement and evaluation, creating and assessing an instrument quality, administration a testing, and grading score and reporting the result. Total of 30 items for testing included 6 items each domain. Descriptive statistics were used to analyze student learning outcomes in educational measurement and evaluation. Also, a t-test is inferential statistics test that used to determine if there is a significant difference between the means of two groups. Result revealed that the posttest score (M=23.53, SD= 1.02) of students' educational measurement and evaluation capability was significantly higher than the pretest score (M=16.12, SD= 1.31), $t(56) = 9.21$, p=.01.

Keyword: College Students' Capability, Teaching Approaches, Comparing Means Analysis

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Introduction

Nowadays, the emergence of diverse students is assigned to refer streaming the high competencies of 21st century, which has been a challenge particularly related to the college students learning outcomes in educational measurement and evaluation, especially in teacher students (Christoforidou and Kyriakides, 2022). There is a significant component that teacher will find out an approach to cover in accommodating the teacher students' capability.

Educational measurement and evaluation capability is seen as the key to foster teacher students for teaching profession (Arista et al., 2022). One of the cognitive skills which lead to be accomplished in the academic of college students and beyond in teaching profession is the educational measurement and evaluation capability. There is selected to be an important factor of competencies development.

In current, a widely integrated approaches for teaching and learning were selected to enhance learning outcome for getting reach school accomplishment beyond the next chapter in profession. Also, the integrated teaching and learning strategy was applied to classroom for implementing student competence. Blended learning implementation usually involves face-to-face and other corresponding online learning delivery methods was transformed into classroom that is a teaching approach used in many classrooms to promote student learning (Daskan and Yildiz, 2020: Alammary, 2019). Furthermore, concept-based instruction was transformed into classroom that was a teaching approach used in several classrooms to promote student learning (Chappell and Killpatric, 2003). Blended learning approach was combined with concept-based instruction that was assigned as innovative learning strategy for sustainable development in education.

Many studies were conducted on how to develop educational measurement and evaluation capability and examine the effect of blended learning in learning outcome (Sluijsmans et al., 2003: Christoforidou et al., 2014: Liu and Li, 2014). Those studies considered various classroom activities and classroom level based on the blended learning approach. Some studies indicated significant effect of blended learning without included the other effective approaches. However, there is little describe and present the understanding of whether students are developmentally ready to educational measurement and evaluation capability can be developed at integrated approaches.

In this regard, it should be investigated to account the effect of blended learning approaches and concept-based instruction in student's educational measurement and evaluation capability.

Literature Review

Blended Learning Approaches

Blended learning implementation usually involves F2F and other corresponding online learning delivery methods (Australian National Training Authority, Blended Learning: learning new skills in blending, Sydney, Australian National Training Authority, 2003).

Key aspects of blened learning derived from Graham (2013) and Moskal et al. (2013) that were face to face activities and online activities. First, face to face activities consisted of classroom lecture, individual/group discussion, presentation activities, classroom interaction,

and assessment. There were focuses on encourages students to participate in learning activities together in the classroom and students participate in a class where the teacher presents the learning content, experiential learning, and practice. Online activities consisted of Online Individual and collaborative learning, web-based training, discussion board, recorded lectures, and online assessment and feedback. The teaching process would be encouraging students to participate in learning activities online. Also, the teaching processis accomplished online with the teacher's assessment of the learning progress and interactions throughout the learning process include the feedback vary on the lesson.

Concept-Based Instruction

Concept-based instruction is an approach to teaching and learning that uses for finding out how learning happens, encourages higher-order thinking strategies and executive function skills (Erickson et al., 2017). Furthermore, the distinction in concept-based curriculum and instruction is the three-dimensional approach. There were focuses on what students know, what students are able to do, and what students should understand conceptually (Erickson et al., 2017). Especially, the element of what students should understand conceptually allows teachers to help students make conceptual connections and generalizations across content, tying together important skills and information (see also figure 1). Concept-based learning is an opportunity for students to create meaning with what they are learning and to see the connection between subject areas.

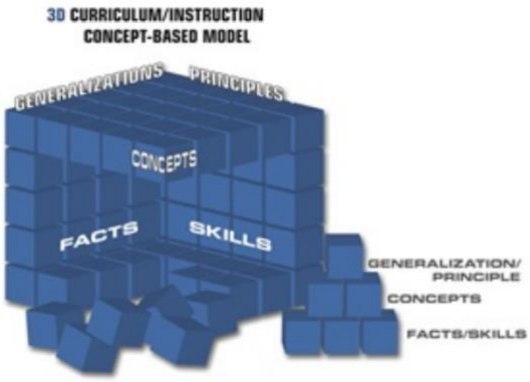

Figure 1: 3D Curriculum and instruction Models (Erickson & Lanning, 2014)

Educational Measurement and Evaluation Capability

Educational measurement and evaluation capability is the one of teacher students' competency (Brookhart, 2011). There were five knowledge domains consist of setting goal ofmeasurement and evaluation, designing a measurement and evaluation, creating and assessing an instrument quality, administration a testing, and grading score and reporting the result.

The researcher analyzed and synthesized the concept, theories and research study that concern the blended learning approaches included concept-based instruction. The conceptual framework is shown in Figure 2.

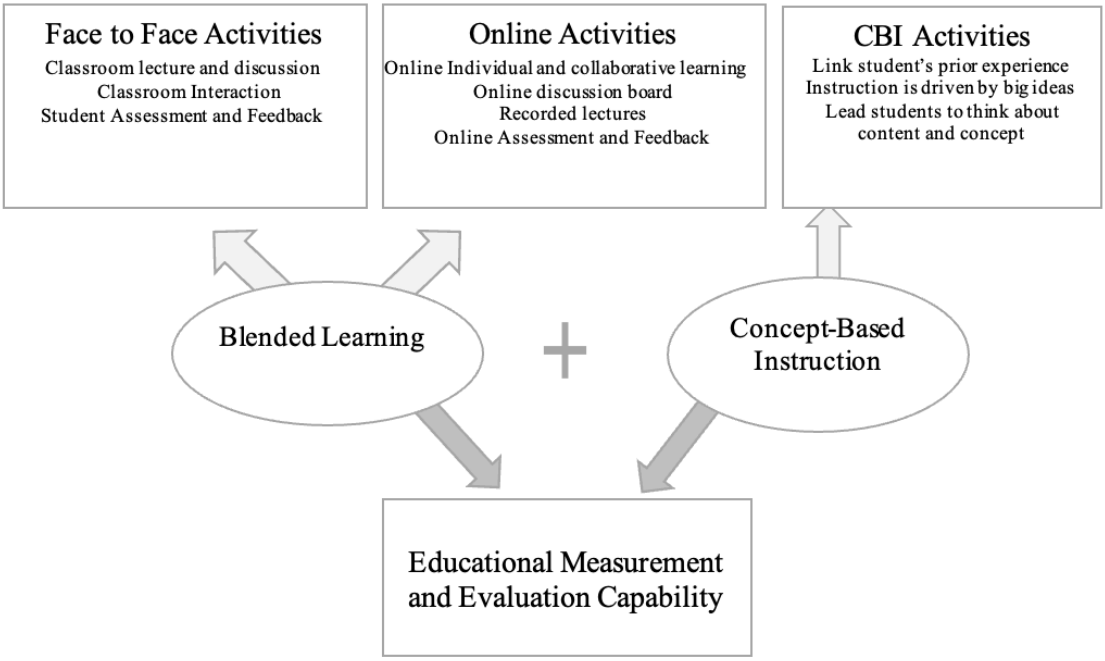

Figure 2: Integrating blended learning approaches and concept-based instruction model

Methodology

The purpose of this study is to investigate a blended learning approaches and concept-based instruction affect to students' educational measurement and evaluation capability. The research method is deemed as quasi-experimental research design (one-group pretest-posttest experimental design) which a treatment is implemented into group of college students and then a dependent variable is measured once after the treatment is implemented.

Participants

The samples were drawn by using cluster random sampling technique from student who enrolled the educational measurement and evaluation course at Lampang Rajabhat university, Thailand. There were 56 college students, 22 were males and 34 were females.

Measurement

The research instrument used in this study was educational measurement and evaluation test (EMET). Test was based on the curriculum guideline that measured five domains: 1) setting goal of measurement and evaluation 2) designing a measurement and evaluation 3) creating and assessing an instrument quality 4) administration a testing and 5) grading score and reporting the result. Total of 30 items for testing included 6 items each domain.

Procedure

The procedure of research took place in three separate steps (see also Figure 3).

In the first step, a classroom instructional model was formed by derived the concept and theories of blended learning and concept-based instruction. The face-to-face approach as traditional classroom was blended to online approach. The face-to-face approach were designed to classroom lecture and discussion, classroom interaction, and student assessment and feedback. Also, the online approach created the learning with self-study and classroom collaborative learning. Moreover, the online discussion board and online assessment and feedback were offered to students. Furthermore, the concept-based instruction was embedded in both approaches included linking student's prior experience, instruction is driven by big ideas, and lead students to think about content and fact. There was the classroom instructional model that integrated the blended learning and concept-based instruction. In the second step, The integrated blended learning approaches and face-to-face activities were distributed in the classroom.The concept included evaluation of classroom issue and school values that inspire students to act upon their learning. Also, concept-based instruction creates connections to students' prior experience. The process time for using integrated blended learning approaches and face-to-face activities was 45 hours that presented by scaffolding. The third step was assessing the student educational measurement and evaluation capability. College students were asked to response the educational measurement and evaluation test (EMET).

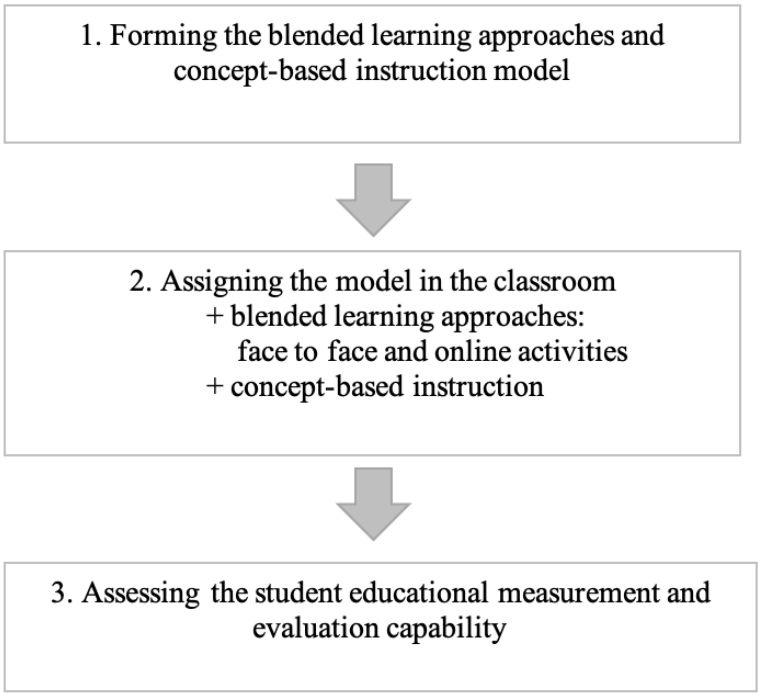

Figure 3: Flowchart of the research process: Integrated blended learning approaches and concept-based instruction into classroom design

Data Analysis

The study used descriptive statistics and analyzed data via the software packages SPSS. T-test was used to investigate how integrated blended learning approaches and concept-based instruction affect the educational measurement and evaluation capability.

To describe the college students' educational measurement and evaluation capability, the capability was interpreted into 4 categories as:

score	level
greater than 75%	refer to high level
51% - 75%	refer to moderate level
25% - 50%	refer to low level
less than 25%	refer to very low level

Results

The Students' Educational Measurement and Evaluation Capability

After the blended learning approaches and concept-based instruction was assigned to classroom. The students' educational measurement and evaluation capability was varying among students (as shown in Table 1). The highest percentage of students were in the high educational measurement and evaluation capability level (58.93%). Moreover, the data reported the maximum score of educational measurement and evaluation capability was 28 and the minimum score of educational measurement and evaluation capability was 23, and the grand mean of students' educational measurement and evaluation capability was 23.56. Also, score of students' educational measurement and evaluation capability as shown in Figure 3.

	Educational measurement and evaluation Capability Level		
	High	Moderate	Low
Number of college students	33	20	3
Percentage	58.93	35.71	5.36
Maximum	28	22	15
Minimum	23	17	14
Grand mean		23.56 (78.53%)	
Standard deviation		1.02	

Table 1: The college student's educational measurement and evaluation capability

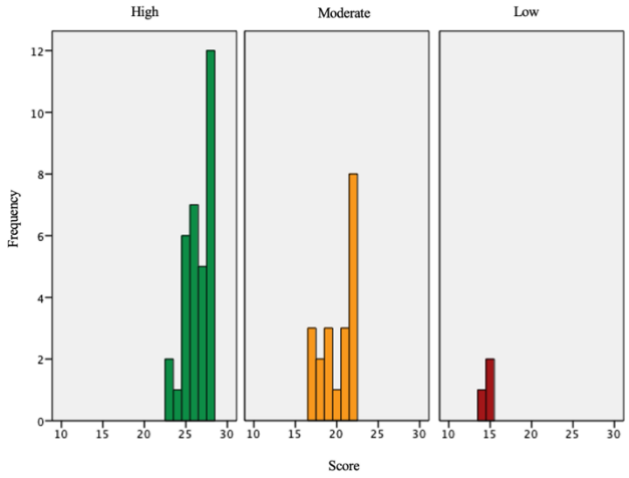

Figure 4: Histogram of college student's educational measurement and evaluation capability

The t-test was analyzed the difference between mean score of students' educational measurement and evaluation capability posttest and pertest score. The result showed that posttest score (M=23.53, SD= 1.02) of the students' educational measurement and evaluation

capability were significantly higher than pretest score (M=16.12, SD= 1.31), $t(56) = 9.21$, p=.01 (as shown in Table 2).

	Educational measurement and evaluation capability			t	p-value
	N	M	SD		
Posttest Score	56	23.53	1.02	9.21	.010
Pretest Score	56	16.12	1.31		

Table 2: The result of t-test analysis of students' educational measurement and evaluation capability between posttest and pretest score

Conclusions and Discussion

College students reported that the highest proportion of educational measurement and evaluation capability were in the high level. In which, the college students' educational measurement and evaluation capability after using blended learning approaches and concept-based instruction were significantly higher than before using blended learning approaches and concept-based instruction. The result revealed students' capability was significant increased that reflect the integrating blended learning approaches and concept-based instruction was the effective approaches for enhancing students' outcome, according to, Hadiyanto et.al (2022) founded that included blended learning in classroom could be foster student accomplish at school and enhance students' performance for 21st century skills.

For implication, the result of this study could effort that using blended learning approaches and concept-based instruction could be developed college students' educational measurement and evaluation capability. Educators should be considered the approach into classroom which emphasized the developing the educational measurement and evaluation capability such as research for learning development course. In the future research, the comparing the other approach for developing educational measurement and evaluation capability should be considered for understanding the capability difference when were treated at least two different approaches.

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Digital Teaching and Children's Engagement in Play During Emergency Remote Teaching in Indonesia Early Childhood Education Context

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Abstract
The implementation of an emergency remote teaching has been informed to be quite successful in some level of educations such as in primary and secondary (Rasmitadila et al., 2020), however, it seems to be a challenge for an early- stage education to conduct the learning which previously is done in a physical setting. This study aims to get deeper understanding the phenomenon of emergency remote teaching and the innovations made to and with incorporating play in the classroom to meet the needs of 'play as the nature of learning' for the children in ECE context through teacher's perspectives and practices. A qualitative phenomenological approach was employed to explore teachers lived experienced during emergency remote teaching in five provinces in Indonesia (indicated as red zone as per data August 2020 by WHO, 2020). Semi-structured interviews was conducted with 10 to 20 teachers from the aforementioned regions. The data was organized and analysed using inductive data analysis based on individual textural and structural organization, and further synthesis a textural and structural meanings and essence (Moustaka, 1994). The findings showed that teachers agreed that selecting, choosing, and using certain media in preparing, designing, and delivering the materials or activities as well as doing assessment have become a dynamic process. Both assessment and learning support are closely related to parent's involvement. Overall, teachers explained that in incorporating play into the remote learning, teachers should consider some aspects, and involve parents in designing the activities and deciding the used of materials.

Keywords: Digital Learning, Digital Play, Emergency Remote Teaching, Digital Games-Based Learning, Early Childhood Education (ECE), Phenomenological Study, And Indonesia

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Introduction

Schools are one of many entities that have been influenced by the presence of world pandemic COVID-19. The change of learning and teaching mode has been reformed from face-to-face to an emergency remote setting. The changes are made to support the continuation of school during the pandemic, not to leave any child behind as much as possible in every stage of education, from early education to higher education (Nations, 2020). The implementation of an emergency remote teaching has been informed to be quite successful in some level of educations such as in primary and secondary education (Rasmitadila et al., 2020). However, it seems to be a challenge for an early-stage education to conduct the learning which previously is done in a physical setting.

Additionally, as the nature of children in early ages are learning by playing in physical and sometime in non-physical settings, involved social interactions, identifying peer's facial expression, and other kinesthetic aspects. The situation of online learning may broadly effect on this nature of learning (Parker & Thomsen, 2019). Therefore, in most of the cases, changes and adaptations have been made throughout the online learning process, especially in Early Childhood Education (ECE) context. From physical play and learning to digital play and learning, for the purpose of accommodating the needs of children in learning as well as to continue their developmental progress during the process. Previous studies (Skolverket: Swedish National Agency for Education, 2010; Finland Ministry of Social Affairs and Health, 2004; England Department for Education, 2012; in Moore et al., 2014) presented that some of ECE curriculums separately put the discussion of play as a main part of pedagogical aspect in ECE learning, and technology as a medium of communication and output in the learning process.

An issue with the current studies regarding digital technology integration and early years learning lay in the predominant focus of teacher's attitudes and beliefs in using it during their practices. Whereas an essential aspect of meaningful children's play and learning experience derive from the curriculum has been seen lack of getting enough attention from scholars (Edwards, 2015). Therefore, there is the urgency to acquire a comprehensive understanding of both digital learning and play-based learning in ECE. Previous studies mentioned that the ideal practice of playful learning environment has at least four features; 1) voluntary involvement from children, 2) intrinsically motivating and pleasurable for its own sake, 3) it involves certain level of physical engagement, and 4) expose the process of meaning-making experience. Hence, by making sure the aforementioned features, the learning would be more meaningful for children (Randolph & Domus Print, 2007); Saracho & Saracho, 2020; Parker & Thomsen, 2019).

As one of the developing countries in Southeast Asia, with more than 200 million population and its multicultural characteristics, as well as with the expansion program of ECE services throughout the country. It is considerably important to know the implementation of emergency remote teaching in Indonesia ECE context. Some studies regarding emergency remote teaching in Indonesia ECE were mainly focus on the discussion of challenges conducting online teaching in regard of facilities, the teaching strategies in online teaching and learning, as well as teachers-parents shared work in children's learning (Gusman, 2020; Nirmala & Annuar, 2020; Nurdin & Anhusadar, 2020; Setyana Hutami et al., 2020; Suhendro, 2020). However, there has not been much focus on how the emergency digital remote teaching incorporate play and digital play/game in their context. As it seems to be challenging to integrate play into ECE system (in the national level) because there has been

shortage of recognition in the importance of play as a basis of academic principles. this study is not focusing on the measurement or evaluation of play-based learning, yet, but aims to get deeper understanding the phenomenon of digital emergency remote teaching and children's engagement in play-based learning during the lesson through teacher's perceptions. Furthermore, the findings of this study may be one of the steppingstones in getting more comprehensive about play-based learning implementation in Indonesia.

This study aims to explore the following research questions to understand thoroughly from the context of Indonesia regarding the adaptation of teaching and learning in Early Childhood Education (ECE) during emergency remote teaching based on teacher's perceptions:

1. What are teacher's perceptions on digital emergency remote teaching in Indonesia?
2. What are teacher's perceptions in incorporating play in their digital remote teaching practices?
3. How do teachers incorporate play and games during digital emergency remote teaching?
4. How do children engage in play-based learning activities during the digital emergency remote teaching?
5. What are the challenges and opportunities in the digital emergency remote teaching according to teacher's perceptions?

Theoretical Framework

The Role of Play in Ece: Structured Play and Free Play

The main characteristics of play are meaningful (as during play children try to connect information from what they just experienced to something they have already known), joyful (an overall process of thrill and stress, when it comes to rules and losing, the enjoyment is the central sense of experience), engaging (play expands and requires children to actively engaged), iterative (as play and learning are not two statis state, it circle up from finding, experimenting, confirming, and back to experiment to deeper the understanding toward particular things or new facts), and socially interactive (communicating and exchanging ideas during play are avoidable and children experience that) (Saracho, 2020, p.7). To get children go from learning to deeper learning experience, children need to experience playful learning experience, the key features are joy and interest. A study explained that joy has strong relation to motivation, derived from the concepts of grit and mindset. In a case when a person is sad or in a low bottom of their life, they may be actively being productive.

In ECE context, from free play to instructed activities or structured play aim to optimally promote learning, growing, and thriving (Pellegrini, Dupuis, & Smith, 2007 in Zosh et.al., 2017). However, when it comes to structured activities or extensively adults-led activities, the children's agency needs to be considered. The adults-children shared control is crucial to encourage children in taking initiative, yet adult's presence is to support the activities by not to give full control but to ensure that children play active role in taking decisions and solving problems. Take for example when children play with puzzle themselves, the presence of adult is not to help them taking a piece at a time and point it out where to place it, instead, giving suggestion or helping to rotate the pieces when it does not fit. In that case, where adults ensure children play an active part in addressing a problem-solving challenge, they foster the children's brain executive functions– an essential process of flexible thinking and goal setting

(Matte-Gagné, Bernier, & Lalonde, 2015; Hammond, Müller, Carpendale, Bibok, & Liebermann-Finestone, 2012 in Zosh et.al., 2017).

Play-Based Learning in ECE Curriculums

Some of well-known curriculum are Montessori, High/Scope, Froebel, and Reggio Emilia introduce the teaching approaches and learning environment of play-based pedagogy in ECE. The concept of play and learning in Montessori approach, discovered that children preferred work to play, hence, throughout her publication it was known as 'working' rather than 'playing.' The difference of children's working and adult's working in Montessori's context is that children were more into process rather than product, as it was the opposite way in adult's concept of working (Montessori, 1988a, in Isaacs, 2015). Montessori was conceptualizing the terms 'work' and 'play' since play characterized by fun and enjoyment and work has tendency to show a serious activity and full of effort. She emphasized that the works children do is voluntary activities, accumulated with effort which they enjoy it (as it seen from how they repeat it and not get bored with it), as it goes it brings joy withing the work. In classroom practices, as an adult, the teachers would not differentiate the activities of play or work for children, as the children do, they simply do things (Isaacs, 2015).

In High/Scope, the organization of learning space and daily routine are consistent to follow, from greeting time in the morning to large-group time to end the day with songs. As for the learning spaces, it is organized based on its functions to accommodate children's interest and offer various support through availability of adult's guidance and materials to play with. The central idea of learning in High/Scope is covered by the principles of active learning which led by children's initiative to explore their surroundings, with spacious learning environment and materials (Hohmann and Weikart, 2002, in Holt, 2010).

In Reggio Emilia, one of the learning values introduced by Loris Malaguzzi is 'the hundred languages of children,' it represents those children themselves have innate creativity which need to be accommodated by giving them opportunities to express themselves in different ways. One of the biggest platforms for children in Reggio Emilia in widening their creativity is by participating in a long-term project designed and supported by teachers, parents, and local communities. Throughout the process of doing a project, take for example the 'Bird's Theme Park,' children in a small and a big group would start by designing and planning the project, from the big picture to small details (Howell, 2013).

Digital Pedagogy

According to Howell (2013) there are reasons that drive the need of digital pedagogy, some of them are: pedagogical imperative and social imperative. The social imperative includes children, parents, and wider community. The pedagogy imperative includes the previous studies on the development of learning and teaching that has shown the influence of digital technology in the creation of knowledge and interaction in teaching and learning process. Looking into the current situation of emergency remote teaching during COVID-19 pandemic, the digital pedagogy is a social imperative as well as pedagogy imperative. Apart from the current situation of COVID-19 pandemic, when online classroom is one of the best alternatives to continue education, the digital pedagogy itself has been considered crucial back then, in responding to the phenomenon of the increment of digital natives (some are labelled as 'Internet Generation,' 'Net Gen,' 'Gen Z' and so on) – referring to children who was born in the fast-growing development of internet. As children get comfortable with their

daily life spending time with digital technologies (smartphones, game-consoles, television, and tablet), hence the presence and integration digital technologies in the classroom are expected to increase the level of engagement and fun during the learning.

Emergency Remote Teaching in Indonesia

The online learning mode has been implemented since the first lockdown in Indonesia (around March 2020) (Harnani, 2020). Teaching approaches and strategies have been remodified to meet children's need and accommodate the needs of all the parties (schools, teachers, parents, and children) involved in the emergency remote teaching and teaching. Based on the interview with the participant teachers, before Covid-19 pandemic, all schools applied face-to-face learning mode, started from 8 a.m. and finished at 13 p.m. Ministry of Education declared set of national education policies during the pandemic, such as sending children home to learn with their parents under both teachers and parents supervision, simplifying the national curriculum to not forcing children and teachers to achieve the designated (prior to pandemic) passing grade, yet proposing some practical life skills to be practiced at home, qualitative feedbacks for children' assignments, and encourage teachers to provide diverse learning activities under the consideration of children's capability and interests (Kemendikbud, 2020). Regarding the policies above, some regional and provinces in Indonesia started to adopt and create some alternative practices based on their region's capability in providing and accommodating the online learning.

The education policies regarding the schooling during pandemic have been reviewed per June and November 2020. During the first 3-months of lockdown (as starting point of the implementation of remote learning), in June 2020, the Ministry of Education, Ministry of Religion, Ministry of Health, and Ministry of Home Affairs established a new set of guidelines for teaching and learning in the new academic year during pandemic. It was mentioned that only schools under the green region was allowed to have face-to-face classes through leveled approvals from province government level, district, sub-district level, and finally parents' permission.

Methodology

Research Design

According to some resources (Jacob, 1987; Hitchcock and Hughes, 1995; in Cohen, 2007), there are three different approaches to qualitative research design, they are phenomenology, ethnomethodology, and symbolic interactionism. Husserl pointed out that phenomenology put a focus of the investigating and questioning life practicality that commonly neglected from our everyday life (Hodges et al., 2020). Regarding understand and making-meaning the structure of the world around us. The process, goals, and its reflective sense of the process vary from one individual to another (Schutz, n.d., in Cohen, 2007). Burrell and Morgan (1979) added that we understand and classify other's behaviors depend on our previous knowledge, the notion of comparing the ideal condition to the reality. Qualitative phenomenological research approach aims to describe and define current, temporal, corporal, and routine that occur around us (Brinkmann and Friesen 2018, Brinkmann 2016ab, in Rödel and Brinkmann, 2018). This study employs the qualitative phenomenological method to understand the current situation of mass emergency remote teaching during Covid-19 pandemic based on teacher's perceptions.

Setting

The setting of this research was some regions in Indonesia which were considered in red zone for their Covid-19 cases, per data August 6th, 2020, by WHO. The red zone regions were chosen considering that public institutions, as well as schools were shut and run in a total online mode. The participants mainly came from these regions: North Sumatera, Jakarta, Central Java, West Java, East Java, and South Sulawesi. Additionally, in the case where participant (s) was/were not available from that region, a neighboring region or island which was indicated in the dark orange zone was chosen, take for example North Sumatera was substituted with South Sumatera.

The participating teachers in the research were mainly taught in private kindergartens which follow national curriculum and one school combined national and Cambridge curriculum. There was total 10 (ten) different schools from 8 (eight) different regions, namely Jakarta, Solo (Central Java), Surabaya (West Java), Jember (West Java), Garut (East Java), Gorontalo (Sulawesi), Tenggarong (East Kalimantan), and Palembang (South Sumatera).

Sampling

The sampling method employ in this study is purposive sampling from the population of Indonesia ECE teachers with some specific characteristics. Purposive sampling works with the sample that promises and abundance of information on the phenomenon of interest (Rapley, 2014 in Flick, 2014). The participating teachers were chosen intentionally due to following reasons:

1. They have worked as a teacher actively during Covid-19 pandemic with the digital remote teaching approach.
2. They operated as a teacher in different regions of Indonesia during Covid-19 pandemic.
3. Those teachers used play-based learning with pre-school children for a period at least 3 months through digital remote teaching.

Data Collection Process

Data collection instrument consisted semi-structured interview with teachers. Semi-structured interview with teachers aims to explore the emergency remote teaching practices in Indonesia ECE, how teachers design their play-based learning and incorporation of digital-games based learning during the process. It was chosen one of data collection methods considering its characteristics of offering structured direction to the subject matter with a flexibility and opportunity to deepen specific aspects that occur during the interview (Cohen et al., 2007). The data collection instrument was designed based on the conceptual definitions and operational definitions that mainly cover the domains of play-based learning (the characteristic of play learning; meaningful, joyful, actively engaging, iterative, and socially interactive) (Saracho, 2020; Zosh et.al., 2017), digital pedagogy – basic instructional design components (objectives, media, teaching and learning method, time, and assessment) (Hodges et al., 2020; Rasmitadila et al., 2020), and children's engagement (Folorunsho, A, 2016). A semi-structured interview guiding questions was formulated, developed and has been through review of 2 experts (educational technologist and play-based learning experts in ECE field). Semi-structured interviews were conducted virtually by video conference, and it was videotaped for accuracy. Previous studies have been done remotely through these digital

media platforms- telephone and video conference (especially for the data collection) and it remained credible, reliable, and doable, especially during the pandemic situation.

Data Analysis

The data analysis follows the Transcendental-Phenomenological Reduction. It is termed transcendental because it goes further than just everyday experience, but it is seen as something fresh and new, and comes a need to be understood. The word phenomenological emphasize the sense of uncommon or mere experience that happen in between commonalty of experiences. Reduction means "it leads us back (Lat. reducere) to the source of the meaning and existence of the experienced world" (Schmitt, 1967, p. 61, in Moustakas, 1994).

Findings and Discussions

Finding

Regarding the play-based implementation experience, all teachers have been equipped with play-based learning training. Seven out of ten teachers have participated in digital pedagogy training, and all teachers have been conducting digital emergency remote teaching. Mostly, all schools were started the full digital emergency remote learning since March 2020 (it was the first month of national lockdown in Indonesia). Hence, based on the date of data collection (May 2020), almost all teachers have conducted digital emergency remote teaching for more than a year, and one participant teacher have conducted emergency remote teaching for a year.

Themes

Themes were identified based on participant's responses to the interview questions created to answer the research questions. Research question one on teacher's perceptions on digital emergency remote teaching; research question two on teacher's perceptions in incorporating play in their practices; research question three on the techniques teachers use to incorporate play and games during digital emergency remote teaching; research question four on ways children engage in play-based learning activities during the digital emergency remote teaching; and lastly, research question five is the challenges and opportunities in the digital emergency remote teaching according to teacher's perceptions. The code frequencies from all participants (in total 10 teachers) and total number of segments with themes and subthemes are presented in the table 7.

Table 1. Participants and themes

Themes	Sub-themes	Number of participant teachers	Number of segments with themes
Digital Pedagogy	Objectives	7	23
	Media	10	78
	Time	10	49
	Assessment	10	40
	Interaction	8	23
	Learner's Control	6	11
	Learning Support	10	59
Play-based Learning	Meaningful	9	23
	Joyful	7	21
	Engaging	9	25
	Iterative	4	7
	Socially interactive	9	12
	Play materials (toys/objects)	6	23
Children's Engagement	Behavioral Engagement	9	37
	Social Engagement	9	25
	Emotional Engagement	10	47
	Cognitive Engagement	4	7

Note: the number of participants and number of segments (total themes found in a total participant who endorsed the themes) were analyzed using MAXQDA 2020.

The themes include digital pedagogy, play-based learning, and children's engagement. In each of the themes, sub-themes were defined and emerged during the interview. In the digital pedagogy, 4 (four) subthemes namely, media, time, assessment, and learning support were endorsed by all participants teachers. Subtheme 'media' was found in 78 segments (statements made by the participant), subtheme 'learning support' was found in 59 segments, subtheme 'time' was found in 40 segments, and followed by subtheme 'assessment' which was found in 40 segments. In play-based learning theme, there were 3 (three) subthemes endorsed by 9 (nine) participants and one new subtheme was emerged, play materials (toys/objects). Subtheme 'meaningful' was found in 23 segments, 'engaging' was found in 25 segments, and 'socially interactive' was found in 12 segments. Below is the detailed findings of all the themes based on teachers' interview:

- Digital pedagogy
  In the digital pedagogy includes media, time, assessment, learning support, objective and learner's, and interaction. The participants shared the main applications they have been using to conduct video conference during emergency remote teaching, the applications to create visual materials (animation learning video and tutorial video), the application to share the learning material and submit children's work, the application and website to get inspiration in designing the activities, as well as the application to share (the learning materials), to submit the works and to communicate with parents. In the time aspect, schedule and learning duration were justified during

the emergency remote teaching, to mitigate children's stress level (as well as parents) and their overall mental wellbeing. Mostly, the duration and schedule were justified based on parents and caregiver's availability in supervising their children during the learning. In the assessment aspect, the assessment related to monitoring children's developmental stages have been claimed to be quiet challenging by most of the teachers. Since, they need to follow K13 curriculum and its evaluation sets, teachers sometime have doubt on to what extend parents help their children in completing or doing the homework and activities. This further led to the need of formative and summative assessments simplification.

- Play-based learning
  In the play-based theme includes meaningful, joyful, engaging, iterative, and socially interactive. Overall, a play-based learning should be relatable with children's life experience to make it meaningful, hence some aspects of joyful iterative and social interaction were essentials to appear throughout the process. Teachers mentioned that it was a bit challenging to observe emotional engagement during play when it was no face-to-face meetings. However, some sort of behaviours could tell teachers how children interact with peers and object (in tasks) during the lessons.

- Children's engagement
  In this theme, it includes emotional engagement, behavioural engagement, social engagement, and cognitive engagement. Engagements aspect are essential part to see how children involve in the activities. Most teachers agreed that emotional engagement was the most challenging one to be found or to be observed at least during the emergency remote teaching.

Discussion

This section aims to present the discussion of the research questions.

Teacher's Perception on Digital Emergency Remote Teaching

According to interview results, participant teachers found that conducting digital emergency remote teaching have always put them into trial-and-error cycles, in almost all components (known also as themes). The statements from teachers can be understood by teacher's attitude and aptitude towards the use of technology in their class. As mentioned in Howell (2013) that technology evolution is fast-changing and therefore teachers need to keep up with the update of it and how to integrate it meaningfully and successfully in the class. Some teachers may find it easy and being open with the change and some may not, these are a matter of attitude. Hence for, the aptitude aspect related to the knowledge of pedagogues, how the integration of technology help learning to happen. The aptitude aspects include teacher's understanding in knowledge construction, including some learning theories in constructivism, social constructivism, distributed cognition, connectivism, computer-supported collaborative learning (CSCL), and technology pedagogical and content knowledge (TPACK) (Harris, et.al, 2009; Shulman, 1986; Piaget, 1977; Papert, 1980 in Howell, 2013). All participant teachers agreed that in designing, preparing, and delivering the activities, it needs a suitable digital media. Some considerations include the complexity of applications for teachers to use in creating tutorials video or finding inspiration in making one. Another one is to find platform that user-friendly for parents, to receive learning materials and to send back children's works. Additionally, there was consideration in picking the media to promote

social interaction between teachers, children, and parents. Based on the interview results, all teachers mentioned that they used WhatsApp to create a group for parents, to collaborate, send learning materials, communicate, and submit children's works.

Teacher's Perception in Incorporating Play in Their Digital Remote Teaching Practices

When it comes to the questions of how teachers incorporate play and see play as a nature of children's learning, some teachers confidently said that we did not use the term 'incorporate play' because all the activities are meant to be play activities, play is there because children learn through play. On the other hand, some other teachers were not sure about seeing play (whether it is free-play or structured play) as a children's nature of learning, they tend to use the terms 'portfolio activities' – which refers to set of activities teachers provide to children to do at home.

These perceptions of teachers about play-based learning were influenced by the socio-cultural, their education background, and their participation in play-based learning trainings. It was observed that teachers who graduated from ECE specialization and/or have taken play-based learning training could elaborate the ideas of play as the nature of children learn. Instead of using the terms 'school's tasks' 'portfolio' and 'homework,' some teachers who have been equipped with the training could elaborate the activities and its benefits for children's development. According to National Council for Curriculum and Assessment (NCCA) (2004), there are four learning themes which belong to two developmental stages, namely communication and exploring and thinking in cognitive and psychomotor developmental stage, and well-being, identity and belonging in emotional/social and psychosexual developmental stage. This framework is one of many frameworks to assess and identify children's developmental stage in the environment of digital game-based learning and/or digital play-based learning.

Incorporating Play and Games During Digital Emergency Remote Teaching

Some specific questions were asked to the teachers on how they could incorporate play during the emergency remote teaching. As it is considered challenging to provide full free time experience (with other children for example) during this kind of situation or making sure that the activities being provided could provide play and learning experiences for children at home. Nine out of ten teachers who use 2013 National Curriculum (Kurikulum 2013) mentioned that they follow the teaching guidance provided by Ministry of Education and Culture. It consists of some essential booklet guidance, namely Language Play at Home (Bermain Bahasa di Rumah), Fun Math Play at Home (Bermain Matematika yang Menyenangkan), Play Science (Bermain Sains), Art and Craft (Bermain Seni Kriya), and Physical Play and Music (Bermain Musik dan Gerak) (Direktorat PAUD Kemdikbud, 2020) One of the teachers sent me all these booklets to give me more precise example on how the ECE teachers in Indonesia (especially the ones who use national curriculum) adapt and develop their teaching materials, learning objectives, and learning activities for children.

Children's Engagement in Play-Based Learning Activities During Digital Emergency Remote Teaching

A study supported that thoroughly designed digital activities with an open-ended form can benefit children in fully to express their artistic skills, imagination, music, art, and storytelling (Folorunsho, A, 2016) . It was found as well in this study that the teachers

realized how important to do evaluation on the tutorial videos to make sure that activities are well-designed and well-understood by the parents (to further delivering it to the child). A teacher [participant M] specifically mentioned one of those successful activities was a digital art splashing using a particular website where children can join in one activity together. The medium of making art, which was found to be non-psychical art supplies gave different sensation, especially when it was done together with peers.

In the digital context, children's play experience can be examined, as well as how far children engage in the play activities. A study explained how playful exploration with digital technology (that may include interactions with peers, adults- parents/teachers) has been identified as non-static chances of learning in ECE context (Yelland, 2015, in Folorunsho, A, 2016). Furthermore, it can be examined on precisely how far children engage in the play-learning activities. Some engagement modes were decided to be the focus of discussion, emotional engagement, behavioral engagement, social engagement, and cognitive engagement.

Conclusion

The implementation of digital emergency remote teaching has made changes into the lives of teachers. This phenomenological qualitative study aims to hear teacher's voices on their experience teaching with fully integrated technology and how they incorporate play into their remote teaching. Some teachers mentioned during the interview that by answering the questions being asked, they felt like go back in time when they first started the remote learning and reflected on what they have done. This statement has fulfilled on of the core aims of this study, to make teachers rewind their experience and reflect on it and furthermore openly shared it to be understood and to be discussed in scientific manner.

All participants are teachers from across Indonesia, covering four out of five big islands in Indonesia, namely Sumatera, Java, Sulawesi, dan Borneo (Kalimantan). This demographic feature was also decided prior the data collection, basing on the policy of full online learning reported by the government. The urgency to understand teacher's opinion on their emergency remote teaching were deeply analyzed based on the emerged themes endorsed by the participants, which mainly cover three main areas of teaching, digital pedagogy, play-based learning, and children's engagement.

The interview results showed that teachers found out in their digital pedagogy that media, time, assessment, and learning support have crucial impacts on the successful of teaching and learning. All teachers agreed that selectin, choosing, and using certain media in preparing, designing, and delivering the materials or activities as well as doing assessment have become a dynamic process. Then, learning duration and schedule have been shortened and this impact major changes in teachers, parents, and children learning routines. Both assessment and learning support are closely related to parent's involvement. As at some points teachers might find that their assessment toward children's developmental stage may no accurate since children may get overwhelming support for their parents and caregivers. At the same time, it is needed as for children who still have low learning's control, the presence of adults is beyond necessary.

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Insight of Twitter Ban: Student's Perspectives in Higher Education

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Abstract
Twitter appears to be a platform for the elites, with abuse, misuse, misinformation, and disinformation. Twitter bans in various countries, including Nigeria, have raised worries about freedom of expression and information access. This study examines Nigeria's Twitter ban's reasons, effects, and alternative measures The research study was carried out using a quantitative method that takes into account the research objectives and questions for this study. A survey was given to University of Ibadan undergraduates in five faculties to collect data was drawn using the Taro Yamane Sample formula to determine a reliable sample size formula with a 95% confidence level. 385 questionnaires were administered to all undergraduate students from year 1 to 4 (level 100–400), while only 235 from the responses were valid for data analysis. The ban on Twitter led to information deprivation, poor decision-making, the end of long-distance family relationships, and the loss of online colleagues for undergraduate students. According to technological determinism and social responsibility theories, the Nigerian federal government's Twitter ban has left a bad impression on residents. The study found that the Nigerian government and its citizens must acknowledge that authority has limits and act within those limits without violating others' rights. The study suggested alternate platforms to help students access learning resources and engage with academic peers for quality education in sustainable development Goal-4.

Keywords: Twitter Ban, Freedom of Expression, Student's Quality Education

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Introduction

The perceived of students and teachers in higher education in Nigeria towards the ban of twitter by the Nigerian government. On 5th June, 2021 and The Federal Government of Nigeria lifted the ban of the Twitter operations in Nigeria on 13th January, 2022 (Moemeke & Mormah, 2022; Anyanwu, Ukpong & Nkechi, 2022).

The tweeter is part of media with interaction among people in which they create, share and exchange information and ideas in virtual communities and networks. It is an internet-based form of communication that allows users to have conversations, share information and create web content. Alagbe and Seriki, (2022) stressed that social media as a computer-based technology facilitates the sharing of ideas thoughts, and information through the building of virtual network and communities. It gives users quick electronic communication of contents, such as personal information, documents, videos, and photos. (Yamini & Pujar 2022).

Social media is often referred to as the new media which involves interactive participation. Hence, the development of media is divided into three main types of news media: print media, broadcast media, and the Internet (interactive). Radio and TV, Newspaper Houses, or movie production studios disseminate messages to their heterogeneous audience and feedback is often indirect, delayed, and impersonal (Zhang et.al., 2022). Individuals can now speak to many and instantly get feedback made possible through the Internet. The Internet has brought exciting developments to news gathering and dissemination (Heleem et.al. 2022; Pawan & Raghavendra, 2018).

Research Questions

In other to examine the Insight of Twitter Ban: Student's Perspectives In Higher Education, the following questions were raised:

1. To what extent has the Twitter ban affected the undergraduate students of the University of Ibadan?
2. To what extent do the undergraduate students of the University of Ibadan believe that the Twitter ban is justifiable?
3. What are the alternative measures engaged in by the undergraduate students of the University of Ibadan in response to the Twitter ban in Nigeria?
4. What are the suggestions of the undergraduate students of the University of Ibadan on how to prevent a future ban of Twitter in Nigeria?

The Nigerian Federal Government suspended the operations of the micro-blogging and social networking service Twitter in Nigeria (Essien, Muoghalu & Sulaimon, 2022). The Twitter ban in Nigeria created major education challenges. Therefore, this was vital for educators and students to share ideas and resources. It was sudden absence hindered information flow and collaborative learning, requiring alternative communication methods. The ban highlighted online freedom and its impact on education, highlighting the need for diverse communication for seamless teaching and learning. It is, therefore, against this backdrop, that this study seeks to investigate the perception of Nigerians on the Federal government's ban on Twitter.

Literature Review

Twitter is a social platform that allows users to follow one another and send messages that are limited to 140 characters. Relationships on Twitter may be entirely one-sided, unlike on other social networking platforms. For example, one user may follow another without the latter being obligated to follow the first. Twitter burst onto the scene in March 2006, owing to the situation simple user interface, which stood in sharp contrast to its rivals, who were allowing users complete customization of their pages at the time, resulting in a crowded, gaudy appearance (Experian, 2009).

Twitter Ban

Twitter is a free social networking micro-blogging service that allows registered members to broadcast short posts called tweets. Twitter members can broadcast tweets and follow other users' tweets by using multiple platforms and devices, thereby facilitating the swift dissemination of information. According to the Twitter help Center, Tweets and replies to tweets can be sent by cell phone text messages, a desktop client, or by posting on the Twitter website (Paredes-Corvalan et.al., 2023).

In other words, Twitter promotes social interaction and public participation in various issues of human concern. As a result, the unrestricted interactive nature of Twitter has provided numerous opportunities for the public to interact with various issues in their society. Regardless of Twitter's significant role and opportunities, some countries around the world have banned its use in their societies, including Turkey, Turkmenistan, the United Kingdom, North Korea, Iran, China, and, most recently, Nigeria (Miller, 2022; Moemeke & Mormah, 2022).

Students Perspectives on Twitter as an Educational Tool

Prior to the ban, Twitter had gained importance as a valuable tool in higher education (Alley & Hanshew, 2022). Researchers have highlighted the potential that Twitter has for enhancing student's activities by promoting peer-to-peer learning and facilitating collaboration between educators and learners (Hassell et.al., 2023).

The understanding of student perspective is crucial to comprehending the full impact of the Twitter ban (Mujahid, et.al., 2021). It has been observed that students in Nigeria were actively using Twitter for academic purposes, including sharing class-related resources, engaging in intellectual discussions, and seeking assistance from instructors. The Twitter ban potentially left students feeling disconnected and disadvantaged in their learning journey (Dindar & Muukkonen, 2022).

Digital Freedom and Educational Access

The ban on Twitter also raised broader concerns about digital freedom and access to information (Vidyarthi & Hulvey, 2021). In a digital era, where technology is integrated into various aspects of life, restricting access to a platform like Twitter can have profound implications for education (Ramzan, Javaid & Fatima, 2023). Limitations on digital platforms could potentially hinder students' ability to engage with a global discourse, access diverse perspectives, and stay updated on current academic trends (Duggan, 2023; Kaddoura & Al Husseiny, 2023).

Disruption and Challenges

The abrupt ban on Twitter in Nigeria had immediate consequences on the educational sectors. (Vahedi, Z., Zannella, L., & Want, S. C. (2021). Students, who were adapted to leveraging the platform for communication with peers and educators, experienced a sudden interruption in their learning routines. This interruption disrupted the flow of information sharing, collaborative learning, and academic discussions that had become essential to the higher education in teaching and learning activities.

Theoretical Framework

Technological Determinism Theory

The Technological Determinism theory, conceived by Marshall McLuhan in 1962, asserts that technology shapes communication and societal interactions. Also known as the medium theory, it contends that technology determines how individuals engage with society. Its argue that technology's influence is socially determined, co-evolving with structures. Amidst ongoing debates, the rise of social media, including Twitter, Facebook, Instagram, exemplifies the profound impact of technology on human life. According to the "Digital 2022: Global Overview Report" by Data Reportable, the global population reaches 7.91 billion in January, 2022, with a projected growth of to 8billion by mid-2023. Mobile phone users reached 5.31 billion, and global internet users rose to 4.95 billion by 2022, fostering connectivity. Social media's immense growth, spurred by the COVID-19 pandemic, underscores technology's transformative role (Lugo-Fagundo, Weisberg, Kauffman & Fishman, 2022).

Social Responsibility Theory

The Social Responsibility theory, formulated by Siebert, Peterson, and Schramm in 1949, bridges the gap between authoritarian and libertarian theories. It allows media freedom but with external checks. The press under this theory is privately owned, shifting from "Objective" to "Interpretative" reporting, promoting investigative journalism. While ensuring accurate news, the theory advocates analyzed and interpretative reporting. The researcher, Uzuegbunam, 2013 stressed that it promotes a free press while subjecting content to public discussion, avoiding interference or self-regulation. An extension of libertarianism, it asserts press freedom tied to responsibilities, maintaining high standards of accuracy and objectivity. This theory contributes to professionalism by emphasizing accuracy and information. It also guides media through self-regulation within the legal framework. The theory's significance lies in promoting responsible media practice, leading to the establishment of codes of conduct, journalism standards, and safeguarding journalistic interest, with penalties for violations.

Methodology

Research Design

The goal of this study is to study "the perceptions of the undergraduate students on the Twitter ban in Nigeria." As a result, this study was carried out using a quantitative method that considers the research objectives and questions for this study. Data were gathered using a survey research method in which a questionnaire was administered to the undergraduate of the University of Ibadan in five faculties. this method was chosen because it provides for the

easiest collecting of a large amount of data from a diverse group of people, due to the nature of the study. The survey research method is dependable, cost-effective, extensive, and flexible (Flynn & Korcuska, 2018).

Research Population

The population of this study consists of the undergraduate students of the University of Ibadan, drawn from five different faculties namely Art, Social Sciences, Education, Law, and Economics. These five faculties were chosen purposively by the researcher.

Sample and Sampling Techniques

Wimmer & Dominick (2011) define a sample as a subset of the population that is representative of the entire population. It's simply a systematically selected part of a population that infers its result on the population. In essence, it is that part of a whole that represents the whole and its members share characteristics like similitude (Udoyen, 2019).

The research samples for this study were drawn from the undergraduate students of five various faculties of the University of Ibadan. Out of the total population of 10917 (Art- 3263, Social Sciences- 1868, Education- 4177, Law- 1056, and Economics- 553) for the five faculties, the total sample of 385 (three hundred and eighty-five) was drawn using the Taro Yamane Sample formula to determine a reliable sample size (Yamane, 1973) formula with a 95% confidence level.

The calculation formula of Taro Yamane is presented as follows.

$$\mathbf{n} = \frac{\mathbf{N}}{\mathbf{1+N(e)2}}$$

Where:

n = sample size required
N = number of people in the population
e = allowable error (%)

Substitute numbers in the formula:

$$\mathbf{n} = \frac{10{,}917}{1+10{,}917(0.05)2}$$

n = 385 (Approximately).

After calculating the sample size by substituting the numbers into the Yamane formula, the number of samples is 385.8619775558893 persons. To obtain reliable data, the researcher decreased the sample size to 385 for participants. 385 questionnaires were administered to all undergraduate students from year 1 to 4 (level 100–400), while the researcher was only able to retrieve 235 from the respondents which was valid for the data analysis of this study.

Findings and Discussion

Items	Frequency	Percent
Deprivation of information	119	50.6
Loss of online collaboration/Networking	48	20.4
Lack of communication	68	28.9
Total	**235**	**100**

Table 1: To what extents was the Twitter ban on you?

Above table reveals the result of the effect of twitter ban on respondents. The result revealed that 50.6% of the respondents agreed that twitter ban led to deprivation of information; 20.4% Loss of online collaboration/Networking; 28.9% agreed it led to lack of communication. This shows that the ban of twitter led to deprivation of information, Lack of communication, and Loss of online network to undergraduate students at the university of Ibadan.

Items	Frequency	Percent
No	211	89.8
Yes	24	10.2
Total	**235**	**100**

Table 2: Do you think Government's decision to ban Twitter in Nigeria is justifiable?

Above table shows the opinions of the undergraduate students of the University of Ibadan on the government's justification of the Twitter ban. The result reveals that majority (89.8%) of the respondents denied the Government's decision to ban Twitter in Nigeria is justifiable whereas the remaining (10.2%) thought otherwise. This shows that the undergraduate students at the University of Ibadan opined, the Government has no justification of the Twitter ban.

Items	Frequency	Percent
Yes	95	40.4
No, I used a VPN or other means to have access to my Twitter account	90	38.3
Yes, but I use other social media in place of twitter (Facebook, Instagram)	49	20.9
Others	1	0.4
Total	**235**	**100**

Table 3: Did you stop using Twitter even after the ban or you find alternative measures?

The table above shows the result of options engaged in by the undergraduate students of the University of Ibadan in response to the Twitter ban in Nigeria. The result revealed that majority (40.4%) agreed they stopped using twitter after the ban, 38.3% used a VPN or other means to have access to my Twitter account, 20.9% used other social media such as Facebook and Instagram in place of twitter whereas the remaining minute (0.4%) engaged

other platforms. This shows that VPN or other means to have access to Twitter account; other social media such as Facebook and Instagram were the options engaged in place of twitter by the undergraduate students at the University of Ibadan in response to the Twitter ban in Nigeria.

	Frequency	Percent
Respect for freedom of Expression by the government	69	29.4
Government should Implement laws devoid of breach on civil liberties	34	14.5
Inciting statements and Defamation should be avoided by the Users	41	17.4
Twitter's Terms of Service should be strictly adhered to by all users	50	21.3
Users must be factual when twitting	41	17.4
Total	235	100

Table 4: Which of these do you think will prevent a future ban on Twitter in Nigeria?

Table above shows the result of the suggestions of the undergraduate students of the University of Ibadan on how to prevent a future ban of twitter in Nigeria. The result revealed that 29.4% % of the respondents agreed that Respect for freedom of Expression by the government, 14.5% government Implementation of laws devoid of breach on civil liberties, 17.4% respondents agreed that the inciting statements and Defamation by the Users. (21.3%) and lastly, (17.4) respondents agree to users must be factual when twisting.

The study revealed the twitting constitute the suggestions of the undergraduate students of the University of Ibadan on how to prevent a future ban of Twitter in Nigeria.

Summary

The findings of this study show that the ban on Twitter is against the use of social responsibility theory which lies between both authoritarian theory and libertarian theory because it gives total media freedom on one hand but external control in the other hands. It proposes that press freedom should be exercised responsibly. It states that the media should serve the public and to do so, should remain free of all forms of interference.

Nigerian government’s action on Twitter ban proves further that it embraces the authoritarian theory, as the government capitalized on the power vested on her which never allowed the look at the purpose of Twitter's platform before banning the operation of Twitter in Nigeria because of Twitter deleting the president's Twit for violation of the Twitter community rules. It is therefore, imperative for the government to prioritize the well-being of the citizens who entrusted them with their mandate, placing their interests before their own.

Conclusion

The Twitter ban in Nigeria significantly impacted higher education by disrupting established communication channels and collaborative learning opportunities. The study concluded that Twitter ban affects the students in their collaboration and networking among students (Moemeke & Mormah, 2022).

It was revealed that the Twitter ban by the Federal Government has left a negative perception in the minds of citizens. To fully comprehend the ramifications of this ban, further research is required to capture the nuanced perspectives of students. This literature review underscores the urgency of examining the ban's effects on education and calls for proactive strategies to ensure the continuity of learning in a dynamic digital integration in higher education.

Recommendation

This study recommended that the Nigerian government should consider never to ban Twitter and all other media platform in the future as it is seeing to be an infringement on the fundamental human rights of Nigerians citizens which is a total freedom of expression as stated by the 1999 constitution of the Federal Republic of Nigeria. Also, government policies and the self-regulatory features of the media should conform or align with the constitutional guarantees on the freedom of expression.

Lastly, both the Nigerian government and its citizens should understand that there’s a limit to power and so, all must operate within the confined of the power accrue to them and must not violate other people’s rights while exercising theirs.

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Exploring High School Learners' Proficiency in Euclidean Geometry

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Abstract
This paper reports on a qualitative study that probed high school learners' proficiency in Euclidean geometry in South Africa. Euclidean geometry lessons were conducted in a collaborative learning classroom, and participants' competence was assessed using Kilpatrick's five strands of mathematical proficiency as benchmark. Kilpatrick's five strands of developing mathematical proficiency was the theoretical framework and it was also used to inductively analyse participants' oral and written responses from the collected data gleaned from participants' oral and/or written responses to activities, investigation tasks, Mathematical proficiency test and classroom observations. This study established that majority of participants had challenges in all the five strands. The few participants who demonstrated competence and proficiency in Euclidean geometry provided substantial evidence of mastery of all the five strands attesting to the assertion of inter-dependence of Kilpatrick's five strands of mathematical proficiency. The researchers concluded that students lacked proficiency in Euclidean geometry, therefore, recommended that appropriate strategies must be implemented during mathematics lessons to assist students to develop all the five strands of proficiency in Euclidean geometry, as this will assist them to overcome their mathematical learning difficulties and under-achievement.

Keywords: Mathematical Proficiency, Euclidean Geometry, Problem-Solving

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Introduction

Teachers, in attempting to ensure students attain efficiency in learning mathematics, has resulted in several vital reconceptualization shifts in classroom practices. The most recent evolution being the development of "mathematical power", that is, cultivating students' competence in reasoning, problem-solving, connecting mathematical ideas and communicating mathematically to others, for the development of "mathematical proficiency" (NRC, 2001; Schoenfeld, 2007; Brijlall & Ally, 2020; Corrêa & Haslam, 2021; Brijlall & Ivasen, 2022). This does not imply that developing students' mathematical knowledge, basic skills, numeracy, and computational skills which preceded the concept of developing students' mathematical power were superfluous. Rather, they were considered insufficient in addressing students' challenges in learning mathematics. Thus, the focus migrated to conceptual understanding and application of mathematical knowledge (NRC, 2001; Corrêa & Haslam, 2021). According to Schoenfeld, (2007, p.64) "knowing mathematics, in the sense of being able to produce facts and definitions, and execute procedures on command, is not enough; rather, being able to use it in the appropriate circumstances is an essential component of proficiency". Schoenfeld, (2007, p. 60-68) classified attaining mathematical proficiency, in four dimensions, namely, developing the knowledge base; developing relevant strategies; developing metacognition and applying what one knows effectively, as well as developing students' beliefs and dispositions.

The concept of developing mathematical proficiency as an appropriate mathematics instructional approach was born in 2001, by Kilpatrick, Swafford, & Findell. It encompasses five strands, namely, conceptual understanding, procedural fluency, strategic competence, mathematical reasoning, and productive dispositions. According to Kilpatrick et al., (2001) these strands are not independent, but rather, intertwined, thus, mathematical proficiency cannot be achieved by only focusing on some aspects of the five strands. This implies that developing mastery in all the five strands is paramount (Corrêa & Haslam, 2021). NRC, (2001) embraced the concept of mathematical proficiency as the modus operandi for effective mathematics learning – competence, knowledge, and facility. NRC, (2001) further asserted that developing students' mathematical proficiency in the early grades can assist them to cope with higher-order concepts in later grades, thus, should be nurtured. This highlights the need for students to be mathematically proficient as it will assist them in higher education, workplace, and daily lives (NRC, 2001; Brijlall & Ivasen, 2022).

Attaining mathematical proficiency is not instantaneous, but rather, it develops over time (NRC, 2001). Researchers have noted with concern that "how" mathematical proficiency can be achieved in different contexts is limited in literature, hence, mathematics education researchers have recommended that there is a dire need to teach, differently, mathematics in general and Euclidean geometry, in particular, to assist students to be mathematically proficient (Brijlall & Ally, 2020; Abakah & Brijlall, 2022). This advocates "the reinvigoration of the teaching of mathematics in its entirety – classroom learning practices, content, teaching and assessments" (DoBE, 2018, p.3). South Africa mathematics teachers, hence, are urged to 'un-teach' inefficient instructional approaches which might be the root cause of students' underperformance in mathematics and 're-teach' integral mathematical concepts such as Euclidean geometry through problem-solving and developing students' mathematical proficiency in those concepts. In effect, students will be dissuaded from using ineffective approaches of learning and concentrate on efficient ways of learning mathematics. This will assist them to become good learners, good problem-solvers, and good thinkers

(Fahim & Eslamdoost, 2014) which can give them the opportunity to engage in more comprehensive practices (Swartz & Reagan, 1998).

Milgram, (2010) cited precision, stages, and problem solving as procedures that are essential components of mathematical proficiency; this author established that problem-solving is indispensable in cultivating students' mathematical proficiency, thus, must be taught. Posamentier, Smith and Stepelman (2010) aver that teachers who aim to teach through problem-solving must ensure that students' prior knowledge is adequate, that relevant mathematical techniques are developed, sufficiently practised, and applied abstractly, based on deduction and logic. Otherwise, students will be incapacitated and unable to cope during problem-solving and learning higher-grade mathematics (Brijlall, 2015; Abakah & Brijlall, 2022), hence, a curriculum, which teaches students thinking and problem-solving skills is sacrosanct (Abakah & Brijlall, 2022). This will require students to engage in explicit organized thinking about mathematical concepts and enable them to facilitate reflections on problem-solving, although the systematicity and profundity of teaching thinking is a challenge (Fahim & Eslamdoost, 2014).

According to NCTM, (2000), problem-solving stimulates mathematical reasoning and understanding for learning new mathematical knowledge; this reiterates the need to teach mathematics through problem-solving. The concepts of teaching and learning mathematics via problem-solving and developing students' mathematical proficiency have empirically been established as indispensable mathematical practices (DoBE, 2018). Problem-solving is gaining grounds as an efficacious instructional approach (Abakah & Brijlall, 2022; Syarifuddin & Atweh, 2022; Ofori-Kusi, 2017; Phuntsho & Dema, 2019; Mwelese & Wanjala, 2014). Developing students' mathematical proficiency has globally been established as relevant instructional aims and/or objectives in any mathematical context (Maharaj, Brijlall & Narain, 2015; DoBE, 2018; Corrêa & Haslam, 2021). For instance, the Mathematics Teaching and Learning Framework (MTLF) in South Africa was developed and underpinned by the two dimensions (see Figure 1). Specifically, developing students' proficiency in mathematics have received global acclamation as an effective medium for addressing associated teaching and learning difficulties which have adversely contributed to students' challenges and under-achievements in mathematics, although similar attention is limited in literature on Euclidean geometry (Brijlall & Abakah, 2022). The researchers, thus, aim to explore students' proficiency in Euclidean geometry as they learn and solve problems.

In realising this aim, the researchers adopted the five strands of developing mathematical proficiency by Kilpatrick, et al., (2001). This was employed as an analytic tool to measure participants' achievement in Euclidean geometry-knowledge, skills, abilities, and beliefs. To this end, the researchers focused on the use of the five dimensions as the medium for determining participants' proficiency in Euclidean geometry, thus, the following critical research question was formulated: *Which of the five strands of Kilpatrick's measure of mathematical proficiency are demonstrated by the participants as they learn and solve Euclidean geometry problems?*

Literature Review

The teaching and learning difficulties associated with mathematics generally and Euclidean geometry have challenged South African teachers and learners for decades. This is ubiquitous in mathematics classrooms. A plethora of research studies have been conducted by mathematics education researchers, using a variety of strategies and research designs.

However, the teaching and learning difficulties in relation to Euclidean geometry are still prevalent, to the concern of all and sundry (DoBE, 2018). These prompted the Department of Basic Education in South Africa to realise the need to approach this conundrum differently. To this end, the Mathematics Teaching and Learning Framework (MTLF), see Figure 1, was developed as a possible solution after expert advice in collaboration with literature. This approach aimed at developing students' problem-solving and mathematical proficiency, which have been identified as measures for addressing students' teaching and learning difficulties and under-achievement in mathematics.

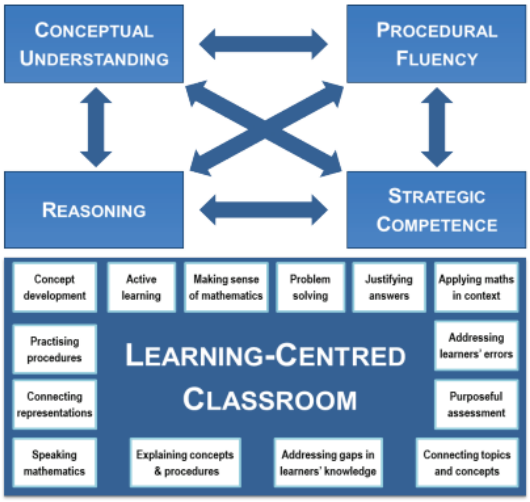


Figure 1: Mathematics teaching and learning framework for South Africa (DoBE, 2018, p.9)

This framework was introduced to South African mathematics teachers to enable them employ appropriate, relevant, and efficient teaching and learning strategies and approaches in mathematics classrooms. It was a follow-up to the Curriculum and Assessment Policy Statement (CAPs) document. The foci of this framework are to guide teachers to teach mathematics to learners effectively; to enable learners develop conceptual understanding, procedural fluency, strategic competence; to develop learners' ability to formulate, present, and decide on appropriate strategies to solve mathematical problems, mathematical reasoning skills, as well as to promote a learner-centred classroom (DoBE, 2018).

Theoretical Framework

Developing Mathematical proficiency by Kilpatrick, et al., (2001), was adopted as the theoretical framework for this study. This theory consist of five intertwined strands of proficiency, each, listed and defined by Kilpatrick et al., (2001, p. 116) as follows: (1) Conceptual Understanding - comprehension of mathematical concepts, operations, and relations; (2) Procedural Fluency - skills in carrying out procedures flexibly, accurately, efficiently, and appropriately; (3) Strategic Competence - ability to formulate, represent, and solve mathematical problems; (4) Adaptive Reasoning - capacity for logical thought, reflection, explanation, and justification; (5) Productive Disposition - habitual inclination to see mathematics as sensible, useful, and worthwhile, coupled with a belief in diligence and one's own efficacy.

In the context of Euclidean geometry, each of the five strands, with reference to Figure 2, can be demonstrated using the following exemplar, which required students to prove that: $XY^2 = DY.YC$; $\hat{A}_1 = \hat{B}_1$; $\frac{r^2}{R^2} = \frac{DY}{CY}$ $if\ \Delta CAY\ ///\ \Delta YBX$. These problems displayed in Figure 3,

demand - recalling, applying, and connecting basic geometry knowledge, relevant circle geometry theorems and/or converses of theorems, appropriate geometry concepts, symbols, geometry language, as well as skills. These are all students' prior knowledge of geometry which are highly essential for solving these higher-order geometry problems and eradicating common errors. According to Kilpatrick et al., (2001), students who can demonstrate those competences have attained conceptual understanding. In addition, learners who can apply relevant skills, knowledge and geometric procedures must also know when and how to use them. This is what Kilpatrick et al., (2001) referred to as "procedural fluency". Students' proficiency in Euclidean geometry also requires them to demonstrate strategic competence - formulating geometric problems, representing geometric problems mathematically, using geometric language, notations, and strategies correctly in solving geometry problems. In the context of Euclidean geometry, this require extensive practice, to be able to attain such level of mastery.

In collaboration with the above three dimensions of proficiency, crucial to attaining proficiency in Euclidean geometry is students' ability in adaptive reasoning, which is advanced geometry thinking by reflecting, explaining, justifying, and authenticating the reasonability of proposed solutions to higher-order, non-routine geometry problems (Kilpatrick et al., 2001). This is because Euclidean geometry by its nature is a thinking-laden mathematical concept (Abakah & Brijlall, 2022), thus, students must cultivate logical, creative, critical, and reflective thinking to be proficient in Euclidean geometry. The last competence that needs to be demonstrated by students, according to Kilpatrick et al., (2001) is productive disposition. As seen in Figure 3, this is a higher-order Euclidean geometry problem-solving task which requires persistence, belief, confidence, self-efficacy, and resilience as students search for meaningful solutions to given problems. The process is aided by students acquiring mathematical sensibility and realising its usefulness and worthwhileness. In other words, students must know the value and experience the need for mathematics (Kilpatrick et al., 2001).

Research Design

This study implemented a qualitative case study research design and data was mainly generated through classroom observations and proficiency test conducted. The researchers considered a qualitative case study research design to be appropriate for this study since participants needed to be intensively observed in their natural classroom setting. This design provided the researchers with detailed accounts and explanations of activities ad occurrences at the research field as participants were continuously observed over the period of the research.

Participants

The researchers investigated 32 participants' competence and proficiency in Euclidean geometry as they learn and solve problems; they were from the same class (11B) and were taught mathematics by the same teacher, at the same research field. Participants were taught Euclidean geometry in a collaborative classroom setting. During the lessons, activities, investigation tasks and classroom observations were conducted. Thereafter, a proficiency test was administered. Gender, ethnic, social and race criteria were not employed when identifying participants, therefore, all learners who willingly agreed to participate in this study were allowed to do so.

Ethical Considerations

Before the commencement of this study ethical procedures were adhered to – informed consent, confidentiality, and voluntary participation. On the aspect of informed consent, permission was obtained in writing from the Provincial Department of Education, the SGB of the research field school, participants and their parents or guardians. Anonymity was adhered to as participants' identifications were not revealed. To ensure voluntary participation, only learners who willingly availed themselves and had signed forms of consent, were taken as participants for this study.

Qualitative Data Analysis

This was a qualitative study. Creswell (2012) aver that in a qualitative study, these four steps are sacrosanct: preparing data, analysing data, reporting results, and interpreting the results. According (Creswell & Creswell, 2018) qualitative research investigates meanings individuals or groups attribute to a social or human problem. These authors further posit that, in a qualitative study- emerging questions, procedures, data collected in the participant's setting, inductive data analysis from emerging themes, which are then interpreted for concise and meaningful inference are paramount.

In this study, after the researchers administered the proficiency test to each participant, they marked each participant's script and content analysis was also conducted on each participant's script. Thereupon, data analysis of each participant's written responses commenced; this was conducted in four phases; the procedure followed in this study is illustrated on the arrow diagram below and each phase is delineated thereof.

Participants written responses →Data reduction →Categorizing, Coding and Tabulation → Developing patterns and themes.

Phase '1- Participants' Written Responses

Participants' written responses, attesting to 'how' and 'why' each of the five strands was attained and/or not attained are presented. In this regard some participants' written responses were taken at random and displayed, content analysis and discussion of participants' work were also carried out.

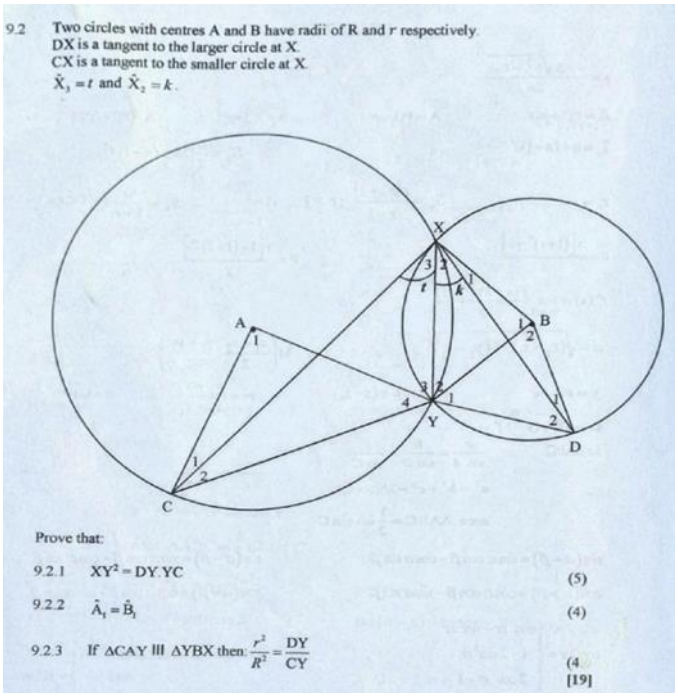


Figure 2: Proficiency test – non-routine task

Figure 2 is a non-routine circle geometry task. This demands applications of the combination of deductions, brainstorming, logical reasoning and advanced mathematical thinking around relevant circle geometry theorems and/or converse of theorems, as well as appropriate geometric properties in order to conjecture appropriate responses to the given questions.

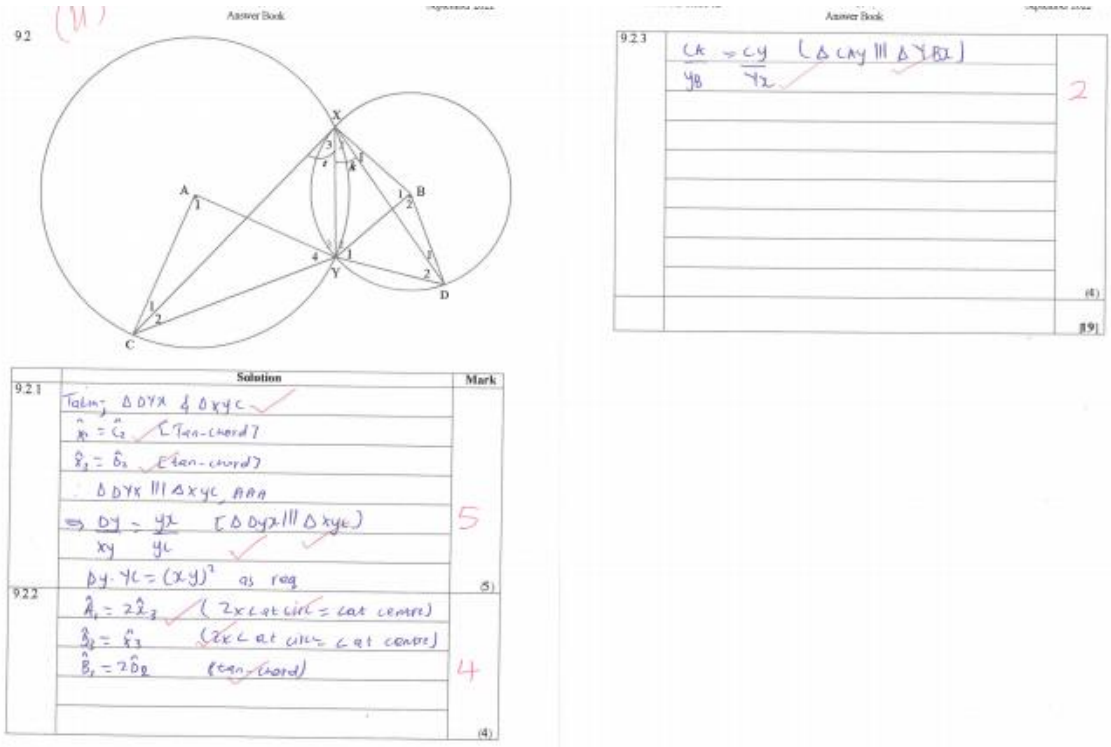


Figure 2.1: A participant's written response

Figure 2.1 informs that this participant was able to interpret the geometric diagram well with reference to the given sub-questions. S/he was able to logically provide appropriate responses

to the given sub-questions as s/he brainstormed around the relevant circle geometry theorems and geometric properties. The analysis of this participants written responses displayed in Figure 2.1 is presented on the Mathematical Proficiency indicator rating index form (see Figure 3). Another participant's work, randomly selected, is presented next in Figure 2.2.

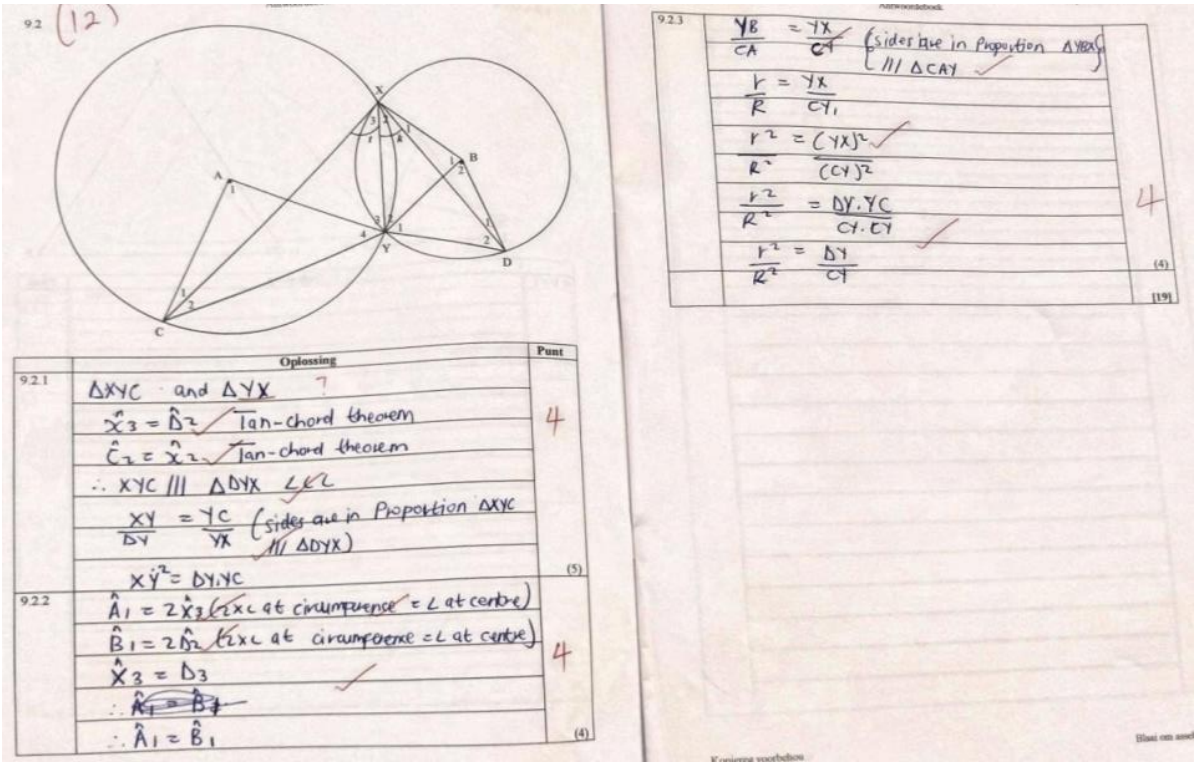


Figure 2.2: A participant's written response

In Figure 2.2 it is observed that this participant was able to interpret the geometric diagram and the sub-questions well. Evidence of logical reasoning and brainstorming around relevant circle geometry theorems and geometric properties can be seen from this participant's work. The analysis of the participant's written responses displayed in scan 2 is like the analysis presented in Figure 3, thus, needed no repetition. The written responses of one other participant, randomly selected, are displayed next in Figure 2.3.

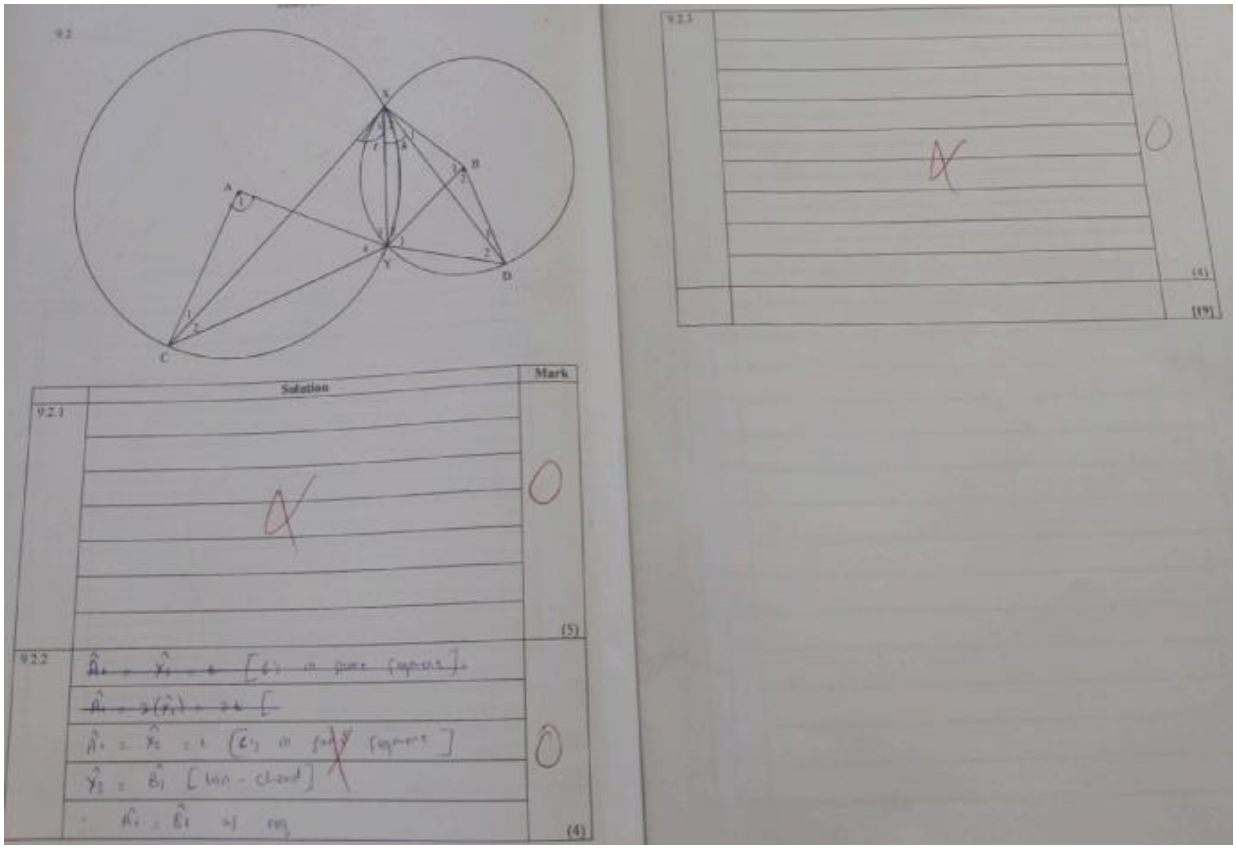


Figure 2.3: A Participant's written response

As displayed on scan 3, it is evident that this participant lacked relevant knowledge of circle geometry concepts and geometric properties. There is no evidence of logical applications of relevant circle geometry theorems, thus, s/he could not make meaningful deductions. This resulted in this participant providing incorrect responses to all the sub-questions - s/he scored zero for all the questions.

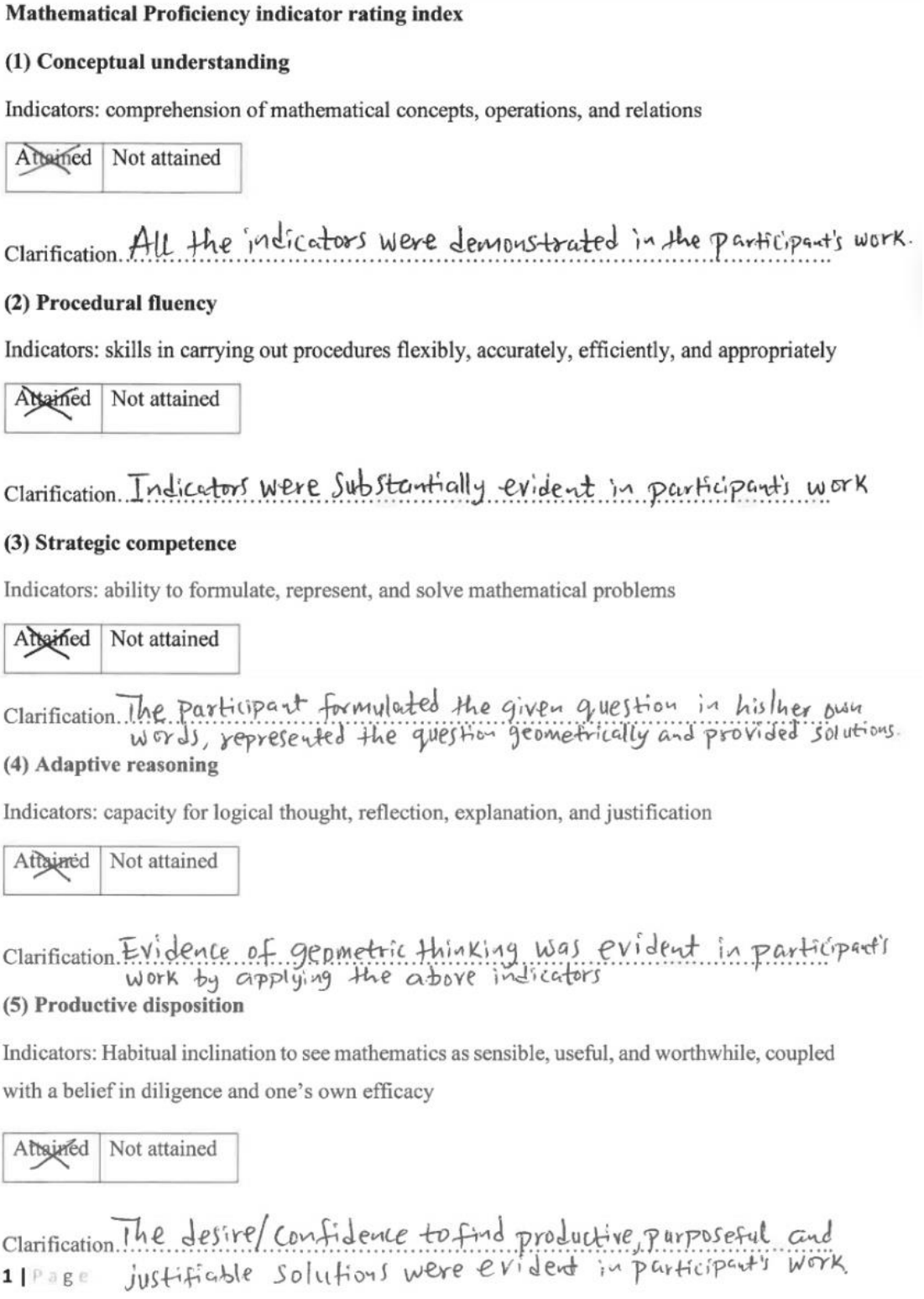
Phase 2- Data Reduction

Data reduction is essential for minimising the volume of collected data, so that it can be summarized for easy presentation, interpretation, and analysis (Mezmir, 2020). The collected data was analysed qualitatively by utilising Kilpatrick's five strands of mathematical proficiency by implementing the following five proficiency indicator parameters:

(1) Participants who demonstrated comprehension of mathematical concepts, operations, and relations were rated as having attained category 1- conceptual understanding.
(2) Participants who demonstrated skills in carrying out procedures flexibly, accurately, efficiently, and appropriately were rated as having attained category 2- procedural fluency.
(3) Participants who demonstrated ability to formulate, represent, and solve mathematical problems were rated as having attained category 3- strategic competence.
(4) Participants who demonstrated capacity for logical thought, reflection, explanation, and justification were rated as having attained category 4- adaptive reasoning.
(5) Participants who demonstrated habitual inclination to see mathematics as sensible, useful, and worthwhile, coupled with a belief in diligence and one's own efficacy were rated as having attained category 5- productive disposition.

The researchers determined each participant's competence in each of the five parameters by using the Mathematical Proficiency indicator rating index form (see Figure 3) to analysis their written responses. There is need to note that content analysis of a participant's written response was done holistically, hence, a participant could be rated as having attained and/or not attained more than one proficiency parameter as far as evidence of attainment of such proficiency parameter indicators were demonstrated in the participant's work.

After the researchers marked participants' script, data reduction (summary of relevant information) was done (Brijlall & Ivasen, 2022). Thus, the number and percentage of participants who attained each of the five strands from the proficiency test were summarized and presented in a tabular format (see Table 1). This information was obtained from participants' Mathematical Proficiency indicator rating index forms.



Mathematical Proficiency indicator rating index

(1) Conceptual understanding

Indicators: comprehension of mathematical concepts, operations, and relations

Attained	Not attained

Clarification. All the indicators were demonstrated in the participant's work.

(2) Procedural fluency

Indicators: skills in carrying out procedures flexibly, accurately, efficiently, and appropriately

Attained	Not attained

Clarification. Indicators were substantially evident in participant's work

(3) Strategic competence

Indicators: ability to formulate, represent, and solve mathematical problems

Attained	Not attained

Clarification. The participant formulated the given question in his/her own words, represented the question geometrically and provided solutions.

(4) Adaptive reasoning

Indicators: capacity for logical thought, reflection, explanation, and justification

Attained	Not attained

Clarification. Evidence of geometric thinking was evident in participant's work by applying the above indicators

(5) Productive disposition

Indicators: Habitual inclination to see mathematics as sensible, useful, and worthwhile, coupled with a belief in diligence and one's own efficacy

Attained	Not attained

Clarification. The desire/confidence to find productive, purposeful and justifiable solutions were evident in participant's work.

1 | Page

Figure 3: An example of a completed participant's Mathematical Proficiency indicator rating index form

Phase 3- Categorizing, Coding and Tabulation

The number of participants who displayed the Mathematical proficiency parameter were categorized, coded, and tabulated. This was so that they can easily be compared, from which emerging themes were noted (McMillan & Schumacher, 2014). According to McMillan and Schumacher, (2014, p. 413), "data must be organized to analyse them, either using predetermined categories or developing codes from the data. Predetermined categories are derived from the research problem, an interview guide, literature, and personal or general knowledge". After content analysis of participants written responses was undertaken, data reduction, categorizing and coding of Mathematical proficiency parameters, were followed respectively. Thereafter, tabulation of the number and percentage of participants who operated at each of the five levels of proficiency of Euclidean geometry was summarized and presented (see Table 1).

Kilpatrick's five strands of mathematical proficiency					
Participants Categorization	Strand-1 Conceptual Understanding	Strand-2 Procedural Fluency	Strand-3 Strategic Competence	Strand-4 Mathematical Reasoning	Strand-5 Productive Dispositions
No. of Participants	7	7	7	7	7
Percentages	22%	22%	22%	22%	22%

Table 1: Summary of how participants responded to the proficiency test items based on Kilpatrick's five strands of mathematical proficiency.

As illustrated in Table 1: 7 (22%) of participants demonstrated conceptual understanding, procedural fluency, strategic competence; mathematical reasoning skills and productive dispositions, whereas none of the other 25 (78 %) participants were able to attain proficiency in each of the five strands.

Phase 4- Developing Patterns and Themes

According to McMillan and Schumacher, (2014, p. 412 - 413), "In inductive analysis, the categories and patterns emerge from the data". It can be observed on Table 1 that the number and percentage of participants who demonstrated each category of Mathematical proficiency parameter were presented. The relationship among the number and percentage of participants for the categories is that the same number and percentage attained and/or did not attain all the five categories.

Discussion of Research Findings

In this section, the research findings are presented and elaborated in accordance with the research question drawn up for this study: *Which of the five strands of Kilpatrick's measure of mathematical proficiency are demonstrated by the participants as they learn and solve Euclidean geometry problems?*

This study established that 7 (22%) of participants demonstrated conceptual understanding, procedural fluency, strategic competence, mathematical reasoning, and productive dispositions (see Table 1). Exemplars to testify they are presented in scans 1-2. The completed participants' Mathematical Proficiency indicator rating index form (see Figure 3)

inform "how" and "why" the researchers analysed participants' written responses to assess their proficiency in Euclidean geometry (Kilpatrick et al., 2001; Brijlall & Ivasen, 2022).

It can be seen in Figure 3 that the researchers judged that the participant attained conceptual understanding of Euclidean geometry concepts. The researchers justified this with the clarification that "*All the indicators were demonstrated in the participant's work"*. This means the participant demonstrated evidence of comprehension of mathematical concepts, operations, and relations. On procedural fluency, the researchers judged that the participant attained this strand of proficiency; the researchers clarified that: *"indicators were substantially evident in participant's work".* This implied that this participant could apply relevant skills in carrying out procedures flexibly, accurately, efficiently, and appropriately. The researchers, also, judged that this participant had attained strategic competence; *"the participant formulated the given question in his/her own words, represented the question geometrically and provided solutions".* In addition, the researchers judged that this participant attained adaptive reasoning; this was supported with the clarification that *"evidence of geometric thinking was evident in participant's work by applying the indicators-logical thought, reflection, explanation, and justification".* Lastly, on productive disposition, the researchers judged that the participant attained this proficiency strand; *"the desire/confidence to find productive, purposeful and justifiable solutions were evident in participant's work"*. According to Kilpatrick et al., (2001, p.116) participants who could show evidence of mastery of conceptual understanding, procedural fluency, strategic competence, mathematical reasoning, and productive dispositions by demonstrating their respective indicators were mathematically proficient.

The narrations above justify "how" and "why" the researchers judged that 7 (22%) of participants demonstrated proficiency in Euclidean geometry. This is because these participants displayed evidence of mastery of the indicators of each of the five stands of Mathematical proficiency. It is illustrated on Scans 1 & 2 that such participants had substantial knowledge of circle geometry theorems, converses of theorems, and properties of geometric shapes and correctly applied appropriate geometric procedures. The contents on scans 1 & 2 also reveal that these participants were able to interpret the geometric diagram well with reference to the given sub-questions. They rightly identified relevant theorems and/or converses and other related geometric concepts; they then logically brainstormed around them and consistently applied chains of deductions and advanced mathematical thinking to conjure appropriate responses to the given questions. These were established as there were ample evidence of advanced, logical, and reflective geometric thinking from these participants' written responses. Also, the persistence, confidence, and desire to obtain meaningful solutions to the given problems were exhibited; scans 1 and 2 serve as evidence. In these scans, according to Kilpatrick et al. (2001, p.16), these participants demonstrated proficiency in Euclidean geometry as all the five associated strands were mastered and demonstrated in their conjectured solutions.

Notably, the few participants who demonstrated competence and proficiency in Euclidean geometry provided substantial evidence of mastery of all the five strands, confirming the assertion that these five strands of mathematical proficiency are not independent, rather, they are inter-woven and inter-dependent on each other (Kilpatrick et al., 2001; NRC, 2001; Corrêa & Haslam, 2021). This point was established in this study as the 7 (22%) of participants who demonstrated conceptual understanding, also demonstrated competence in the other four strands.

Conclusion

The analyses conducted in this study established that few participants' written responses portrayed that they had factual knowledge of Euclidean geometry concepts, and had understood, applied, analysed, synthesised, and evaluated their conjectured solutions to the given problems. These dimensions are measurement criteria of proficiency in mathematics and extended to Euclidean geometry in this study. Interestingly, the few participants who demonstrated competence and proficiency in Euclidean geometry provided substantial evidence of mastery of all the five strands confirming the assertion that Kilpatrick's five strands of mathematical proficiency are inter-dependent. This study also established that, although, participants were exposed to Euclidean geometry content and problems, majority of them were still unable to attain proficiency as they had challenges in all the five strands. The researchers, thus, deduced from these findings that a participant either demonstrated competence and mastery of all the five strands or none of them. Most participants who did not demonstrate competence in any of the five strands gave the researchers a reason to conclude that students lacked proficiency in Euclidean geometry. It is, therefore, recommended that appropriate strategies must be implemented during mathematics lessons to assist students to develop all the five strands of proficiency in Euclidean geometry as they are inter-dependent. This approach will assist students to overcome their learning difficulties and under-achievement.

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Student Personality and Emotional Intelligence: Canton Ambato Case Study

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Abstract
The aim of this study was to evaluate the personality of students in the eighth, ninth and tenth years of the Private Educational Units of the Ambato-Ecuador canton, using the Eysenck Personality Test. Initially, we worked with a population of 287 students between 13 and 15 years of age of both sexes, the aspects evaluated by the questionnaire are the dimensions of the children's personality, these differential structures shape their relationships with learning situations and their adaptations to the social environment; however, the analysis of criterion "L" - Truthfulness, included in the questionnaire, led to the exclusion of 231 (80.48%) students from the research, originating the presentation of results based on 56 (19.52%) students. The dimensions evaluated were: (i) E = introversion - extroversion; (ii) N = stability - instability; and (iii) L = truthfulness (lie scale) where it was identified that most students are in an ambiverted range, characteristic of age, being able to be considered as flexible people who can be introverted and extroverted depending on social conditions, being this an incident aspect in the formation of emotional intelligence.

Keywords: Personality, Emotional Intelligence, Eysenck Test

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Introduction

Emotional intelligence allows understanding, managing and examining the emotions of oneself and others, thus achieving positive effects and greater satisfaction with life (Rafique, 2020), it constitutes the human being's ability to perceive, evaluate and express emotions accurately, thus achieving to acquire and or produce feelings while promoting thinking and emotional awareness, which are responsible for regulating emotions, promoting emotional and intellectual growth (Gómez-Leal, 2021), on the other hand emotional intelligence can be understood as the ability to control one's own emotions and influence the emotions of others in any context involving problem solving (Millán-Franco, 2021), it is conceptualized as a combination of self-perceptions related to emotions and behaviors associated with the ability to recognize through information closely related to emotions (Delgado-Bello, 2021).

According to the above-mentioned emotional intelligence is a set of skills that can be assimilated in order to guide thoughts and thus social interaction (Ayala-Servín, 2021), when it comes to emotional intelligence, emotional stability is closely related, as it refers to a person's ability to maintain stability and balance. On the other hand, highly neurotic or emotionally unstable people tend to experience negative emotions easily (Ali Ahmed, 2020), in other words, emotional stability refers to the process by which people influence their emotions, the moments in which they perceive them and how they experience and express them (García Pardo, 2020).

When talking about emotional stability, the following personality traits should be taken into account: extroversion, agreeableness, neuroticism, rectitude and openness (Santos Pazos, Erazo Salcedo, & Mogrovejo Gualpa, 2019). The factors that make up the personality are: Openness to experience - closure before experience, responsibility - lack of responsibility, extraversion - introversion, agreeableness - opposition, and emotional stability - neuroticism (Guadalupe, 2021).

Extraversion - Introversion: Extroverts encompass approach behaviors rooted in the need for greater stimulation caused by cortical understimulation, while introverts demonstrate avoidance behaviors to inhibit overstimulation. Similarly, extroverts are more likely to engage in approach behaviors, usually associated with impulsivity, whereas introverts are more likely to engage in avoidance behaviors (Walker, 2020). Agreeableness - oppositionalism: This refers to the social relationship and the responses that are proposed to others. At one pole of this component would be items such as sympathy, generosity, faithfulness, gentleness or participation and, at the other, being icy, unfriendly, ruthless, stiff and ungrateful (Sanchez, 2020).

Responsibility - lack of responsibility: Reflects the level of organization, persistence, control and motivation in goal-directed behavior, and deals in essence with the way in which people conduct their work. The causative subjects could be those who are characterized by neatness, organization, accuracy, caution, efficiency or care, and at the other extreme would be the abandoned, disorderly, irresponsible, forgetful or independent people (Centelles, 2021). Emotional stability - neuroticism: neuroticism contrasts equality with instability in the emotional adjustment achieved by the individual, where there may be presence of negative affective states, such as anxiety, fear, sadness and guilt. Individuals with high levels of Neuroticism also tend to have irrational ideas and problems in controlling their impulses and coping with stressful situations. At the other extreme, subjects with low levels of Neuroticism are generally calm, controlled and relaxed (Cuyul, 2021).

Openness to experience - closure before experience: This is a new, albeit controversial, dimension that refers to the inquiry of experiences and the pleasure for the unknown and its experimentation. Those who are located at the preeminent end of this magnitude could be subjects with broad interests, original, curious, inventive, witty, ingenious, insightful, imaginative or sophisticated, while the opposite could be conventional individuals in their beliefs and reactions, conservative in their tastes, dogmatic and solid in their beliefs, with limited and unemotional interests (Ruiz, 2020).

Population

In the development of the research, we have considered the students of the private educational units of the Ambato Canton who are part of a study population of a community outreach project.

To indicate the study population, technical exclusion criteria have been used due to the characteristics of the case study with the Eysenck personality questionnaire; initially 287 students from different Private Educational Units of Canton Ambato ranging between 13 and 15 years old are considered; subsequently, after analyzing the dimension "L" (scale of lies) immersed in the questionnaire, the scores obtained exceed the allowed value of "L" in the scales, so 231 students were excluded, the reasons are described in section 2. 5; finally, a study sample of 56 students belonging to eighth, ninth and tenth grades was defined.

In addition, prior to the study, an informed consent was socialized and applied to the students' parents, who agreed to their participation in the assessment process; thus, the information was collected individually, and the data collected are confidential and for academic purposes.

Criteria for the Application of the Eysenck Personality Inventory Questionnaire

Once the study population has been determined, the following criteria were considered for the application of the Eysenck personality inventory: (i) informed consent to the students' parents, (ii) voluntary participation of the students; (iii) students from 13 to 15 years old from private Educational Units of the Ambato canton (Cassilde & Gilson, 2017).

Methodology of Application of the Instrument "Eysenck Personality Inventory"

The instrument applied for the case study is authored by the University of London called "Eysenck Personality Inventory for Children" - Form A by the author H. J. Eysenck; it can be applied to boys and girls from 7 to 16 years old, it does not indicate a specific time of application of the questionnaire, however, the average time ranges approximately between 15 minutes.

The aspects that the questionnaire evaluates are the dimensions of children's personality, these differential structures shape their relationships with learning situations and their adaptations to the social environment.

The following dimensions: (a) Dimension "E" - Introversion - Extraversion, are manifested in the change, or not, in personality and in their susceptibility to fatigue and psychological exhaustion as indicated in Tables 1 and 2; (b) Dimension "N" - Stability - Instability analyzes

the degree of adjustment of the individual to his environment, as indicated in Tables 3 and 4; and, (c) "L" - Truthfulness (lying scale), as indicated in Table 5.

It should be noted that in Tables 1, 2, 3, 4 there are abbreviations whose meaning is as follows: A.I. = Highly Introverted; T.I. = Introverted Tendency; A. = Ambiverted; T.E. = Extraverted Tendency; A.E. = Highly Extraverted which correspond to the scores according to age range and sex.

Age	A.I.	T.I.	A.	T.E.	A.E.
13	0 - 9	10 - 13	14 - 21	22 - 23	24
14	0 - 10	11 - 13	14 - 21	22 - 23	24
15	0 - 7	8 - 12	13 -21	22 - 23	24

Table 1: Extroversion - introversion scale (GIRLS) Dimension E

Age	A.I.	T.I.	A.	T.E.	A.E.
13	0 - 11	12 - 14	15 - 21	22 - 23	24
14	0 - 11	12 - 14	15 - 21	22 - 23	24
15	0 - 10	11 - 14	15 -20	21 - 23	24

Table 2: Extroversion - introversion scale (CHILDREN) Dimension E

Age	A.I.	T.I.	A.	T.E.	A.E.
13	0 - 2	3 - 7	8 - 18	19 - 23	24
14	0 - 4	5 - 9	10 - 18	19 - 23	24
15	0 - 4	5 - 9	10 - 18	19 - 22	23 o more

Table 3: Stability - instability scale (GIRLS) Dimension N

Age	A.I.	T.I.	A.	T.E.	A.E.
13	0 - 1	2 - 5	6 - 15	16 - 20	21 ó more
14	0 - 1	2 - 6	7 - 15	16 - 20	21 ó more
15	0 - 1	2 - 5	6 - 15	16 - 20	21 ó more

Table 4: Stability - instability scale (CHILDREN) Dimension N

Age	Girls	Boys
13	3	3
14	3	3
15	2	2

Table 5: Scale of lies

The Eysenck personality test is a verbal-written structured test with dichotomous answers. It uses the forced technique: YES - NO. As indicated in Table 6: Answer key, it has 60 questions, distributed as follows: "E" = 24 questions, "N" = 24 questions and "L" = 12 questions; the questions are interspersed without any special order, an indispensable requirement is that the child knows how to read.

It can be evaluated individually, but also collectively, in groups of no more than 25 members.

To evaluate either individually or collectively, the evaluator reads aloud the instructions and the examinees "read mentally". It is necessary that the participants understand the instructions and all the doubts are clarified by the evaluator, it is necessary to mention that all the

questions are answered; when any question is blank the evaluator must ask the examinee the reason why it was not filled to analyze or provide support.

	YES	NO		YES	NO		YES	NO
1	E		21	N		41	E	
2	N		22	E		42	N	
3	E		23	N		43	E	
4		L	24	L		44	L	
5	N		25	E		45	N	
6		E	26	N		46	E	
7	N		27	E		47	N	
8	L		28	L		48		L
9	E		29	N		49	E	
10	N		30	E		50	N	
11	E		31	N		51	E	
12		L	32		L	52	N	
13	N		33		E	53	E	
14	E		34	N		54	N	
15	N		35	E		55		E
16	L		36	L		56	N	
17	E		37	N		57	E	
18	N		38	E		58	N	
19	E		39	N		59	E	
20		L	40		L	60	N	

Table 6: Answer key

2.4. Consolidation of Information

An Excel spreadsheet shown in Figure 1 was used to consolidate the data, which contains: (i) Database, is the consolidated information of the 287 students, the questionnaires were physically applied and transcribed to the dynamic table "Eysenck Personality Inventory"; (ii) Tabulation, shows results on the 3 dimensions; it is made up of 60 questions, these results are the summation of the results delimited by the dichotomous questions; (iii) Results, are represented in YES - NO, the source of information in the spreadsheet "Eysenck Personality Inventory".

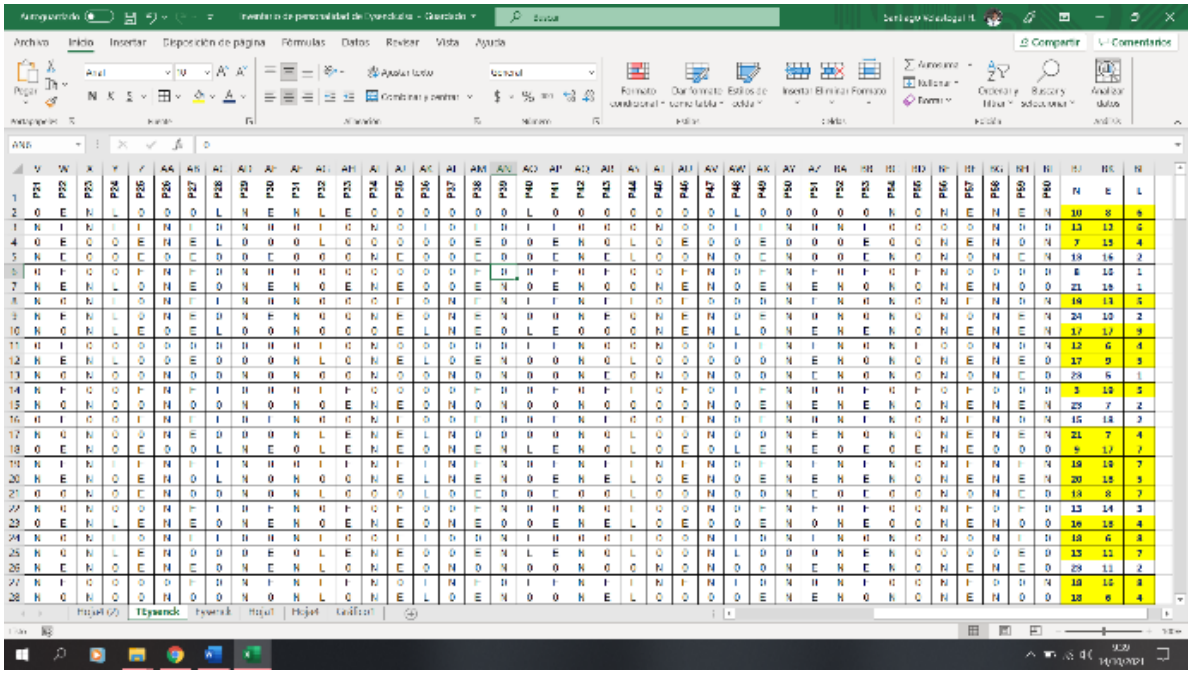

Figure 1: Excel data tabulation tool

2.5. Exclusion Based on Dimension "L" Truthfulness (Scale of Lies)

With the dimension of truthfulness or scale of lies, 231 students were excluded, equivalent to 80.49% of the study population, for the following reasons: they do not show interest in the execution of the test, they do not understand the meaning of the questions and/or they read too fast, which is allusive to personality characteristics or situations that the students go through that finally originate can mark the answers randomly.

3. Results

The initial results applied to the study population are shown in Table 7: Study population; in general, 55% of participants were male and 45% female.

Age	Sex				Total	%
(years)	Male	%	Female	%		
13	39	14%	61	21%	100	35%
14	50	17%	43	15%	93	32%
15	69	24%	25	9%	94	33%
Total	158	55%	129	45%	**287**	**100%**

Table 7: Population to which the Eysenck Personality Inventory was applied

Once the 287 students had been evaluated, the "L" dimension was analyzed, which resulted in the exclusion of 231 questionnaires as shown in Table 8; the reasons were explained in section 2.5 below.

Age (years)	Sex.				Total	%
	Male	%	Female	%		
13	6	11%	10	18%	16	29%
14	7	13%	8	14%	15	27%
15	12	21%	13	23%	25	45%
Total	25	45%	31	55%	**56**	**100%**

Table 8: Number of students applying the exclusion criterion (dimension "L")

Subsequently, Table 9 and Figure 2 show the results of the number of thirteen year old students with tendency Extroversion - Introversion Scale or Stability - Instability Scale of students who are 13 years old.

Age 13 years	Extroversion - introversion scale		Stability - Instability scale	
Sex.	H	M	H	M
Highly introverted	0	2	0	0
Introversion Tendency	2	3	0	1
Ambiverted	4	5	4	7
Extraversion Tendency	0	0	2	2
Highly extraverted	0	0	0	0
Total	6	10	6	10

Table 9: Results of the Eysenck Personality Inventory (13 years)

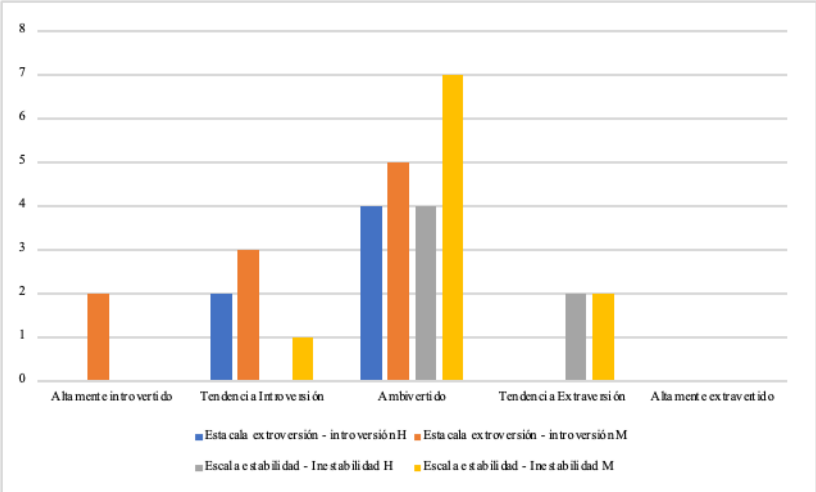

Figure 2: Eysenck Personality Inventory score (13 years)

Table 10 and Figure 3 show the results of the number of thirteen year old students with tendency Extroversion - Introversion Scale or Stability - Instability Scale of students who are 14 years old.

Age 14 years.	Extroversion - introversion scale		Stability - Instability scale	
	H	M	H	M
Highly introverted	2	0	0	0
Introversion Tendency	2	2	0	0
Ambiverted	3	6	6	6
Extraversion Tendency	0	0	1	2
Highly extraverted	0	0	0	0
Total	7	8	7	8

Table 10: Results of the Eysenck Personality Inventory (14 years)

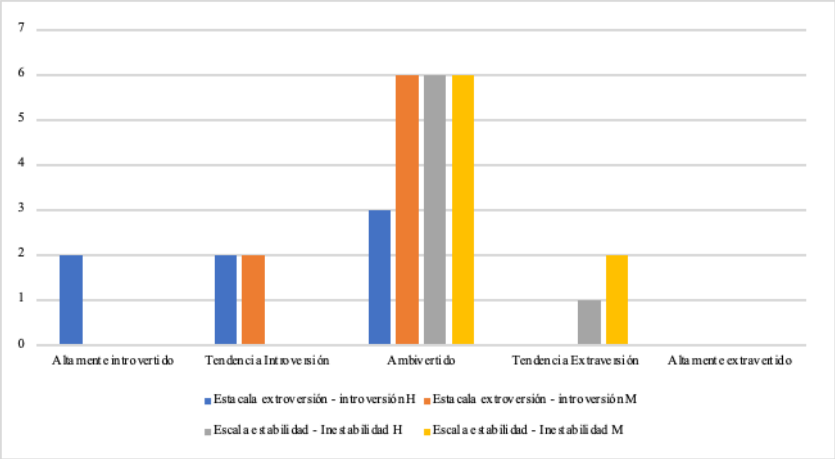

Figure 3: Eysenck Personality Inventory score (14 years)

Table 11 and Figure 4 show the results of the number of thirteen year old students with tendency Extroversion - Introversion Scale or Stability - Instability Scale of students who are 15 years old.

Age 15 years	Extroversion - introversion scale		Stability - Instability scale	
Sex.	H	M	H	M
Highly introverted	2	2	0	0
Introversion Tendency	3	3	0	3
Ambiverted	7	8	6	10
Extraversion Tendency	0	0	6	0
Highly extraverted	0	0	0	0
Total	12	13	12	13

Table 11: Results of the Eysenck Personality Inventory (15 years)

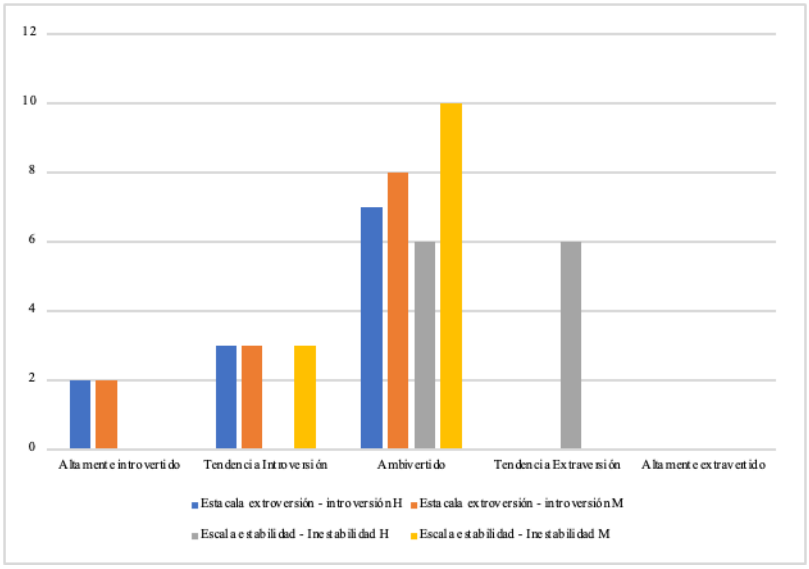

Figure 4: Eysenck Personality Inventory score (15 years)

In addition, tables 12 and 13 show the general results of the number of students under study, after applying the exclusion criterion (dimension "L").

A.I.	T.I.	A	T.E.	A.E.	T
8	15	33	0	0	**56**

Table 12: Results of the extroversion - introversion scale

A.I.	T.I.	A	T.E.	A.E.	T
0	4	39	13	0	**56**

Table 13: Results of the stability - instability scale

Finally, Figure 5 shows the tendency that most of the children tend to ambivert.

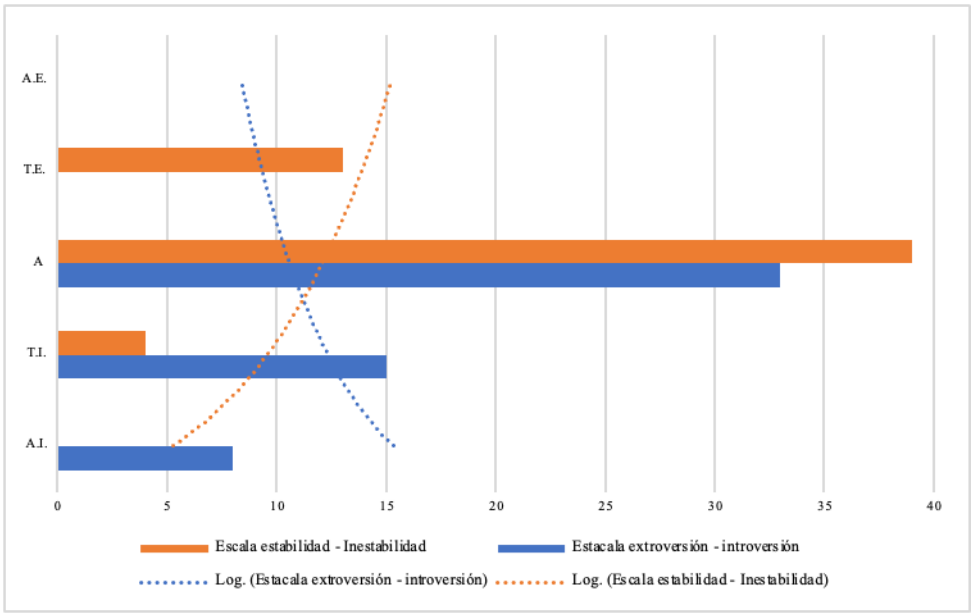

Figure 5: Students with ambivert personality tendency

Conclusion

Of the 287 students evaluated, 231 students equivalent to 80.49% exceeded the indicator "L" - Truthfulness (scale of lies) and were therefore excluded from the research. Therefore, we worked with a population of 56 students between 13 and 15 years of age in the eighth, ninth and tenth grades of elementary school.

The parents of the students, through informed consent, allowed their children to participate in the research.

The study shows that both boys and girls have an Ambivertido tendency.

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A posthumous tribute to Dr. Paúl Santiago Pullas Tapia who promoted with his incomparable leadership the creation and development of educational and scientific activities in favor of the Ecuadorian youth, so that from heaven he may guide us along the path of truth and honesty.

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Efficiency in Learning Computer Programming Through Blended Learning Methods

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Abstract
The COVID-19 pandemic has shifted the way education is delivered, leading to a widespread adoption of online learning methods. Online education has adopted many methods of learning, such as synchronous, where teaching is present during instruction, and asynchronous, where pre-recorded video learning is provided for students. In addition, there is also blended learning, where both methods are combined simultaneously. This research compares pure synchronous teaching and blended learning of a computer programming course in the Faculty of Engineering. We collect data by comparing performance between fully synchronous learning and blended learning from two groups of students, with 25-30 students in each group. The method to compare two groups of students is divided into two parts; the first part uses a quantitative approach by using the outcome of the exam. The second part uses a more qualitative approach by collecting feedback from students they have an experience in blended learning. The result of the first approach has shown that students' exam scores using the blended method give a higher median of 5.76% and a higher average score value of 1.59% than those who only participate in a synchronous approach. For the second approach, we found that students prefer blended learning over either only asynchronous or synchronous learning. They believe asynchronous learning can provide flexibility in terms of learning and course revision, while synchronous learning can provide instant feedback and reassurance from the instructors if they have questions and clarifications. The combination of both methods can help students reach the best outcome.

Keywords: Blended Learning, Computer Programming, Online Teaching

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Introduction

Computer programming course is a fundamental course for all engineering students. Students come into the university with various backgrounds, it usually takes a lot of time to ensure all students can reach the same level of understanding of computer programming concepts. Designing a classroom with video sessions can encourage students to have the basic knowledge beforehand so that during their classroom sessions to practice with real problems. Since students with various background can impact their learning experience, through the video sessions, students learn the basic concepts and try to understand different examples in a self-learning environment (Anthia & George, 2016; Delen, 2014; Hughes 2009).

A lot of study shows that with video content, the performance and satisfaction of students significantly increases with better knowledge transfer and memory. (Desai & Kulkarni, 2022; Dilani & Arezou, 2018; Greenberg & Zenetis, 2012; Bravo, et al. 2011). Moreover, another main advantage in using video is it can provide flexible time and place that may suitable each individual student (Henderson, et al, 2017). However, using series of videos with linear content alone cannot achieve the best learning outcomes. Many studies have suggested that interactive activities are useful in encouraging students to focus more and promote active learning rather than the passive one (Dilani & Arezou, 2018). Questions and quizzes are one of interactive activities during and after watching the video to get more student attention and to emphasise the key contents where students should be focusing (Anthia & George, 2016; Wouters et al., 2007). There combining both video and questions can provide interactive activities during the self-learning without the aide from the instructor.

However, a lot of previous research shows that students are more content with face-to-face interaction, even in an online environment (Barbara & Flowers, 2020). Moreover, using only video sessions cannot fully facilitate students as much as teacher interaction and attention. Blended learning can be essential to encourage the most student involvement especially in the online learning environment (Moorhouse & Wong, 2022; Mukminatus, Z & Maskhurin, 2022). There are quite a few of studies have been conducted on primary and secondary school not many studies have been conducted on engineering subjects (Moorhouse & Wong, 2022; Mukminatus, Z & Maskhurin, 2022, Desai & Kulkarni, 2022; Barbara & Flowers, 2020).

Therefore, the author experimented by adopting a blended learning method where students can study using the instructional video before the live session as a method of blended learning which is include the synchronous learning mode where students use the video session for basic theory and examples and asynchronous mode where students will meet with instructor face-to-face and focus more on example and practical sessions.

In this study, there are two groups of students. The first group is using fully synchronous mode and the second group is using blended learning mode. There are two measurements used in this paper, which are:

1. Student Performance's assessment
2. Questionnaire Feedback

Student Performance's Assessment

The final exam scores are used to evaluate students' performance in two groups. Students in the first group use a fully synchronous method, where the instructor is present during the teaching period. The second group uses blended learning, where the pre-recorded video is used before the synchronous teaching is performed. We compared the data for two groups of students using a simple statistical method which are average, mean, and standard variation values, based on their scores.

1. Scores collected during midterm exams
2. Score collected during final exam

The scores during the midterm exam can be difficult to compare because it is based on a different settings. Students in synchronous mode took the exam in person with a closed-book option. While the second group of students took the exam online with an open-book option. Both groups have a time limit of three hours.

The scores during the final exam are in the same environment, which is in an online mode with an open-book option and with a time limit of three hours.

Questionnaire Feedback

A questionnaire is collected, blinded-folded through an online platform. Students who have experience in the blended learning are asked to provide feedbacks. There are 5 main categories in the questionnaire.

Analysis Students' Performance

Table 1 shows the score summary of the midterm exam in two groups of students. Group A is the first group of students who study in a fully synchronous method. In comparison Group B is a group with blended learning. There are 28 students in Group A and 25 students in Group B. The results can be difficult to interpret as it has been mentioned since Group A took the exam in person with a closed book while Group B took it online. The result shows that the average, median, minimum, and maximum score of Group B is higher with a slightly higher standard deviation value. Group B, with the advantage of open book can get much better scores during their midterm exam.

Teaching Mode	Group A	Group B
Average Score	34.03	70.47
Median Score	32.5	73.71
Minimum Score	0	24.29
Maximum Score	80.5	100
Standard deviation	15.26	19.41

Table 1: Midterm exam score

Figure 1 shows the distribution of scores in both student's groups using a histogram. The x-axis denotes the score, while the y-axis represents the number of students within that range. The distribution of Group A is significantly lower, and only one student receives a score of more than 80. Most students in Group B receive a better score than group A.

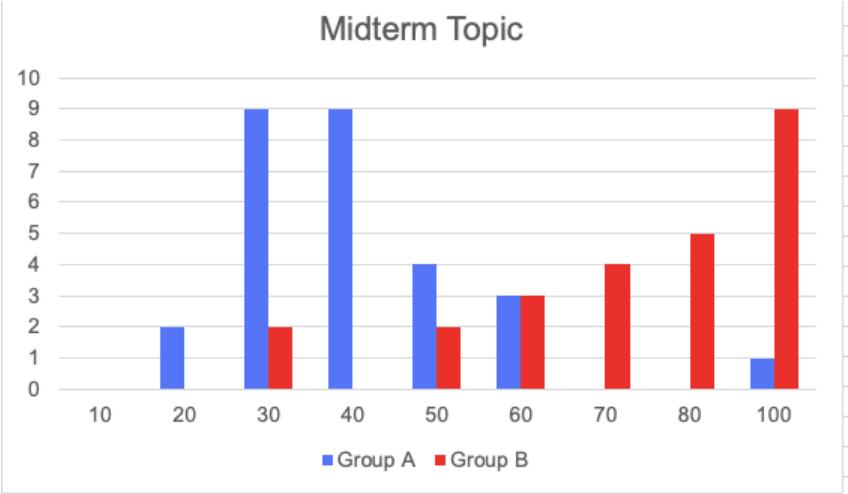

Figure 1: Histogram Distribution of midterm score from students in two different modes of study during the midterm exam, using midterm topic

Table 2 shows the score summary of the final exams. In this exam both groups are taken exam in the same environment which is online and open book setting. The results show that the average, median, and maximum scores of Group B are 1.59%, 5.76% and 4.25% higher than Group A respectively. However, the minimum score in Group B is 9.71% lower than Group A. The fluctuation in scores of Group B makes the standard deviation of Group B higher.

Teaching Mode	Group A	Group B
Average Score	58.23	59.82
Median Score	60.83	66.59
Minimum Score	20.24	10.53
Maximum Score	83.33	87.58
Standard deviation	16.80	23.17

Table 2: Final exam score

Figure 2 shows the distribution of scores in both student groups in a histogram. So, it can be seen that a few students from Group B get low scores thank Group A. However, most of Group B students tend to have higher score than those in Group A. It shows that students in blended learning environment can perform slightly better than students in synchronous learning only.

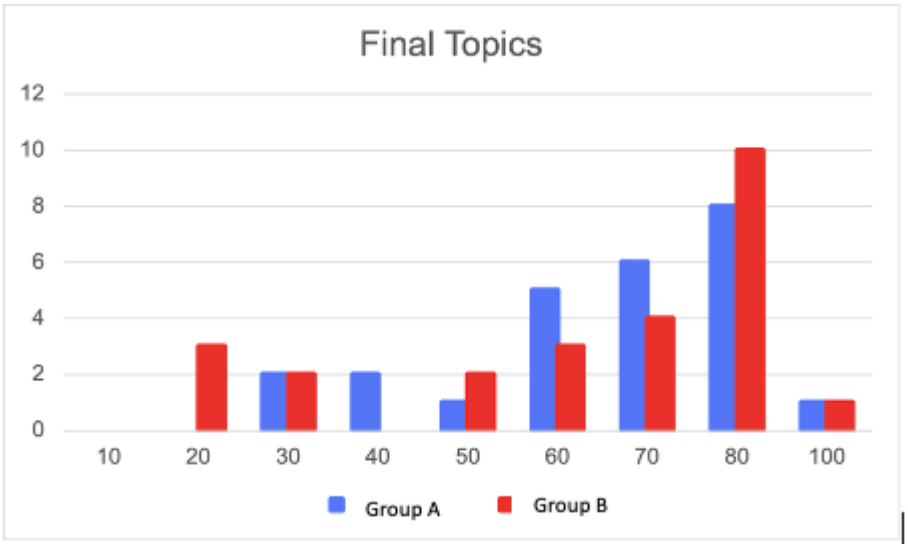

Figure 2: Histogram Distribution of the final exam scores from students in two different modes of study during the final exam, using final topic

Analysis of Questionnaire Feedback

A questionnaire is conducted in voluntarily manner for students in Group B who have experience in blended learning. All students are requested to answer different type of questions in 5 categories. There are 15 students who participated in providing the feedback to this questionnaire.

Each section contains a set of questions, with different scaling questions and questions that ask for their opinion in each topic. For the scaling questions, a scale of 1-5 is used to evaluate their satisfaction and agreement with the question. Scale 5 indicates that the student agrees with the question and scale 1 refers to student who completely disagrees with the statement.

The 3 main sections are as follow:

1. Perception of learning through video recording
2. Perception of learning of live online learning
3. Perception of learning of blended learning

All sections focused on modes of learning: asynchronous, synchronous, and blended learning.

In the first section, there are five scaling questions, which are:

Question 1: How much does watching videos help develop your programming skill?

Question 2: Does watching videos improve your understanding?

Question 3: Does doing interactive quizzes while watching the video helps you understand the topic better?

Question 4: How much do you think doing quizzes helps you learn compared to not having quizzes?

Question 5: Does doing more exercises after all asynchronous and synchronous teaching help improve your understanding?

Question	Average	Standard deviation
Question 1	3.47	0.62
Question 2	3.26	0.85
Question 3	3.73	0.68
Question 4	3.53	0.62
Question 5	4.07	0.77
Average	3.61	

Table 3: The average score of each question in the topic perception of learning through video recording

The average and standard deviation score results for each question are shown in Table 3.The results show that students are slightly satisfied with asynchronous learning with an overall average score of 3.61 out of 5. The first two questions are about watching videos; the average of satisfaction score of watching the video is 3.36. The following two questions are about doing quizzes during the video session, which give a better average score of 3.63. This indicates that doing quizzes along with video watching can improve students' understanding and learning. The last question emphasises the additional exercise after class which give the highest score of 4.07. In almost all the questions there are barely any students who have given score lower than 3, besides one student who gave a score value of 1 in Question 2. As a result, the average score of Question 2 is slightly lower than the other questions.

Additionally, for non-scaling questions, the questionnaire asks students about their opinion on benefits and obstacles in engaging asynchronous learning. Table 4 and Table 5 show the results of students' responses to the benefit and obstacle respectively. Both tables show the most frequently answered. Each student allows to have multiple comments.

The most common benefits that all students agree are that the video can be rewatched easily and almost everyone (86.7%) agrees that the video allow flexible time for them to study at their own pace. About half believe that the content can be understood easily by the instructors in the video.

Benefits	Number of students	Percentage of respondent
The video can be rewatched easily	15	100.%
Flexible time	13	86.7%
Easier to understand the content	6	53.3%
Many instructors make the content more understandable	5	33.3%

Table 4: Benefit of online asynchronous learning

Obstacles	Number of students	Percentage of respondent
Poor internet connection	11	78.6%
Difficult to access lecturer	7	50%
Personal device is not good enough	6	42.9%
Watchings video wasting ore time	4	28.6%

Table 5: Obstacle online Asynchronous learning

On the contrary, students find that their personal device with their poor home internet connection is the greatest obstacle to accessing online asynchronous learning. About a half of students believe that they cannot easily reach the lecturer during the asynchronous session because they do not have a face-to-face experience with the instructor. A few of them believe they must watch the video before class as a wasteful of time.

The second section is about students' perception of learning of live online learning or during synchronous learning sessions. There are 3 scaling questions as follows:

Question 1: Does "instructor-led" learning help improve overall learning?

Question 2: If learning with fully asynchronous, without an instructor present, how well do you understand the contents?

Question 3: How much do doing exercises during synchronous class useful for learning?

The average and standard deviation scores for each question are shown in Table 6.

Question	Average	Standard deviation
Question 1	4.13	0.62
Question 2	2.99	1.18
Question 3	4.00	0.63

Table 6: The average score of each question on the topic of students' perception of learning of synchronous learning

In this section, each question asks students in different aspects, so the average score across all questions is not calculated. Question 1 and question 3 ask about students' preferences for synchronous learning, while question 2 focuses more on the asynchronous approach. Question 1 and 3 have received a lot better response compared to Question 2. Figure3 shows the histogram distribution of answer to all three questions. In Question 1 and 3, the minimum score is on a scale of 3(Neutral). But in Question 2, the distribution of answer is very diverse.

There are 7 out of 15 students disagrees that that without the synchronous session, they can still understand the content in the same way that they do with the blended learning. They believe that synchronous learning is essential for them. However, there are still 4 out of 15 students believe that they can understand the content in the same way by using only asynchronous learning.

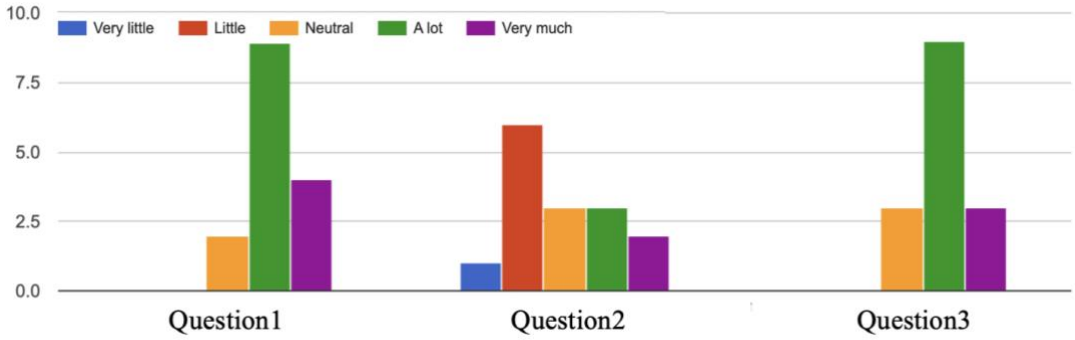

Figure 3: Histogram distribution of students responding to the questions regarding to perception to synchronous learning

For non-scaling questions, the questionnaire asks students about their opinion on benefits and obstacles of engaging synchronous learning. Table 7 and Table 8 show the results of students' responses to the benefit and obstacle respectively.

Benefits	Number of students	Percentage of respondent
Understand the content instantly	11	78.6 %
Receive immediate comment during exercises	10	71.4%
Ability to discuss with instructor easily	10	71.4%
Ability to access using personal device easily	2	14.3%

Table 7: Benefit of online synchronous learning

Obstacles	Number of students	Percentage of respondent
Poor internet connection	8	57.1%
Personal device is not good enough	7	50 %
Difficult to access the lecturer	5	35.7%

Table 8: Obstacle online synchronous learning

Most answers regarding the benefit of synchronous learning indicate that they can access to the instructor easily and instantly without delay. If further discussion is required, the instructor is available to give students feedback and clarification immediately. Unlike asynchronous learning where students feel that they cannot communicate with the instructor

easily even though there are many communication channels available for students. Some students may have queries, but they prefer to wait until they meet with the instructor during the synchronous session. Additionally, the internet connection and personal device are still the main issues during online learning which is similarly to asynchronous learning. This means that some students find it difficult to access the online classroom. However, a few more people, complain about their internet connection more during asynchronous learning, it may be the result from some students feel that they require to use their internet connection unnecessarily during asynchronous learning.

The third section of the questionnaire is about the student's perception of blended learning. There are three scaling questions which include:

Question 1: You prefer blended learning more than purely asynchronous learning.

Question 2: You prefer blended learning more than purely synchronous learning.

The average and standard deviation scores for each question are shown in Table 9. The average score of both questions in this section is the same, which is 3.73. The results indicate that students prefer blended learning more than either asynchronous or synchronous learning.

Question	Average	Standard deviation
Question 1	3.73	0.68
Question 2	3.73	0.77

Table 9: The average score of each question on the topic perception of learning through a blended method

A histogram distribution for each question is shown in Figure4. Even though the average scores of both questions are the same, there is slightly different distributions. Question 2 gives a slightly higher standard deviation. Overall, all students give a score of at least 3 out of 5 however more than half of the students give a score of 4 and 5 which indicates a preference toward blended learning.

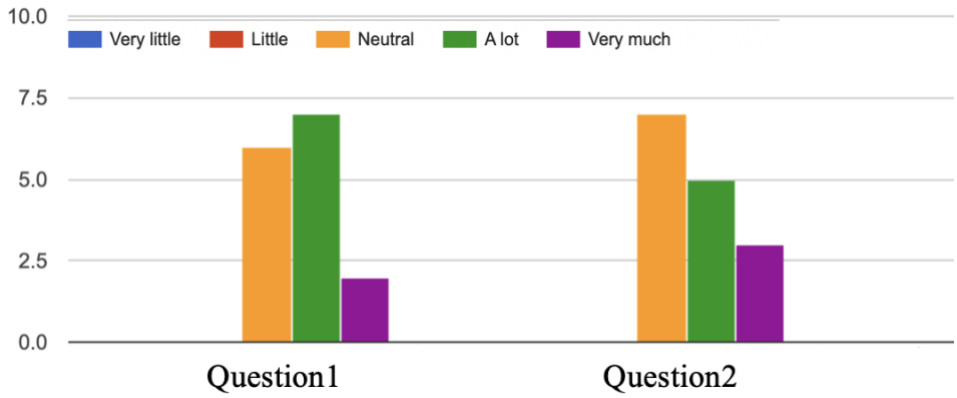

Figure 4: Histogram distribution of students responding to the questions regarding perception of blended learning

Furthermore, with the questions regarding obstacle to blended learning, the list of responses is shown in Table 10. Some students feel they require to spend more time watching videos which may waste their time and need a lot of time to understand the content better since it may not be clear at first. Some students feel they must wait until the online session to make some content clearer, which they feel it's a waste of time.

	Number of Students	Percentage of respondent
Spend more time to understand	6	60.0%
Waste more time to watch video	5	50 %
More internet expenses	2	20.0%
The content is already clear during the video. Instructor may not be necessary.	1	6.7%

Table 10: Obstacle of online blended learning

Conclusion

Our study shows that using blended learning between synchronous learning and asynchronous learning, in terms of scores, students with blended learning get higher average and median score better score compared to student using fully synchronous learning.

Asynchronous learning is useful that it provides students flexibility in terms of time, place, and pace of study. A few students tend to prefer video watching, even more than synchronous learning because of its flexibility and ability to repeat the video for revision.

However, most of them still believe synchronous learning is useful. They believe with the instructor present, they can get more clarification if they have questions, there is someone who responses to their questions and queries instantly. Therefore, classroom interaction is important for students to engage and develop better.

One of the main problems students raise about online learning is internet connectivity. Instructors must be aware of students' devices and connectivity, especially during online synchronous learning where students must participate fully using their own devices. Therefore, the main contents of the lecture should be provided during the video sessions for fair treatment of all students.

It can be concluded from this study; blended learning is useful. Asynchronous learning provides guidelines and flexibilities, for learning and revision. The synchronous session is also essential, especially to provide better guidelines to students and give reassurance for skill development to all students.

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Pre-service Teachers' Learning Experiences With Educational Technologies in South Africa

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Abstract
Online teaching and learning have become a fundamental platform for teaching and learning in higher education institutions, more so, since globally an extensive academic disruption was experienced during the coronavirus pandemic 2019 (COVID-19) lockdown. This study describes pre-service teachers' perceptions on online teaching and learning platforms at one University in South Africa. The purpose of this paper is to report on the challenges detected in their perceptions. The paper engages a quantitative approach, through 10 statements on a Likert scale to draw the perceptions of 220 pre-service teachers on their online teaching and learning experiences. Data were analyzed by means of MS Excel and presented in the form of bar charts, indicating percentages. The findings indicated that although some pre-service teachers agreed to the benefits of online teaching and learning, challenges such as the lack of access to relevant digital resources, equipment and skills led to the ineffectiveness of this platform. The preservice teachers' perceptions abetted the researchers to conclude that although online teaching and learning practices are in place, the stakeholders still need to ensure equal access to all relevant digital resources for teaching and learning on this platform to be highly effective.

Keywords: Online Teaching and Learning, Coronavirus Pandemic 2019, Challenges, Digital Resources

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Introduction

Online teaching and learning have become a fundamental platform for teaching and learning in higher education institutions, more so, since globally an extensive academic disruption was experienced during the coronavirus pandemic 2019 (COVID-19) lockdown. Hence, it is imperative for all institutions to ensure equal access to all relevant digital resources for teaching and learning on this platform to be highly effective.

The use of educational technology in the classroom is growing in popularity every day, greatly expanding the area available for instruction and learning (Beese, 2014). According to studies, these materials also support meaningful information interchange at any distance within the context of the student-teacher system (Bachmaier, 2011; So & Brush, 2008) and allow students to learn their programmes in depth (Aktaruzzaman & Plunkett, 2016). The use of educational technologies in teaching and learning is thus justified as having many advantages over more conventional approaches.

In addition, organisations and educational institutions have steadily increased their investments in technology over the past few decades (Purnama & Subroto, 2016). Organisations have realised that maximising the advantages of information technology is essential for success in the new digital era (ibid). Higher education institutions realised the value of information technology for their institutional success, just as other corporate organisations (Dlamini, 2015). Higher education institutions experienced an unparalleled transformation in how they run their operations as a result of the rapid infusion of information technology.

Although studies have found significant educational technology benefits, institutions continue to encounter infrastructure-related challenges that limit students' access to these tools (Ngampornchai et al., 2016). One issue is that investments are insufficient since technology investments need a costly and long-lasting infrastructure. Solid infrastructure and energy supplies are initially needed by institutions, which is a prerequisite for putting in place solid educational technology systems. A significant barrier to facilitating operations and Internet connectivity is a paucity of supply (Hamidi et al., 2011). Because they lack enough equipment or technological infrastructure, several universities simply emphasise theoretical education rather than practical training (Dahil et al., 2015). These difficulties appear to be common in the case of this study.

Results and Discussion

Below is Table 1 in which the biographical data of the pre-service teachers who participated in this study is presented:

Gender	Female	143 = 65%	Male	77 = 35%
Age	Between 18 and 20 years old	0 = 0%	Above 20 years old	220 = 100%

Table 1: Biographical data of the participants

The pre-service teachers were requested to indicate their single response to each statement by marking X on any of the 5-point Likert scale which entailed the following options: strongly disagree (SD), disagree (D), unsure (U), agree (A), and strongly agree (SA).

The following were the 10 statements that they had to respond to:

1. I am experienced with various online teaching and learning platforms
2. I can access the internet at without any challenges
3. Online teaching and learning are more effective than face-to-face platforms
4. The use technological tools help me learn better
5. Through online activities, I actively engage with other students and my lecturers.
6. My technological skills are above average
7. I have access to all basic technology resources to enable me to do all my work efficiently
8. The use relevant resources from various web sites improved understanding of concepts
9. Video clips from various websites enhance my understanding of seemingly difficult concepts
10. Face-to-face teaching and learning should be permanently replaced with the online teaching and learning
11. Figures 1 to 5 below illustrate insights on the participants' responses to each of the points in the Likert Scale used

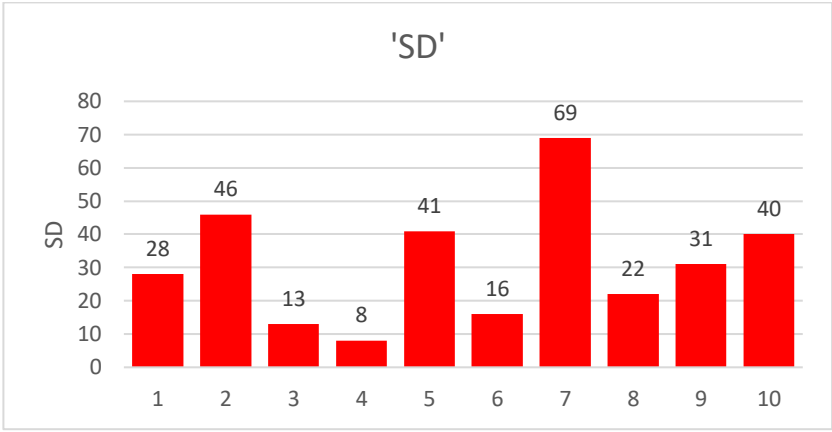

Figure 1: insights on strongly disagree (SD)

Figure 1 illustrates that 69% strongly disagree they have access to all basic technology resources to enable me to do all my work efficiently, and 46% also strongly disagree that they can access the internet at without any challenges. These responses are in line with research findings by Ngampornchai et al. (2016) who state that institutions continue to encounter infrastructure-related challenges that limit students' access to these tools.

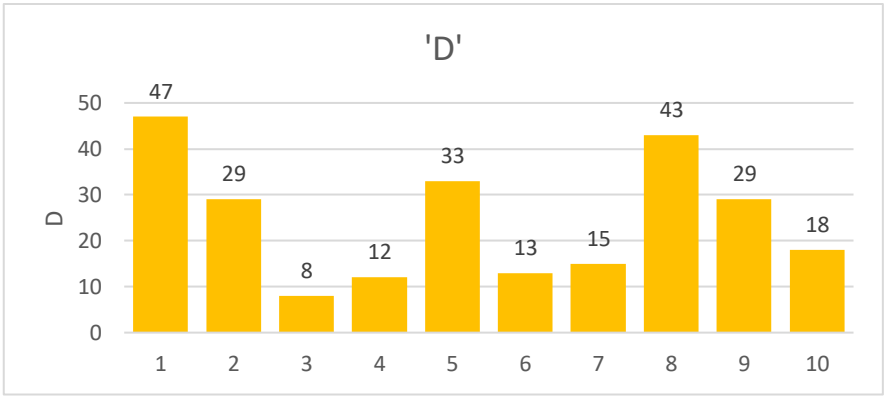

Figure 2: insights on disagree (D)

Figure 2 illustrates that 47% disagree that they can access the internet at without any challenges, and 43% also disagree that the use relevant resources from various web sites improved understanding of concepts. These responses are in line with research findings by Dahil et al., (2015) who argue that because they lack enough equipment or technological infrastructure, several universities simply emphasise theoretical education rather than practical training.

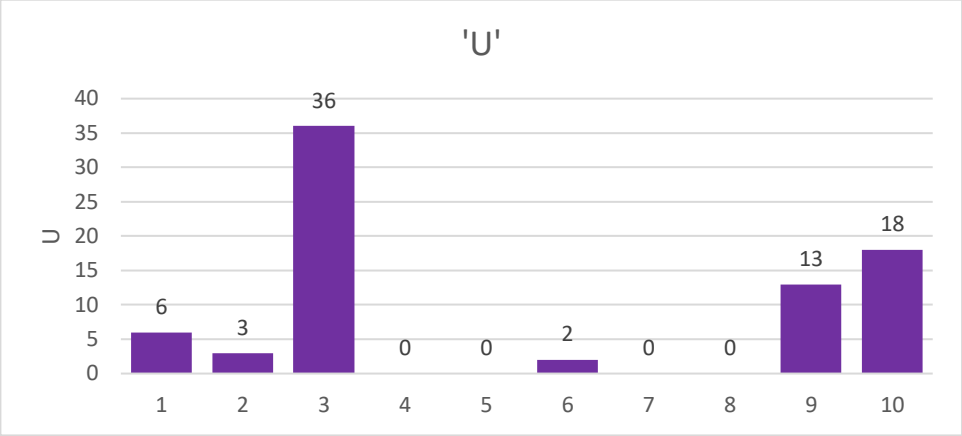

Figure 3: insights on unsure (U)

Figure 3 above illustrates that 36% were not sure whether online teaching and learning are more effective than face-to-face platforms, and 18% were also not sure if face-to-face teaching and learning should be permanently replaced with the online teaching and learning. This clearly implies that the integration of educational technologies has not yet met the expected standards for universities to completely change from traditional teaching and learning methods.

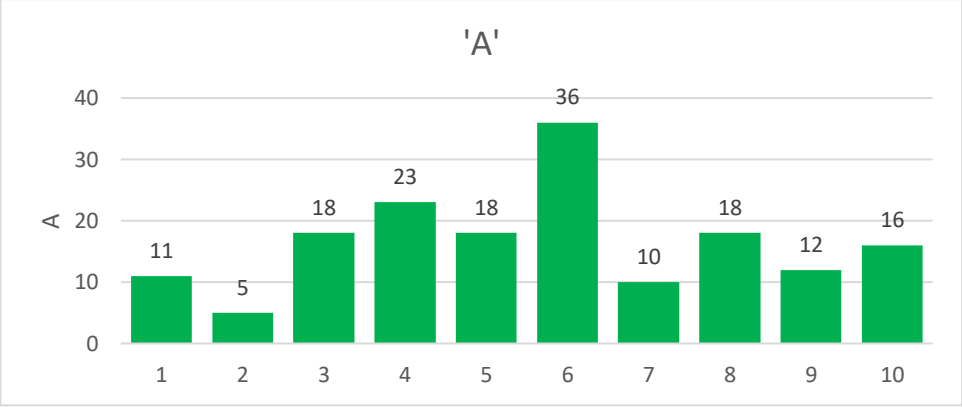

Figure 4: insights on agree (A)

Figure 4 above illustrates that 36% agree that their technological skills are above average, and 18% agree that online teaching and learning are more effective than face-to-face platforms, and that the use relevant resources from various web sites improved understanding of concepts. These responses indicate that although not all students pre-service teachers acknowledge the effectiveness of educational technologies, there is quite a few who benefit from these tools as they allow themto learn their programmes in depth (Aktaruzzaman & Plunkett, 2016).

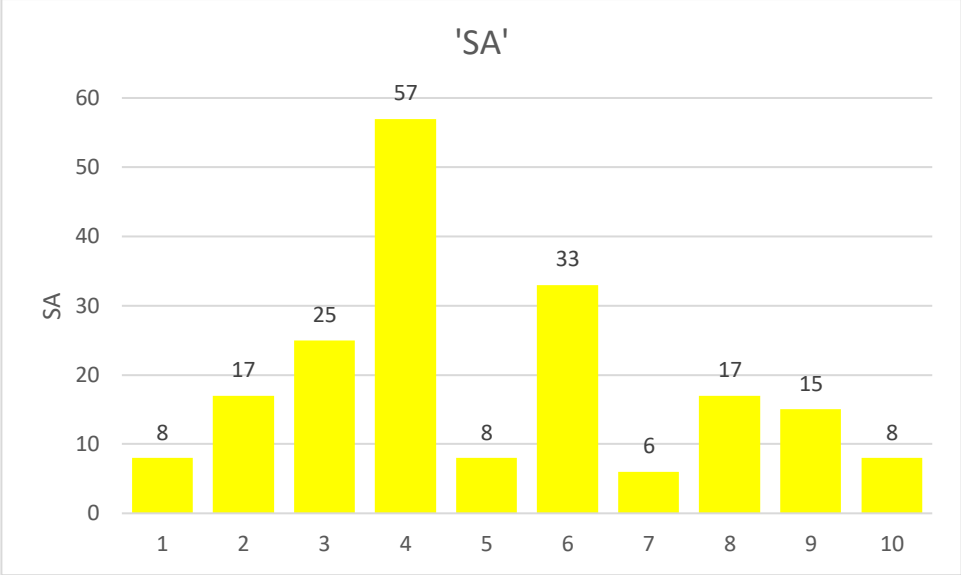

Figure 5: insights on strongly agree (SA)

Figure 5 above indicates that 57% strongly agree that the use technological tools help me learn better, and 33% also agree that their technological skills are above average. This is quite motivating to have pre-service teachers who have good technological skills to meet the expectations of the fourth industrial revolution (4IR). Purnama and Subroto (2016) also support this view in that educational institutions have realised that maximising the advantages of information technology is essential for success in the new digital era.

Conclusion

To some extent, the pre-service teachers indicated that they have some skills in the use of educational technologies for learning. However, the inadequate access to resources hinders their maximum usage. The university managers need to ensure equal access to all relevant educational technologies tools if teaching and learning on this platform is to be highly effective.

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Research Supervision During COVID-19: A Comparison Between Supervisors' and Supervisees' Experiences

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Abstract
The COVID-19 pandemic shaped teaching, learning, and research activities and imposed an urgent online transition. Technology was extensively used to facilitate research and mentoring purposes, including research supervision. The importance of this research project stems from the need to explore the experiences of research students and research supervisors during the pandemic to assess the way their role and experiences have been impacted, the difficulties they faced and how these can be resolved in the future and/or inform future practice. This study reflects on findings from small-scale qualitative research at City, University of London, exploring the retrospective accounts of doctoral students, based on online focus groups and supervisors, using online interviews, during the pandemic to assess its impact in digital research supervision. The data was analysed using thematic and discourse analysis and suggests that some of the key changes that occurred in research supervision were changes in the working environment, the stressful setting, and the relationship between supervisors and supervisees. Although technology offered opportunities for collaboration and a shift in traditional power dynamics, it also amplified existing issues concerning the style of supervision and the interaction among mentors and mentees. Considering these gaps, the paper informs digital research supervision and recommends how we could reconceptualise doctoral pedagogy to develop hybrid formats beyond the context of the pandemic.

Keywords: Digital Research Supervision, COVID-19, Doctoral Pedagogy, Supervisor-Supervisee Relationship, Supervision Style

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Introduction

Since the outbreak of the COVID-19 pandemic, teaching, learning and research activities have been taking place online (Rasheed et al., 2020). Education has significantly been impacted with the transition to virtual learning and technology has been extensively used to facilitate research, teaching, and mentoring purposes (Adedoyin & Soykan, 2020). Research supervision was transformed in this context as research could only be practiced online as well as supervision meetings, working on collaboration projects etc. More importantly, doctoral supervision lies between customised scaffolding teaching (Albertyn & Bennett, 2021) and research mentoring (Bruce & Stoodley, 2013) which makes it difficult to assess the impact of the pandemic and explains to an extent why this has not been widely discussed over the pandemic period.

This research paper addresses the need to explore the retrospective accounts of research students and research supervisors during the pandemic to assess the way their role and experiences have been impacted, the difficulties they faced and how these can be resolved in the future and/or inform future practice. Also, although technology has been used extensively in research supervision, the modes of engagement are rarely addressed, and limited research has been focusing on digital research supervision (Dowling & Wilson, 2017). Considering the sudden and complete abundance of face-to-face supervision during the pandemic, it is essential to examine the role of technology, the benefits that offers to research students and advisors and how we can sustain and further develop these going forward.

Literature Review

Working towards a PhD has often been described as a "doctoral journey" where supervision plays a significant role in the timely completion of the PhD (Nash & Winstone, 2017) but also on shaping the researcher's experience and future academic identity (Hounsell, et al., 2008) from being a student to becoming a scholar (Kaur, Kumar & Noman, 2021). At the same time, little attention has been placed on the supervisors' understanding of the educational relationship with their students, the way they engage with them and the identity formation process of "becoming a supervisor" (Halse, 2011). Generally, effective doctoral supervision is seen as "a complex, multifaceted, and unstable process" (Grant, 2003) which expects the adaptability of advisors and researchers to develop and perform diversified roles (Mainhard, et al., 2009) and agree on a supervision framework that meets their needs and preferences (Watts, 2008, 2010; Wisker, 2012). Different models of research supervision and supervisor-supervisee relationship have been suggested overtime (key supervision models discussed in Andriopoulou & Prowse, 2020), but I will focus on Lee's model (2008; 2018) that offers a comprehensive framework of doctoral research pedagogy and demonstrates potential in delivering transformative doctoral learning experiences (Kaur, Kumar & Noman, 2021). According to Lee (2018), research supervision involves five elements:

- *Functional*: this element focuses on the project management, setting and meeting deadlines, giving practical advice, and observing the researcher's progress.
- *Enculturation:* encouraging the researcher to develop an academic identity by participating in research and teaching communities, as well as engaging with academic life such as research collaboration and publication.
- *Critical thinking*: inspiring the researcher to critically and proactively question their research, reflecting on their work, making decisions and being able to justify them convincingly while being intellectually present throughout the research process.

- *Emancipation:* empowering the doctoral student to control their research and academic pathway. This stage is developed gradually as the researcher progresses and becomes confident and independent learner.
- *Relationship development:* reinforcing a relationship with the research student based on dialogue and interaction. This can be facilitated through practices of encouragement, recognition of achievement and pastoral support.

These elements are at times used in combination in research supervision depending on the co-regulation and scaffolding of the learning processes which describe the transition of the doctoral student to an independent, self-regulated learner (Agricola et al., 2019), but often academics might adopt one sole approach with their research students. In both cases the disruption of face-to-face supervision, research and teaching practices prohibits these processes and thus poses a risk in PhD research completion. According to Manathunga's work (2005), some of the most warning signs when students experience difficulties with their doctoral studies are changing their research topic or plan of work, avoiding submitting work for review, avoiding communicating with the supervisory team and isolating themselves from the school and other students. Due to the pandemic and the uncertainties this caused, a lot of research students might have found themselves in at least one of these situations because their research plan had to adapt the new circumstances (for example conducting online research) and self-isolation was unavoidable considering the lockdown restrictions. Based on Zaheer's and Munir's work (2020), lacking face-to-face interaction and physical presence prohibits the establishment of a trustworthy relationship between advisors and doctoral students. This might impact the frequency and the quality of online supervision meetings but also the confidence of both parties to communicate concerns and develop a plan/pattern of collaboration for the successful completion of the doctorate. Considering that PhD research has been linked to isolation and loneliness, this emergency digital mode of supervision might cause increased stress, exhaustion (Devine & Hunter, 2017), lack of confidence and motivation or even depression and other mental health issues (Brown, 2013), especially due to the covid-19 anxiety that was added (Nash, 2021). Consequently, the risks of candidature's extension (Park et al., 2011), PhD failure and risen drop-out rates grow (Devos et al., 2017).

Technology, however, has offered an online environment that transforms education including research supervision (Dowling & Wilson, 2017) potentially enhancing collaboration and dialogue (Maor, Ensor & Fraser, 2016). This includes practices related to the actual research (for example training sessions, conducting research online etc.) but also relationships (such as online supervision, sharing files, participating in virtual research communities). Based on a previous research, informal mediated supervision was practiced using "What's up" instant messaging and the findings suggested the establishment of a meaningful relationship among supervisors and supervisees, frankness of conversations and disruption of traditional hierarchical relations (Rambe & Mkono, 2018). Thus, it is important to purposively invest on building online supervisory relationships and make good use of technology for communication and collaboration (Jacobsen, Friesen & Becker, 2021). Nevertheless, there is lack of research on digital research supervision especially during the pandemic and the learning mechanisms and practices that were used to replicate previous face-to-face or blended models of supervision. This study uses the rapid transition to online research supervision during the pandemic as an opportunity to improve our understanding of digital doctoral supervision and the lived experiences of supervisors and supervisees to inform research supervision framework, pedagogy, and practice.

Methodology and Methods

I conducted a small-scale qualitative project informed by the interpretative paradigm (Bryman, 2004). I combined two ethnographic online research methods using the Zoom conferencing technology as it quickly became popular during the pandemic. The data was collected online as it was considered the most suitable method (and context) to discuss retrospective experiences of digital research supervision. Three online interviews with research supervisors and three online focus groups with research students were conducted between April and July 2023.

Interviews are particularly helpful when this involves busy professionals like academics. I used a semi-structured format to allow participants to focus on the aspects that concern them around digital research supervision, allow new questions to emerge and to emphasize on their lived experiences. Focus groups consist of small groups of people who are brought together explore attitudes and perceptions, feelings, and ideas about a specific topic (Kitzinger, 1994). This method was selected to explore research students' perspectives to encourage a discussion of their experiences but also promote solidarity among people who might face similar challenges and concerns (Nakou, 2022b).

Given that this research project involved human participants ethical approval had been granted from my institution. Participation was voluntary and the data was kept anonymous and confidential. Upon the participants' informed consent, the interviews and focus groups were video recorded via zoom. The data was safely kept until the completion of the project, all quotes were anonymised, and pseudonyms were used. All data was deleted from the devices of the researcher once the paper was completed.

Sampling and Participants

As this research investigates research supervision in the pandemic the population consists of research students who were enrolled by January 2020 and PhD advisors who have been actively supervising research students since January 2020. I used purposive sampling to include different fields of expertise within City University of London and explore the ways research supervision was conducted during the pandemic. Overall, I conducted three online interviews with supervisors and three online focus groups including four participants with supervisees from City University of London. Amazon vouchers were used as incentives for the doctoral students to participate in the study. The profiles of the participants are described in the tables below.

Table 1: Profiles of the supervisors interviewed, created by the researcher.

Supervisors Profiles	School/Department at City	Digital literacy (self-evaluation)
Professor Helen	School of Social Policy & Public affairs	Competent user, self-trained
Professor Jonathan	School of Communication & Creativity	Uncomfortable using technology, need for training and support
Dr Sue	Learning Enhancement and Development Educational Research Centre	Proficient user, familiar with digital teaching methods, staff trainer

The research supervisors were selected from different schools of City University of London. Some self-evaluate themselves as proficient or competent users of digital technology, while others felt uncomfortable using technology and would have welcomed training and support during the pandemic to meet the needs for online teaching, research supervision and mentoring. Overall, the participants drew on different and unique competences, digital literacies, and experiences that produced rich data.

The PhD researchers in the online focus groups comprised another diverse group as some were attending a doctoral research programme in Sociology, International Politics, Psychology, Journalism, and Criminology. Additionally, I had a wide range of experiences deriving from UK, European, and International doctoral students as their status shape their doctoral journey.

Table 2: Profiles of the supervisees who participated in the focus groups, created by the researcher.

Doctoral researchers' profiles	School/Department at City	Student status	Year of Study during 2020
Mary	Sociology	International	Year 2
Ben	Journalism	International	Year 1
James	Psychology	European	Year 1
Vivian	Psychology	UK	Year 2
Linda	Sociology	UK	Year 1
Catherine	Criminology	European	Year 1
Anna	International Politics	International	Year 3
Stephanie	Sociology	UK	Year 4
Dina	International Politics	International	Year 2
Emma	Sociology	International	Year 1
George	International Politics	European	Year 1
Tanya	Sociology	International	Year 1

Furthermore, most of the researchers who took part were in their first year of study during the COVID-19 pandemic (2020-2021), but I also managed to identify and access participants in their second, third, and final year of study. Finally, all the doctoral researchers self-evaluated themselves as strong, confident users of digital technology (full profiles available in Table 2).

Findings

During the interviews and the focus groups as an ice-breaking activity to initiate the discussion I invited supervisors and supervisees to summarise in a few words their experiences (Nakou, 2022a). Unsurprisingly, the participants' reflections were highly diverse, unique, and contextual. As illustrated in the word cloud (Figure 1) the description of digital supervision during COVID-19 received different and often conflicting positive and negative connotations. Some elements of digital supervision were seen as comfortable, flexible, and collaborative while other parts came across as challenging, isolating, and confusing.

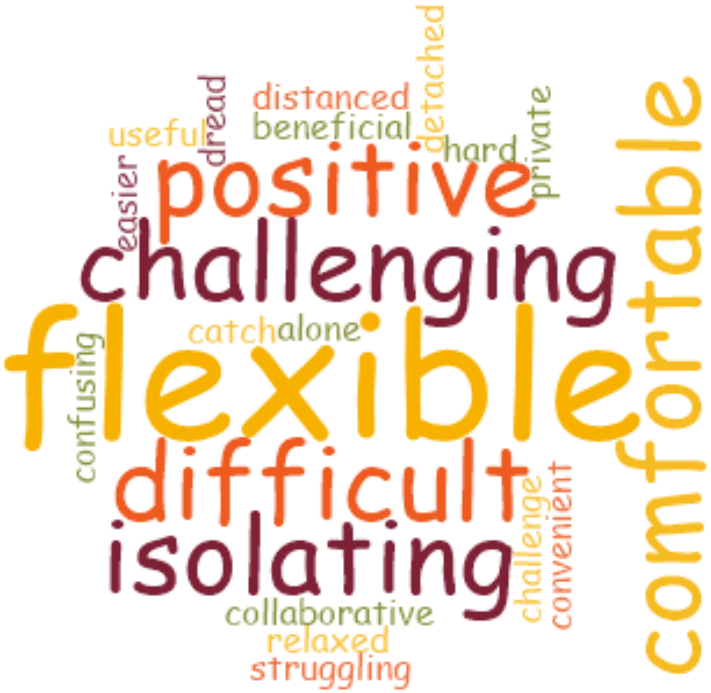

Figure 1: Word cloud with in-vivo descriptions of digital supervision during COVID-19. Produced by the researcher using NVivo.

Working Remotely

The COVID-19 pandemic catalysed a profound transformation in the landscape of digital research supervision, reshaping the dynamics between supervisors and students in academia. One of the most significant changes was the dramatic shift in working environments and daily routines. Previously, scholars and their supervisees often navigated through shared office spaces and tangible calendars marked with face-to-face meetings, which fostered spontaneous interactions and a sense of physical presence.

> I think it was tough situation was like very challenging. It felt different sending somebody an email and scheduling a call instead of like going and kind of having a conversation. Being in the PhD office, having an interaction with other PhD students

> feels also really important for me, and having the space- that is kind of not in like the room that I'm sleeping in makes a big difference to separate my time for relaxation and my work.

However, as illustrated in the quote above, the pandemic dismantled these conventional structures, forcing researchers to adapt to remote working conditions. This often meant working in an isolated environment, converting your home into an office space, and often having increased workload outside of normal working hours. The digital realm became the new nexus for scholarly engagement, substituting 'desk traffic' with an influx of virtual notifications and Zoom appointments as one of the supervisors mentioned:

> I have also been really aware sometimes that we've booked the supervision, and then somebody's put something in my calendar straight afterwards, and they do quite often overrun.

While this shift increased the flexibility of scheduling, it also presented challenges such as the blurring boundaries between different aspects of academic work and personal life and the need for heightened self-discipline in time management. All these elements may result in the automation of the research supervision practice and the lack of a strong relationship between supervisors and supervisees.

At the same time, the shift to remote work during the pandemic led to a newfound flexibility in scheduling, emphasizing the 'anywhere and anytime' nature of digital research supervision. Face-to-face meetings were replaced by virtual interactions, erasing the constraints of geographical proximity. This change in the frequency of meetings provided both researchers and supervisors with greater flexibility in managing their time and accommodating diverse schedules. It allowed for more frequent check-ins, quick problem-solving, and ad-hoc discussions, fostering a dynamic and agile approach to research supervision as it was noted during the focus groups:

> And with online meetings we could do it from anywhere. So, the workspace made me feel a bit more relaxed, even though I had the supervision meeting, I can do this by the beach, I can do this at home in an environment where I feel safe.

Researchers were no longer confined to rigid office hours, and supervisors could provide support as needed, promoting a more adaptable and responsive research environment. Moreover, this neutral setting changed traditional hierarchies and dynamics which are associated with institutional settings, such as meeting in the supervisor's office. The physical distance imposed by remote work dismantled the traditional hierarchy that often existed in face-to-face supervision, creating a more neutral space for collaboration. Researchers could become masters of their research domains, using digital tools to organise, analyse, and present their work. This shift emphasised a collaborative and peer-like relationship between supervisors and researchers, where expertise was shared and co-created, resulting in more empowered and self-driven researchers. This flexibility underscored the potential for a hybrid model of research supervision that combines the benefits of face-to-face interactions with the convenience of digital connectivity, offering a promising avenue for the future of academic mentorship.

Living Under Stress

Moreover, the pandemic introduced a new layer of complexity to the academic journey by requiring scholars and researchers to 'curry on' within an exceptionally stressful context. The pressures of global health concerns, remote learning, and often constrained access to research facilities posed significant obstacles to research progress. At the same time, some of the participants fall ill or experienced the loss of family and friends, while having to continue their PhD research and required support from their advisors, as one of the supervisees shared:

> My dad died right at the beginning of lockdown. I told my supervisors, and they did everything they could to support me through that. They were like academic parents for me at that time. (…) During supervision, both my supervisors would be there, I would have given them some work beforehand, in the first half we would be catching up, personal chit chat, and me crying, you know, just like emotional support. And then we talked about the work, and the next supervision.

Supervisors, recognising these challenges, had to take on the role of not only mentors but also empathetic supporters, helping students navigate the emotional and psychological toll of the pandemic. This normalisation of coping with difficult situations and strong emotions is reflected also in the experiences of supervisors. For example, one of the academics shared her concerns about her international supervisee who was located outside of the UK during the pandemic and had to resolve visa issues and safety concerns further exacerbated in the context of a global pandemic.

> I knew that the Covid situation there was much worse than in Europe because, even though there were very many statistics, and there wasn't very much news. People I knew were falling ill and dying. So, I was very worried about him and his family. I knew that there was like there were real serious risks in terms of health, and security as well, so yeah, it was quite tense and worrying. I was trying to work out what my responsibility was in terms of enabling him to continue with his PhD but at the same time not putting himself and other people at risk.

Obviously, the shift in supervision dynamics showcased the need for resilience and adaptability of both supervisors and students, as they learned to persevere in the face of adversity, emphasizing not only scholarly progress but also mental and emotional well-being. Sadly, often there was little institutional support provided to both parties from the university to navigate these challenges or provision of practical and emotional support.

In fact, there were aspects of digital supervision and institutional policies that caused extra pressure to supervisors and supervisees. the university uses a ‘Research Manager’ platform were supervision meeting details and summaries should be added upon the completion of meetings to keep a record of the PhD candidature and the research progression. Although this tool in principle aims to support the researchers and their advisors often is understood as immigration checker -specifically for international students with visa requirements who are required to fill in a form every month, which adds to the existing stressful context.

> Whether or not we had supervision once a month doesn't mean that we're not engaged with our studies. There should be a different way to like, prove our engagements and I think the system, or like how the mechanics of supervision can actually affect relationships between supervisors and supervisors.

> Every month my student gets an email saying: ‘your last meeting was this and it’s time to prepare your next’. I complained very loudly about this, it's very threatening, because people know that their visa depends on this, and that's not a good environment.

Instead of adding pressure to research students and advisors, it is essential for doctoral schools and universities to explore informal ways to check in with the concerned parties. Feedback is important but it needs to be delivered to meet the preferences and needs of the doctoral students.

Digital Relationships and Collaborations

The disruption of relationships and collaboration was another pivotal aspect of the pandemic's impact on digital research supervision. The traditional mentor-student relationship, characterized by face-to-face interactions, was replaced with a more virtual and mediated connection. Collaborative projects, once fostered through in-person meetings, had to adapt to remote tools, which, while enabling continued work, lacked the intimacy and spontaneity of physical collaboration. Supervisors found themselves navigating uncharted waters, striving to maintain meaningful connections with their students through screens and emails.

> I had asked my son to help me set up Zoom and then I was feeling very nervous about turn-taking, switching on the mic during the supervision. It was difficult for me to focus on the actual agenda for discussion.

Moreover, they highlighted the need for further training and support that should have been provided during the pandemic to identify gaps in digital literacies and offer solutions. Others faced issues buying the necessary equipment or establishing a stable internet access. This shift also amplified the importance of clear communication, adaptability, and innovative approaches to sustaining research collaborations in the absence of physical presence.

Another significant change was the widespread adoption of digital tools for collaboration and feedback. The pandemic accelerated the integration of technology into research supervision processes. Virtual communication platforms (Zoom, Microsoft Teams, and Skype) and collaborative tools (OneDrive shared documents) became essential for maintaining research momentum. Researchers and supervisors harnessed these digital resources to bridge the physical gaps, allowing for real-time collaboration and seamless feedback exchange.

> My experience of online supervision is very positive. It works really well and feels really private. We can easily look at documents together. Both of us as supervisors were able to add our comments on OneDrive, so that would be really helpful. It makes it much more, as you say, collaborative, but also quite time efficient.

This digital evolution not only enhanced the efficiency of research supervision but also enriched the quality of feedback, enabling more nuanced and structured discussions. It demonstrated that technology could serve as an effective enabler of research collaboration, offering opportunities for more comprehensive and dynamic engagement between supervisors and researchers.

Focusing on the Real Issues

Interestingly, amidst the profound digital transformation of research supervision brought about by COVID-19, participants' concerns shifted away from the digital technology itself and the technical issues that obstructed supervision. Instead, their primary concerns focused on the more abstract and human aspects of the supervisory process such as the style of supervision and the nature of the supervisor-supervisee relationship (Figure 2). The shift to digital platforms didn't merely alter the logistics of supervision; it challenged the very essence of how mentorship and guidance were provided. Researchers were not merely looking for technical guidance; they were seeking a supervisory style that could adapt to the virtual realm, offering support, encouragement, and clear communication tailored to the unique challenges of remote work.

Furthermore, the existing issues in research supervision were exacerbated within the digital ecosystem and the context of a health crisis. While the digital tools offered convenience, they also magnified existing disparities in access to resources and created new challenges in terms building a strong relationship among supervisors and supervisees. The health crisis itself added a layer of stress and uncertainty that permeated the supervisory process. The need to balance health concerns, remote work, and research progress became an additional burden. Yet, within these challenges, participants identified opportunities for critical thinking, functional progress, and emancipation specifically regarding the management of their research but also in setting the supervision meeting agenda.

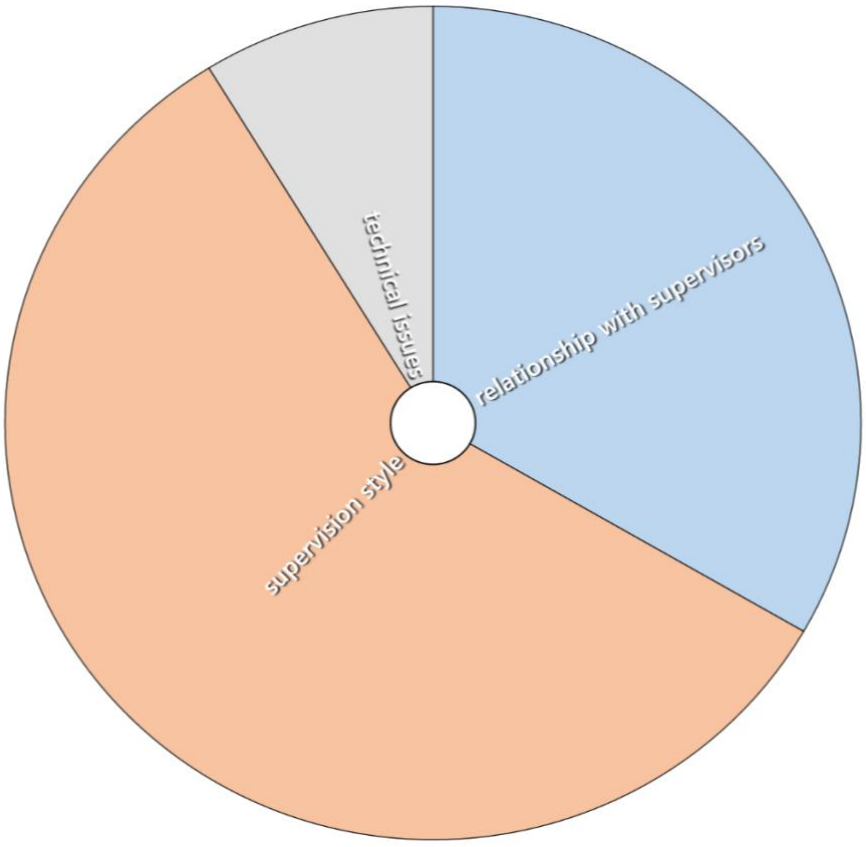

Figure 2: Distribution of key themes regarding supervision: technical issues (grey), relationship with supervisors (blue), and supervision style (orange). Produced by the researcher using NVivo.

Importantly, the shift to a more transactional and outcome-oriented approach meant less focus on relationship building and the process of enculturation of doctoral researchers into the essence of academic life, which both shape the future of academic mentorship. While some found this shift to be liberating, others lamented the potential loss of the rich, holistic learning experiences that traditional mentorship provided.

Concluding Remarks

Training and support are paramount in realising the potential of hybrid supervision. Institutions should invest in programs that help both doctoral supervisors and researchers navigate the nuances of this new paradigm and provide institutional support. It's essential to design a supervisory style that meets the needs of all involved parties, recognising that one size does not fit all. Flexibility in approach, tailored to individual preferences and circumstances, will be a cornerstone of effective hybrid supervision. Furthermore, there is an opportunity to institutionalise informal and flexible formats of feedback and progression that do not threaten the doctoral researchers. This approach can lead to more productive and fulfilling research experiences for all exploring areas to support both research supervisors and supervisees, specifically during times of crisis and stressful circumstances (Figure 3).

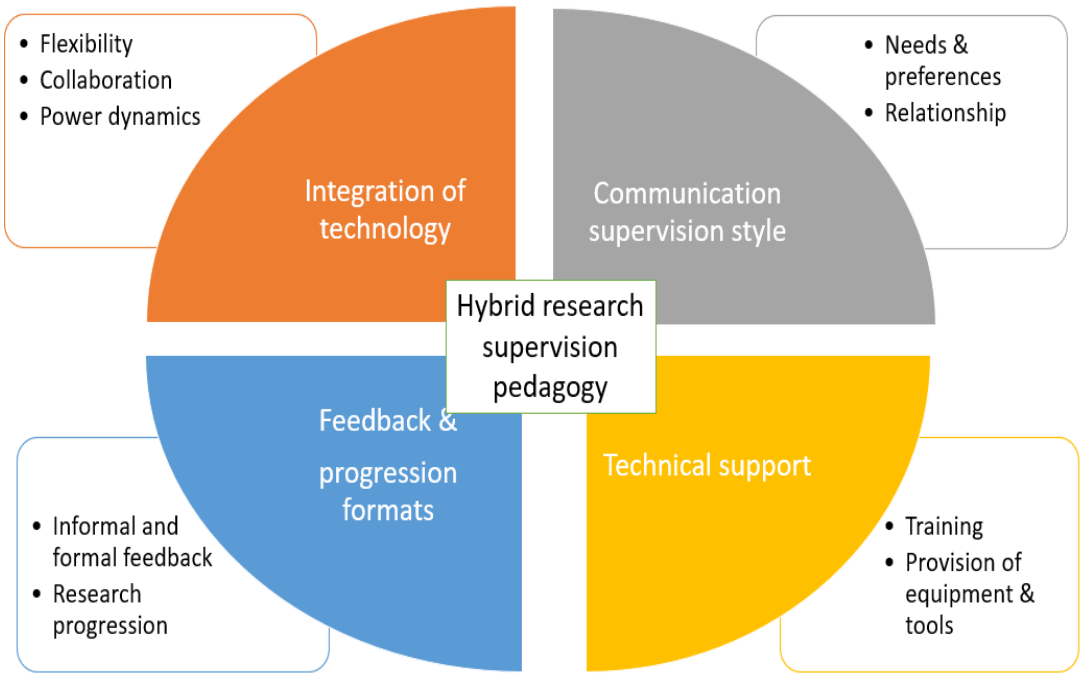

Figure 3: Areas that could be improved in hybrid doctoral supervision models: integration of technology (orange), communication supervision style (grey), feedback and progression formats (blue), and technical support (yellow). Produced by the researcher.

In conclusion, the era of hybrid research supervision is upon us, offering the best of both digital and in-person worlds. It's a dynamic, adaptable, and innovative approach that has the potential to transform the way research is conducted and supported. By harnessing the strengths of digital tools, fostering balanced power dynamics, investing in training and support, tailoring supervisory styles, and institutionalising flexible formats, we can unlock the full potential of hybrid research supervision and empower a new generation of scholars to thrive in an ever-evolving academic landscape.

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Accessibility of Inclusive Education in Indonesia: A Trajectory From Classroom Practice to Policy Recommendation

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Abstract
Based on statistical data for Special Education (2020), there are a total of 2,270 Special Schools (SLB) at various levels of education units throughout Indonesia. With details of 593 schools owned by the government and 1,677 schools owned by the private sector. The number of SLB mentioned above is compared with the number of predictions based on prevalence (more than 10 million children) and data recorded by the Ministry of Education and Culture (1.6 million), indicating limited access to education and many children with disabilities are not enrolled in school. This study employs descriptive analysis and uses online surveys for teachers who want to participate in this study (convenience sampling). The instrument used is a survey with the following components: perception, pedagogy, and facilities, with sub-components concerning the 'teacher-student', 'student-student', and 'student-content' aspects. There are a total of 35 (thirty-five) statement items as measured by a Likert scale. It was recorded that 229 teachers participated in the online survey which was conducted from December 2020 to February 2021. The survey results show that only 50% to a maximum of 70% of the ideal conditions of inclusive schools have been fulfilled. Cooperation and communication with parents is an aspect that has been carried out a lot and of course, this still needs to be expanded toward active participation. The hope is that in the future, the education budget can also begin to be directed to meet facilities and infrastructure, and services towards a sustainable Inclusive School.

Keywords: Inclusive Education, Accessibility, Indonesia Education System, Classroom, Teachers' Perceptions, Policy Recommendation

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Introduction

Indonesia's education system has been evolving from time to time, from the curriculum until its trajectory to accommodate the needs of all, the progress to becoming more inclusive has been doing quite well. Based on the statistical data for Special Education (2020), there are a total of 2,270 Special Education Schools in all levels of education in Indonesia. There were 593 schools owned by the government and 1,677 schools owned by private sector. The number of SLB mentioned above in comparison with the prevalence prediction of the number of children with special needs (which above 10 million children), as well as the data recorded by the Ministry of Education and Culture (around 1.6 million) reveal an indication of limited access of education for children with special needs (WHO, 2011). Based on World Health Organization (WHO) data (2011), there is around a 50% gap between disabled students and non-disabled students who attend primary school (*Sekolah Dasar* or SD) and junior high school (*Sekolah Menengah Atas* or SMP) levels. It shows that students with special needs or disabled students in Indonesia do not have access to junior high school, hence, this might show the reason behind the government being only able to record 1.6 million children with disabilities attending school.

Furthermore, in statistics it is also reported that there are a total of 144,102 students in the 2019/2020 school year. Meanwhile, data for 2017 states that there are around 32 thousand inclusive regular schools in various regions in Indonesia (Maulipaksi, 2017). The large number of inclusive regular schools in Indonesia shows that the need for teaching personals who are involved in the teaching and learning process is also greater. Therefore, it is considered necessary to expand professional development for teachers on inclusive pedagogical matters, especially in inclusive regular schools. Increasing awareness and equipping teachers with practical skills, regardless of special schools or regular inclusive schools. This can be a good endeavour to guarantee of the right to equal access of education for children with disabilities as it also a part of national education policy agenda.

Apart from the urgency at the national level, the priority of providing inclusive spaces for all children is one of the key indicators in SDGs (Sustainable Development Goals) number 4, namely ensuring inclusive and equitable quality education and promoting lifelong learning opportunities for all (United Nations, 2022). It is clear here that studying the direction of government policies in creating an inclusive environment is a matter of concern. Departing from the needs to create an inclusive environment, an initial step would be investigating teachers' perceptions toward their practices and some aspects in schools. In more depth, the study that we carried out was drawn from an analysis of teacher perceptions at various levels of education, in experiencing, dealing with, and reacting to teaching practices in schools with inclusive or non-inclusive environments, and the relation to their teaching practices with students with special needs.

Some studies present that investigating teachers' perception has a major influence on the performance of teachers in the classroom and overall professional developments (Vorkapic and Katic 2015; Hegde and Cassidy 2009; Hegde et al. 2014; Fang 1996, in Bubikova-Moan et.al., 2019). In this study, the perception's aspect includes communication aspect between teachers and students, as well as students and students; and perceptions related to pedagogy and facilities. Specifically, this study aims to answer these following research questions:

1. What are teachers' perceptions in general, regarding the existence and interaction between teachers and students, as well as students and students in inclusive classes?

2. What are teachers' perceptions regarding teaching (pedagogy) as well as facilities and infrastructure to support teaching and learning activities in inclusive school?

Theoretical Framework

Inclusive Education in Indonesia

Education is a basic right for all citizen, Indonesia implements 9 (nine) years of basic education for all. However, the concept and practices of inclusive education in Indonesia are meant to accommodate further specific conditions of children in public schools. Most of children with special needs are still struggling to access education in many parts of the world. There are many definitions of inclusive education, in the western part, they define inclusive by having children with special needs in inclusive schools, on the other hand, according to Salamanca World Conference on Special Needs Education define inclusive education as a space to give equal access for children with special needs in public or mainstream learning environment (Nishio, 2017 cited in Susana, et.al, 2020).

Providing inclusive education, meaning a long process in accommodating the needs of all children in public schools. In line with the idea of inclusive education shared by Khan et.al (2019) that focuses on the role of inclusive education is an obligation to provide quality education for children in public schools by giving maximum educational services. As a developing country, Indonesia has been facing some challenges in related to its implementation, one is in a policy, and another one how to integrate it with international conventions.

Some studies related to inclusive education practices in Indonesia are not many and mainly focus on specific subject matters (English language teaching, natural science, mathematics, and Indonesian language) and/or abilities (e.g., teaching students with autism spectrum disorder). Some studies focus on exploring specific teaching approaches, such as individual education plan, the use of visual media, quantum teaching strategic, and transformational teaching approaches (Susana, et.al, 2020).

Teachers' readiness was also highlighted in some studies, in most of the developing countries, teachers' capacity and awareness to teach in inclusive setting has been considered low, as found in some studies that teachers tend to feel reluctant to teach students with special needs. Apart from teachers, to successfully create inclusive learning environment, some parties are crucial to provide support, such as parents, school leaders and administrators, and counsellors. According to Baguisa & Ang-Manaig (2019 in Susana, 2020) stated that supportive parents, nurses, doctors, local government, and counsellors are essential to create action plans with teachers to accommodate the need of all children.

Teachers' Perception Toward Inclusive Education

Teachers' perception is one of the essential components to create successful learning environment. Starting from what teachers' belief to what approaches they take in running their class, that is how we understand a significant impact the teachers give to the class. According to Sowiyah & Perdana (2022), there are two aspects that give significant affect to their perception; first is teachers' current teaching situation (for example teachers experience with at least one student with disabilities in their classrooms and size of the school) with the former being favourable and the latter being negative.

Teachers' positive perception and attitude are important, as it influences the success of inclusive education. Since the positive perception has a positive impact on classroom practice and all students can derive benefits of inclusive education (Avramidis, 2013; Choate, 2004; MacFarlane & Woolfson, 2013; Moran et al., 2012; Song, 2016, cited in Sowiyah & Perdana, 2022).

According to a study done in Lampung, Indonesia, inclusive education is not compatible with primary or secondary educational institutions. They disprove the claim that it is challenging to achieve inclusion within the framework of the present academic curriculum. In other words, they disagree that being included makes them perform less well. As a result, it is simple for them to modify their teaching methods to accommodate the needs of students with disabilities.

Methodology

Research Design

The purpose of this study was to examine the practices in inclusive classroom setting and how education policy influences an overall classroom implementation. This study employed descriptive qualitative approach with online survey as one of the data collection instruments. Qualitative approach allows researcher to get in-depth view on specific case, especially when it takes place in real-life context (Lichtman, 2013; Khan, 2014, cited in Ramsey, 2018). The online survey contains the components of perception, pedagogy, and facilities, with sub-components namely 'teacher-students', 'students-students', and 'students-contents'. There are 34 (thirty-four) items or statements delivered in Bahasa Indonesia which were measured with Likert scale, with 5 for 'strongly agree' / '*sangat setuju'* and 1 for 'strongly disagree' / '*sangat tidak setuju.*

Sampling

There were 229 (two hundreds twenty-nine) teachers participated in our online survey with chosen by convenience purposive sampling. Prior to our study, we had conducted inclusive education webinar (conducted by Overseas Indonesian Students' Association) with more than 1000 (one thousand) teachers across Indonesia from different education levels. Hence, as our post-webinar activity, we sent them survey as they already fulfilled the sample criteria. The survey was conducted from December 2020 to February 2021. The sample criteria included: teacher with more than 2 years teaching experience, has experienced in teaching students with special needs, and/or has joined professional development related to inclusive pedagogy training.

Procedure

Prior to the dissemination of the online survey, a webinar on inclusive education was conducted to understand an overall context of inclusive practices in Indonesia education system, then a survey was drafted and pilot, and finally sent to all the former participants of our webinar.

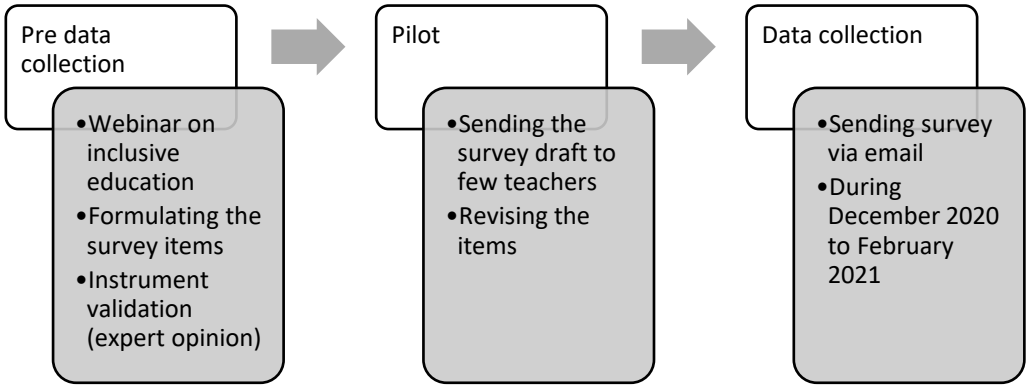


Figure 1. Research flow (Source: *own elaboration)*

Findings and Discussions

This part describes an overall data collection finding which consists of demographic information, description, and brief data collection summary.

As mentioned briefly in the sampling that our participants consist of teachers from all levels of education. It was recorded that 62% (sixty two percent) of participant came from Elementary School level (*Sekolah Dasar*), and the rest of percentage (38%) came from Junior high school (*Sekolah Menengah Pertama*), Senior high school (*Sekolah Menengah Atas*), and Higher education (*Perguruan Tinggi*). Most of the participants were female teachers with 1 (one) to 5 (five) years of teaching experience.

Regarding inclusive education training, there was an almost equal number of teachers who received training (42.8%) although the percentage did not receive training was several percent higher (57.2%). Hence, it can be stated that the provision of training must continue and be expanded in the future.

Table 1. *The perception components*

Sub-components	Statements in Bahasa Indonesia and English
General perception on inclusive education	1. *Siswa berkebutuhan khusus sebaiknya duduk di sekolah reguler bersama dengan siswa reguler pada umumnya /* Students with special needs should be placed in regular schools with regular students. 2. *Mengajar siswa dengan kebutuhan khusus lebih sulit dibanding mengajar siswa regular di kelas reguler /* Teaching students with special needs is more difficult than teaching mainstream students in regular classes. 3. *Saya percaya perlunya pendekatan berbeda untuk anak berkebutuhan khusus, baik secara akademik maupun emosional /* I believe a different approach is needed for children with special needs, both academically and emotionally. 4. *Saya percaya pentingnya memahami emosi dan cara mengelola emosi (saya dan siswa) ketika mengajar di kelas dengan anak kebutuhan khusus. /* I believe in the importance of understanding emotions and how to manage emotions (myself and students) when teaching a class with special needs children.

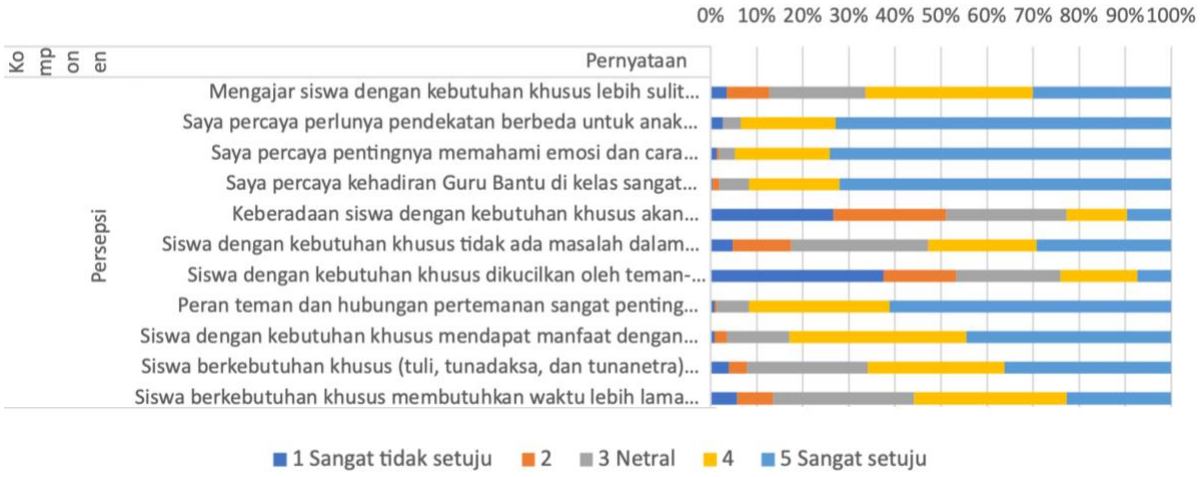
	5. *Saya percaya kehadiran Guru Bantu di kelas sangat diperlukan jika terdapat anak dengan kebutuhan khusus. /* I believe the presence of an Assistant Teacher in class is very necessary if there are children with special needs. 6. *Keberadaan siswa dengan kebutuhan khusus akan mengganggu pembelajaran siswa dengan kebutuhan regular dan mereka sendiri /* The presence of students with special needs will disrupt the learning of students with regular needs and their own. 7. *Siswa dengan kebutuhan khusus tidak ada masalah dalam menjalin pertemanan dengan teman-teman sebaya di kelas dan sekolah. /* Students with special needs have no problem making friends with peers in class and school. 8. *Siswa dengan kebutuhan khusus dikucilkan oleh teman-temannya di kelas maupun di sekolah. /* Students with special needs are ostracized by their peers in class and at school. 9. *Peran teman dan hubungan pertemanan sangat penting untuk anak-anak dengan kebutuhan khusus di dalam kelas dan di sekolah. /* The role of friends and friendships is very important for children with special needs in the classroom and at school. 10. *Siswa dengan kebutuhan khusus mendapat manfaat dengan berteman dengan siswa reguler. /* Students with special needs benefit from making friends with regular students. 11. *Siswa berkebutuhan khusus (tuli, tunadaksa, dan tunanetra) memiliki tingkat kecerdasan tidak lebih rendah dengan siswa reguler. /* Students with special needs (deaf, quadriplegic, and blind) have an intelligence level not lower than regular students. 12. *Siswa berkebutuhan khusus membutuhkan waktu lebih lama dalam menyelesaikan tugas. /* Students with special needs take longer to complete assignments. 13. *Siswa berkebutuhan khusus lebih sulit mencapai target pembelajaran pada kurikulum reguler. /* Students with special needs have more difficulty achieving learning targets in the regular curriculum.
Perception on pedagogy aspect	1. *Saya mempunyai pengalaman mengajar anak dengan kebutuhan khusus di kelas reguler. /* I have experience teaching children with special needs in regular classes. 2. *Saya mampu merancang pembelajaran khusus untuk memenuhi kebutuhan khusus siswa penyandang disabilitas (pembelajaran personal) agar mampu mencapai target yang sama dengan siswa-siswa dengan kebutuhan reguler. /* I can design special learning to meet the special needs of students with disabilities (personalized learning) so that I am able to achieve the same targets as students with regular needs. 3. *Saya melakukan personalisasi materi pembelajaran untuk siswa berkebutuhan khusus sesuai kebutuhan mereka (contoh: ukuran huruf yang lebih besar untuk anak-anak dengan disleksia). /* I personalize learning materials for students with special needs according to their needs (example: larger font size for children with dyslexia).

	4. *Saya mengetahui beberapa metode pengajaran yang bisa diaplikasikan di dalam kelas reguler yang terdapat siswa dengan penyandang disabilitas di dalamnya. /* I know of several teaching methods that can be applied in regular classes where there are students with disabilities in them. 5. *Saya mempersiapkan rancangan penilaian yang berbeda untuk siswa berkebutuhan khusus di kelas saya. /* I prepare different assessment designs for students with special needs in my class. 6. *Saya mengintegrasikan teknologi pembelajaran tertentu untuk membantu saya dalam memonitor perkembangan anak dengan kebutuhan khusus. /* I integrate certain learning technologies to assist me in monitoring the development of children with special needs. 7. *Saya mengetahui manajemen kelas inklusi yang dapat mendorong terciptanya interaksi antar siswa penyandang disabilitas dan siswa reguler. /* I know of inclusive classroom management that can encourage interaction between students with disabilities and regular students. 8. *Dalam pelaksanaan tugas kelompok, siswa dengan kebutuhan khusus saya pasangkan atau gabungkan dengan siswa reguler. /* In carrying out group assignments, I pair students with special needs with regular students. 9. *Saya mengetahui cara menyelesaikan konflik yang terjadi antar siswa berkebutuhan khusus dan siswa reguler di kelas (ataupun keduanya). /* I know how to resolve conflicts that occur between students with special needs and regular students in class (or both). 10. *Saya mampu menyesuaikan metode pengajaran yang sesuai dengan kebutuhan khusus siswa dengan disabilitas sehingga mereka tetap bisa menguasai capaian pembelajaran yang sama dengan siswa reguler. /* I can adapt teaching methods to suit the special needs of students with disabilities so that they can still master the same learning outcomes as regular students. 11. *Dari hasil penilaian dan evaluasi akhir menunjukkan bahwa siswa berkebutuhan khusus (tuli, tunadaksa, dan tunanetra) memiliki tingkat kecerdasan yang sama dibandingkan dengan anak-anak lain di kelas reguler. /* The results of the final assessment and evaluation show that students with special needs (deaf, quadriplegic, and blind) have the same level of intelligence compared to other children in the regular class.
Perception on facilities	1. *Sekolah saya memberikan fasilitas pengajaran yang dapat membantu memenuhi kebutuhan khusus siswa penyandang disabilitas (misal, mesin penerjemah suara untuk siswa tuli, alat pembesar tulisan untuk siswa diseleksia, dan mesin pembaca untuk siswa buta). /* My school provides teaching facilities that can help meet the special needs of students with disabilities (e.g., voice translation machines for deaf students, amplification devices for select students, and machine readers for blind students). 2. *Sekolah saya menyediakan guru bantu minimal satu orang untuk satu kelas. /* My school provides at least one assistant teacher for one class.

	3. *Sekolah merancang bangunan sekolah yang ramah untuk siswa berkebutuhan khusus (contoh: lantai landai dan toilet untuk pengguna alat bantu kursi roda). /* The design of school buildings is friendly for students with special needs (for example: sloping floors and toilets for wheelchair users). 4. *Guru diberikan pelatihan dan pengembangan profesional untuk mengajar anak-anak dengan kebutuhan khusus. /* Teachers are provided with training and professional development to teach children with special needs. 5. *Sekolah memberikan dan mempunyai program khusus dalam perancangan pembelajaran personal untuk anak-anak dengan kebutuhan khusus. /* Schools provide and have special programs in personal learning design for children with special needs. 6. *Sekolah saya memiliki program "sahabat mentor" yang membantu siswa penyandang disabilitas untuk bersosialisasi dengan siswa reguler di luar jam pelajaran. /* My school has a "peer mentor" program that helps students with disabilities to socialize with regular students outside of school hours. 7. *Sekolah memberikan pelatihan bagi orangtua untuk memahami peran orangtua dalam membantu kesuksesan pembelajaran anak dengan kebutuhan khusus. /* Schools provide training for parents to understand the role of parents in helping the successful learning of children with special needs. 8. *Sekolah dan pihak orangtua bekerjasama dalam memfasilitasi tersedianya guru bantu di sekolah. /* Schools and parents cooperate in facilitating the availability of assistant teachers at schools. 9. *Adanya pertemuan antar orangtua, guru, guru bantu, siswa berkebutuhan khusus, dan siswa reguler dalam upaya pengenalan lingkungan inklusif di sekolah. /* There are meetings between parents, teachers, teacher assistants, students with special needs, and regular students to introduce an inclusive environment in schools. 10. *Sekolah saya menyediakan fasilitas olahraga dan kesenian yang dapat memenuhi minat dan bakat siswa penyandang disabilitas. /* My school provides sports and arts facilities that can meet the interests and talents of students with disabilities. 11. *Sekolah mempunyai program khusus untuk peningkatan kapasitas belajar siswa-siswa dengan kebutuhan khusus. /* Schools have special programs to increase the learning capacity of students with special needs. 12. *Sekolah memfasilitasi buku-buku dengan huruf braile, video belajar dengan teks, dan bahan belajar pendukung lainnya di perpustakaan atau di kelas. /* Schools facilitate books in Braille, learning videos with text, and other supporting learning materials in the library or in the classroom.

Teachers' Perception About Inclusive Education

Table 2. General perception on inclusive education



The table above shows that there is a total of 69 teachers (30.1%) stated that they strongly agreed that "*teaching students with special needs is more difficult than teaching regular students in regular classes*". This is most likely related to the lack of teacher pedagogy supplies in designing learning activities or making personalised learning with students with special needs in regular classes. It could also be related to environmental support and facilities at school.

However, the second statement "*I believe a different approach is needed for children with special needs, both academically and emotionally*" shows that most teachers (72.9%) strongly agree with this condition. This illustrates that there is a real understanding of the need for personalized learning or Individual Learning Programs (ILP) for students who need it. 74.2% of teachers strongly agree with the statement on the importance of understanding emotions and how to manage emotions (teachers and students) when teaching classes with children with special needs. This result is in line with study conducted by Padmadewi & Artini (2017) stated that the Individual education plan (IEP) which is equipped with visual media through a "buddy program" is very suitable in helping students learn English. This strategy is very effective in implementing inclusive class programs.

The existence of assistive teachers is also a real need, referring to the justification stated by most teachers (72.1%). Several phenomena in non-public schools, assistive teachers are usually provided from the parents, but not all parents are able to provide assistive teachers in public schools. Of course, this needs to be a real consideration by the government.

Regarding the condition "*The presence of students with special needs will disrupt the learning of students with regular and their own needs*", it seems that teachers are still confused about this condition, as seen from the survey results which showed that 26.6% stated that they strongly disagreed, 26.2% are neutral, and more than 13% agree with this condition. This shows that some teachers still see children with special needs as an obstacle in the teaching and learning process in inclusive classrooms.

Furthermore, in terms of friendships (social interaction with peers), teachers' opinions are also quite diverse, although around a total of more than 50% of teacher participants agreed that "*Students with special needs have no problem making friends with peers in class and in*

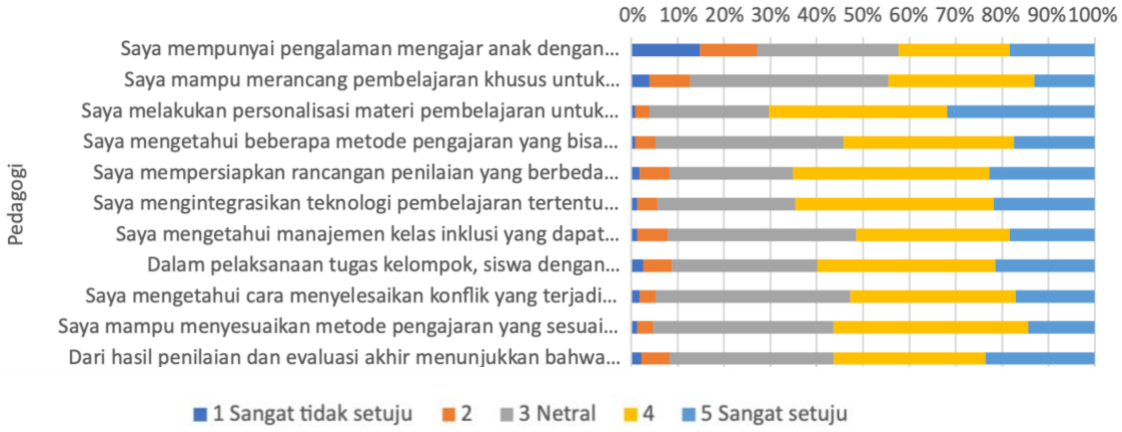
school", and there were still around 17.5% who stated otherwise. This illustrates that in some conditions, students with special needs still have difficulty building friendships and/or may be accepted in their learning environment. However, assumptions related to acceptance are felt to be not entirely correct, seeing from the responses of teachers who disagree (about more than 50%) on the statement "*Students with special needs are ostracized by their friends in class and at school*". It was identified that there is a big role for friends and friendships both inside and outside the classroom, and more than 90% of teachers agree with this condition.

Finally, regarding cognitive abilities for some special needs (such as deaf, quadriplegic, and blind), teachers believe that they have no lower intelligence than other children in inclusive classes. So, this indirectly also does not affect the length of time they need to complete the assignments given by the teacher. However, regarding overall academic achievement, more than 45% of teachers confirmed that *"Students with special needs have more difficulty achieving learning targets in the regular curriculum*". This could be related to the assessment standards that must be followed by all students at the school. Even though learning can be personalized, most schools are still not ready for the implementation of an inclusive curriculum which will also have an impact on the assessment framework and achievement standards for children with special needs.

Teachers' Perception on Pedagogy

In this section, the analysis will focus more on aspects of teacher perceptions in teaching (pedagogy).

Table 3. Teachers' perception on pedagogy aspect



Departing from teachers' general perception about inclusive classroom environment, this part gets deeper on exploring teachers' knowledge and perception on inclusive pedagogy. The table shows that there is about 27% of teachers have no experience teaching students with special needs in regular classes and more than 40% say they have experience. Almost all teachers teach children with special needs in regular classes. Hence, you can imagine that teachers who teach in regular classes need inclusive pedagogical capacity, facilities, and full support to be able to create inclusive classes for students in those classes. Regarding the opinion of personal learning design, almost half of the participants did not take a position of agreeing or disagreeing (neutral). This shows the possibility that the teacher has not fully designed personal learning or maybe even does not know about the personal learning design intended for an inclusive classroom environment. However, regarding statements about

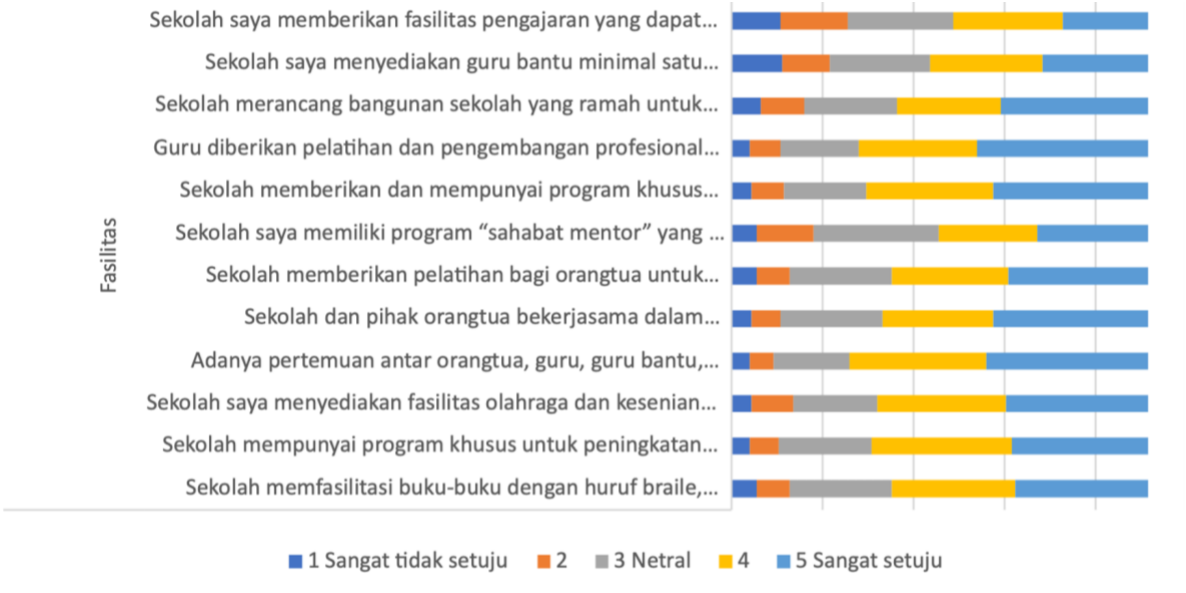
personal learning materials, more than 60% of participants stated that they had personalized learning materials. Lastly, in relation to inclusive teaching methods (pedagogy), which can be applied in inclusive classrooms, it was noted that more than 50% of the participants said they knew and around more than 40% had doubts about inclusive pedagogy.

More than 60% of participants stated that they had integrated technology to assist learning in inclusive classes, one of which was to monitor the progress of the children in their class. Several studies related to teacher perceptions and the integration of technology in inclusive classrooms are indeed diverse, one of which is the use of Robot Mouse at the PAUD (Early Childhood Education) level to make students (not only those with special needs) more understanding and easier to learn basic programming skills (Utami & Hidalgo, 2020). Other things such as live captioner technology can assist deaf students in accessing text from sound media during online learning. Additionally, in classroom management and in building relationships between students, around 59% of participants encourage students with special needs to work together with their peers in regular classes. This can be a pro or con for both parties, such as the possibility of an unbalanced workload or conflict between students when the process of working together. However, it should be realized that such problems do not only occur with students with special needs. The teacher is expected to be able to make the classroom a place for collaboration without barriers for every student in it.

Teachers' Perception on Facilities

It is fully understandable that inclusive conditions do not only come from the teacher's decent knowledge and positive perceptions on teaching practices in the classroom, but also how facilities in schools support the continuity of the learning and teaching process. In this section, teachers' perceptions regarding the existence and support of facilities in classroom management or efforts to create an inclusive learning environment will be discussed.

Table 4. *Teachers' perception on facilities*



For the statement "*My school provides teaching facilities that can help meet the special needs of students with disabilities (for example, a speech translator machine for deaf students, an amplification device for select students, and a reader machine for blind students)",* the participants answered variously. There were around 11.8% of participants who stated,

'strongly disagree'; 16.2% stated 'disagree'; 25.3% 'neutral'; 26.2% 'agreed'; and 20.5% 'strongly agree'. The larger percentage of 'neutral' to 'strongly disagree' statements can illustrate that most of the facilities in the participating schools are still not fully supportive for an inclusive environment. Additionally, teaching assistant personnel is also considered essential, and survey results show that more than 50% of participants agree that their school already provides teacher assistant personnel. On the building infrastructure aspect, the statement "*Schools design school buildings that are friendly for students with special needs (for example: sloping floors and toilets for wheelchair users)*" with more than 60% of participants agreeing on this condition. This illustrates that although in detail the facilities such as teaching aids have not been completed, the physical condition of most of the school buildings has provided more access to special conditions for school members. Regarding professional development, around 68% of participants stated that they had been given training and development to teach children with special needs. Coupled with the existence of a special program to help design personal learning in inclusive classes (about 67% of participants gave this statement).

This result in line with the study conducted by Rasmitadila & Tambunan (2018) that shows, 90% of schools lack supporting infrastructure, 94% lack exceptional teachers, 72% haven't received information about inclusive schools, 80% haven't worked with organisations that are relevant to inclusive education, and 82% don't yet have an inclusive school administration system. Only 60% of school principals are prepared to implement inclusive schools. Obstacle-causing factors include the following: the availability of infrastructure and facilities (24.35%), teacher expertise (23.48%), the presence of special educators (20%), community attitudes (14.78%), financial difficulties (9.5%), and government involvement (7.82%).

In terms of social life support, only about 50% of participants stated that their school already had the *Sahabat Mentor program* (peer mentorship program) to help students with disabilities socialize with other students outside of class hours. Due to equal access to educational opportunities, inclusive education benefits both students with and without impairments. Students with impairments have more positive role models thanks to inclusion. They also think that to support impaired children in regular classes, special education and general education teachers ought to collaborate. Both their professional and personal lives can benefit from their joint teamwork (Sowiyah & Perdana, 2022).

Efforts to strengthen and involve parents in the learning process also seem to have been noticed. Such as training activities for parents related to parenting and learning assistance (more than a total of 60% of participants agreed and strongly agreed), the provision of Assistant Teachers in collaboration with parents (63% of participants agreed), and regular meetings between parents showed there was (71% participants agreed). Collaboration with parents seems to be enough concern and from a financial perspective it does not require a large amount of funding. So that this effort is one of the steps that many schools take and is also a very important element in creating a sustainable inclusive environment (from school to home, and vice versa). That way, efforts are not broken between all parties.

Making the proper individual learning programmes while paying attention to the response to intervention, incorporating parents in learning plans, and creating programmes for students with special needs are all extremely important in relation to the improvement of teaching tactics for teachers (Friend & Bursuck, 2015; Taylor, Smiley, & Richard, 2009; Vaughn, Bos, & Schumm, 2011, cited in Padmadewi & Artini (2017).

Finally, the provision of sports and arts facilities, special learning programs, and teaching materials (books in braille, audio, videos with text, and other teaching materials) can be seen as a whole, more than 60% of participants stated that the facilities mentioned above were available.

Policy Recommendations

The following is a framework for policy recommendation basing to the results of the survey analysis that has been conducted.

1. It is necessary to provide debriefing (training or workshop) in collaboration not only with senior inclusive class teachers, but also with child psychologists and therapists or psychiatrists. Especially in giving teachers experience identifying children with special needs that are difficult to observe directly (such as high-grade autism spectrum disorder or learning difficulties caused by past trauma). Scientific training related to attitude observation and intervention design that can be integrated between classroom practice and therapists seems to be something that needs to be done. This can provide teachers with readiness to design Individual Learning Programs and better understand the socio-psychological conditions of students in class.
2. It is necessary to think about the professional recognition of the Assistant Teacher profession or class assistant for classes with children with special needs. So far, teaching assistants have not been seen as a profession, making their availability minimal and receiving less attention. In fact, the comfort of the class for both students, teachers and other students in the class can be greatly helped by having an Assisting Teacher.
3. There is no need to separate or clearly show the separation of additional classes for regular students and students with special needs. This further shows the existence of differences and makes social interaction between children very pronounced because their friends are considered different. Subsequent program development can be discussed with parents regarding additional programs, so additional classes should not be needed. With this, parents also continue to follow and understand the Individual Learning Program (ILP) that their children get.
4. The *Sahabat Mentor program* (peer mentorship program) can also be developed and expanded, with the help of Assistive Teachers and the age difference between children with special needs and their Friends Mentor partners. It is hoped that the age difference that is older than *Sahabat Mentor* can nurture and provide a reflection of emotional stability when interacting and socializing.
5. It is necessary to provide teaching materials and teaching aids in the classroom and school environment, as mentioned in the analysis section (such as technology or machine translation for deaf children, audiobooks, books with Braille). It is necessary to pay attention to the school buildings and completeness of the school facilities, starting from the school entrance gate (such as a sloping floor) to hygiene facilities (such as toilets). Collaboration with the development of educational technology, the local community, and parents should be able to create sufficient synergies to fulfil the completeness of the above facilities.
6. It is necessary to establish policies and guidelines for achievement indicators for Inclusive Schools (all levels) that can be directly implemented or followed by Regional Governments in creating or starting Inclusive Schools.

7. There needs to be a program to increase synergy between educational institutions, communities, community leaders, parents, and local governments in creating an inclusive environment. This is because the atmosphere, perceptions, and paradigms brought by students and teachers to school are the result of social interaction which will then be brought back to society. So there needs to be a focus on creating an inclusive environment not only in schools, but in society. An example that can be done community involvement in the construction of wheelchair-friendly facilities.

Conclusion

In creating an inclusive learning environment, knowing teacher perceptions regarding aspects of inclusive education practice is an essential first step. Understanding how the real conditions on the ground, the challenges faced, and the expectations to be achieved is an effort to provide responses and see the distance between the initial and ideal conditions that need to be closer. The analysis in this policy brief may not cover equally all levels of education, as well as aspects of inclusive education in Indonesia. However, at least the results of the survey above show that most of the components from the inclusive aspect only range from 50% to a maximum of 70% for the ideal conditions of inclusive schools that have been met. This shows how many components and conditions still need to be improved. Cooperation and communication with parents is an aspect that has been carried out a lot and of course this still needs to be expanded towards active participation. The hope is that in the future, the education budget can also begin to be directed to meet facilities and infrastructure and services towards a sustainable Inclusive School.

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A Longitudinal Case Study on Transformational Videoconferencing-Based EFL Teacher Education for Pre-service Teachers' Professional Development

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Abstract
New technologies and digital learning have opened up a wide range of learning possibilities for language learners. Even though traditional, face-to-face foreign language teaching remains predominant, there is a growing interest in teaching foreign languages (especially English as a Foreign Language - EFL) on videoconferencing (VC) platforms such as Zoom and MS Teams. Using the technological affordances of VC platforms effectively requires pedagogical skills. teachers' teaching strategies of VC-based EFL teaching are pivotal in maintaining high-quality online interactions among learners. Effective video-conferencing-based EFL teaching is imperative. Nonetheless, many teacher training programmes worldwide are still lacking, and teachers are not being prepared to implement EFL courses which are effectively VC-based. This study explored two pre-service EFL pre-service teachers' professional development initiatives: The first stage aimed to explore teachers' independent teaching strategies in a five-week practicum where they were encouraged to put the knowledge of VC-based EFL teaching they gained during a teacher training course into practice. The second is exploring the development of teachers' teaching strategies in VC-based, EFL teaching after a year from the practicum. Data were gathered from a series of in-depth, individual interviews and random in-class observations. Findings indicate that teachers' teaching competencies in VC-based EFL teaching have improved thanks to self-regulated professional development and internal motivation strategies offered during the training. By refining teaching approaches together during the training and the practicum, teachers had opportunities to receive and provide peer feedback, guiding their professional development from the training onwards.

Keywords: Professional Development, Teacher Training, Videoconferencing, EFL

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Introduction

One of the persisting challenges that some teacher training courses attempt at facing is how to prepare pre-service teachers to deal effectively with different pedagogical situations without having pre-service teachers revert back to some older (maybe-ineffective) teaching strategies with which they are more familiar (Larsen Freeman, 2005). Teachers' professional development is, therefore, usually considered central to teacher training courses which aim to help pre-service teachers' transform the knowledge they gain through the training course into practice in their usual teaching contexts (Avalos, 2011). In the case of preparing EFL teachers to teach using videoconferencing (VC) tools, the task of teacher training and teacher development becomes vital because teachers have to be able to make informed decisions regarding different pedagogical and technical challenges and features that are specific to the VC-based EFL context which are different to other modes of EFL instruction (Nunneley et al., 2020). Different studies were conducted on the use of VC tools for teacher professional development (Gerona & Bautista, 2022, Hrastinski, 2021, Saleh, 2006), but these studies were either carried out because of the emergency situation of the breakout of the COVID-19 or not designed for teaching EFL wholly through videoconferencing. This study sought to explore the professional development of pre-service teachers involved in a teacher training course designed for VC-based EFL teaching. The study examined the preservice teachers' professional development in two stages. The first stage explored pre-service teachers' teaching professional development in a five-week practicum where they were encouraged to put the knowledge of VC-based EFL teaching they gained during a teacher training course into practice. The second stage explored the professional teachers' development in VC-based EFL teaching a year after the practicum.

Literature Review

Need for Teacher Ddevelopment in VC-Based, EFL Teaching

Training EFL teachers to implement effective, videoconferencing-based, EFL teaching results from careful instructional design and planning and not just the spontaneous use of online tools (Carrillo & Flores, 2020). Research has, however, shown that different teacher training studies were found to be based on general, classroom-based, EFL teacher training and, consequently, teachers in the VC medium had difficulties in providing immediately-applicable insights, and lacked in practice experience and confidence relevant to VC-based EFL teaching (Thomas, 2020). Other studies exploring the training that EFL classroom teachers go through as they start VC-based EFL teaching highlighted that the training goes beyond the required acquisition of ICT skills to acquiring a rather new pedagogical understanding of the affordances of the new VC medium plus an acceptance of new VC teaching roles and identities in that medium (Knipe & Lee, 2002, Quinn, 2011). Such studies emphasise that teacher education programmes should start offering courses particularly designed for VC-based EFL teachers. According to Albrahim (2020), VC-based EFL teacher training course should aim to investigate the skills that are needed for VC-based EFL teachers including: pedagogical skills and their applications in the VC medium; content skills including designing different language learning and assessment activities; design skills, including selecting appropriate online tools and techniques to present any class activities and how to tailor them based on the learning goals of each class; technological skills to provide teachers with enough experience regarding the learning and teaching capabilities and limitations of various online educational tools; class management skills including creating and developing respectful relationships and a sense of community among the learners (even

though they are isolated physically from each other; finally, social and communication skills including facilitating and maintaining interactive discussion and information exchange with learners and among learners in the VC medium. Since teacher training programmes may lack sufficient practice for all these skills, after their initial training to teach VC-based EFL courses, encouraging VC-based, EFL teachers to start an online community and to attend teacher training webinars is vital. Through actively participating in teacher communities and attending teacher training webinars designed for VC-based EFL teaching, teachers can discuss and reflect on their teaching strategies and how they can be improved and modified using different VC features and online tools which will allow teachers to stay up to date and improve their VC-based EFL teaching strategies effectively (Son, 2018). Such an approach encourages VC-based EFL teachers to take a learning-by-doing approach to their professional development (Son, 2018).

Activating Teachers' Sustainable Professional Development

Sustainable teacher professional development refers to teachers' continuous professional development including gaining up-to-date knowledge and understanding of pedagogical practices and applying this knowledge in their lesson plans, curriculum design, teaching methods, and evaluation (Meesuk et al., 2020). Studies have shown that in order to effectively change or enhance teachers' teaching strategies and techniques, teacher training courses should not forcefully change teachers' teaching strategies otherwise teachers' professional development cannot be achieved (Darling-Hammond & Bransford, 2007). On the contrary, an effective teacher training programme aiming for sustainable teachers' professional development should be merely shaping process of teachers' professional autonomy by offering pedagogical insights, practical teaching tasks, activating teachers' critical thinking through allowing pedagogical discussions among teachers, guiding their decision making and giving them opportunities to evaluate their own decisions and form their own conclusions (Liu et al., 2018). Teacher training for VC-based EFL teaching should, therefore, include elements of sustainable professional development including creating teachers' discussion forums and offering opportunities for teachers to analyse and evaluate different learning activities and lesson plans (Isperdon & Selcuk, 2021). No studies have been found exploring teachers' professional development regarding VC-based EFL teaching after a year or more from training and whether VC-based EFL teacher training programmes are able to trigger necessary and sustainable professional development.

Aims of the Study

This paper traces changes in two pre-service VC-based EFL teachers' teaching strategies throughout two stages. The first is the initial training practicum, which focussed on their professional development through self-reflection and pre-service teachers' peer feedback. The second one is after a year of independent, VC-based EFL teaching. Based on the research aims, the following two questions were formulated:

1. How did pre-service EFL teachers perceive their professional development through VC-based teacher training practicum?
2. What VC-based EFL teaching strategies did pre-service teachers develop after a year from the practicum and how did they develop them?

Methodology

Design

As Hamilton and Corbett-Whittier highlighted (2013), case study research investigates in-depth selective cases or instances focussing on increasing the understanding of the case(s) being studied and it may be longitudinal analysing how different aspects regarding the case(s) affect each other(2013). In this current research, a qualitative case study was conducted with two Syrian, pre-service EFL teachers with a two-fold aim of (1) exploring pre-service teachers' professional development throughout a five-week practicum where they were encouraged to put the knowledge of VC-based EFL teaching they gained during a teacher training course into practice independently and, subsequently, (2) exploring the professional development of these pre-service teachers' teaching strategies in VC-based EFL teaching a year after the practicum.

Participants

The study participants were two Syrian EFL pre-service teachers: one female (P1) and one male (P2) . The two prospective EFL teachers voluntarily participated in the teacher training for over two months. Participants were selected from a group of six pre-service EFL teachers who were recruited through random sampling based on their English proficiency (B1 was considered a minimum) and their access to a high speed internet and a laptop/computer. The participants' English proficiency was determined using an online, mobile-based English placement test developed by the British Council - the "*English Score.*" The reason for selecting P1 and P2 was their urge to continue this longitudinal research study. They had little to no previous basic EFL teacher training and no VC -based EFL teacher training. They had limited experience teaching English in their local settings. Their EFL teaching strategies were spontaneous and lacked sufficient pedagogical knowledge.

The Context - The Training Course

The training course was designed in two stages by the author of the present study. The first stage took place in 2021 and it was offered for 11 weeks online by a university in Central Europe. The first stage included conducting a five-week training course for VC-based EFL teaching and a five-week practicum with a one-week gap. The training included self-paced, asynchronous learning material offered via Google Classroom and synchronous VC-based sessions via Zoom. VC-based training sessions were held once a week. Every session lasted two and a half hours, which included pre-service teachers discussing the suggested topics and doing mock lessons to teach all four macro skills (reading, writing, listening and speaking) as well as grammar and evaluation.

In the five-week practicum, pre-service teachers were asked to teach independently a group of learners. The practicum started one week after the training because this time-gap allowed participants to find a group of volunteer students and to design their five-week course. Each pre-service teacher independently taught a group of learners who were at the same English language proficiency level. During the practicum, pre-service teachers were encouraged to keep teacher's diaries where they can reflect on the way they were teaching and also to discuss with the other course peers what tools and strategies would work better for teaching different things. The second stage included conducting random observations of P1's and P2's VC-based EFL classes and in-depth interviews a year after their training practicum.

Data Collection

The data, for this study, were gathered in two stages with the informed consent of the participants. Data were collected throughout the first stage from a focus group interview including P1 and P2, teacher diaries and random in-class observations. The online group interview, which lasted for about two hours, used semi-structured questions to examine their perceptions of their professional development through the teacher training practicum for VC-based EFL teaching. P1's and P2's teaching diaries (N=15) were collected using 'Google Form'. Six random, in-class observations happened (using observation checklist in Appendix 2) without giving teachers any prior notice (three observations for each pre-service EFL teacher). Observations took place at the beginning, in the middle, and at the end of the course to check teachers' professional development from one stage to another. In the second stage, a year after the practicum, data were collected using random in-class observations and individual in-depth interviews. A year after the practicum, participating EFL teachers were each invited for an online interview using open-ended interview questions (see Appendix 1 for the interview questions). At the end of the interviews, participating teachers were asked to share web-links and schedules of any VC-based EFL courses they were at that time conducting and the researcher observed two random VC-based EFL classes of the courses the participating teachers shared.

Data Analysis

All collected data (that is, verbatim transcriptions of all group and individual interviews, participating teacher diary entries, and observation notes from each stage) were first transferred to a single Word document. Data concerning P1 and P2 were extracted and analysed for the sake of this present study. The method of thematic analysis was used by the researcher as it is commonly used with qualitative research (Braun & Clarke, 2012). The datasets of each stage were analysed separately through open coding. The open coding analytical method helped the researcher to undertake more detailed coding, clustering and organising the open codes into broader themes that describe the data. Having undertaken a rigorous analysis of three datasets, the researcher presented the findings under two main headings: themes (1) teachers as self-constructivist learners; (2) teachers as self-regulated learners.

Findings

Teachers as Self-Constructivist Learners

While investigating Research Question1 & 2, findings suggested that teachers were able to construct their own VC-based EFL teaching strategies thereby considered as self-constructivist learners.

Table below explains how P1 and P2 showed insights for independent professional development as they developed their own teaching strategies.

(Table 1) Teachers as independent learners (self-constructivist learners)	
Throughout the practicum	After a year from the practicum
Teachers independently taught the four skills using different asynchronous and collaborative tools to supplement the VC medium. Still, they followed specific text books and were hesitant regarding teaching techniques and strategies so they consulted with each other.	Teachers created their own lesson plans and slides and did not stick to a specific curriculum. Teachers used authentic materials and tried to compensate the lack of a social community in the VC medium by creating a lively social community through different social media platforms. Teachers recognised the need to reduce the time for the session to 60-75 minutes maximum. Teachers recognised the need to minimise learning goals in VC-based EFL sessions to reduce learners' fatigue. Teachers realised the need to engage students with real-life language situations that match their needs.

Professional Development Throughout the Practicum

Data taken from teacher diaries of both P1 and P2 showed instances of independent teaching as they explored different synchronous and asynchronous teaching tools and planned how to teach the learning objectives of each class through these tools. For example, P1 mentioned that they had "the lesson plans ready based on the selected textbooks" they needed to teach and they had to "figure out what online tools can be effectively used to implement different tasks trying to teach different skills." Similarly, P2 indicated in his diary that he "had to experiment with different online tools on his own to be able to decide what works best for the lesson plan to be conducted efficiently in the VC mode". Participating teachers' sense of freedom and yet responsibility as they become critical when making choices regarding their own teaching strategies and techniques reflects their self-directed professional development (Hargreaves et al., 2012).

While participating teachers showed instances of self-directed professional development, they still appeared to be not confident enough to create their own activities from scratch based on the learning objectives for each class. Data collected from observation notes showed that P1 and P2 closely adhered to the activities suggested in the textbooks they were using even though some activities were redundant and could be replaced with more efficient ones in terms of the learning objectives in hand. Data taken from group interviews showed, also, that P1 and P2 often consulted with their peers and their trainer when designing lesson plans and how to conduct them via the VC medium because they lacked sufficient experience and needed some affirmation or evaluation of their work. The urge of participating teachers' to

have teacher-teacher consultations plays an important role in teachers' professional development (Blase, 2014).

Professional Development a Year After the Practicum

Data taken from observation notes of classes taking place a year after the practicum showed that P1 and P2 did not stick to a certain textbook anymore. P1 mentioned that they "preferred designing their own lesson plans from scratch based on the learning objectives they set for each session and then delivering the planned tasks classes using slides." Furthermore, data obtained from P1's and P2's observation notes showed that they decided to use authentic materials taken from Youtube videos, Instagram reels, and other online materials rather than customised educational materials suggested by different textbooks. These data were consolidated from similar data taken from P1's and P2's individual interviews as they both suggested that the use of authentic materials can further increase EFL learners' motivation for learning and are easily accessible in the VC mode. P2 suggested "the use of captions available in different online video platforms such as Youtube can aid learners' EFL listening skills and authentic videos can broaden learners' understanding about the target culture. Such sources are free and easily accessible in VC-based EFL classes." These insights were constructed by P1 and P2 based on their own VC-based EFL teaching experience and their motivation to enhance their teaching skills (Ball et al., 2009).

Another shared insight taken from P1's and P's individual interviews is the teachers' need to compensate for the lack of real-life social communication happening outside VC-based EFL classes as learners are usually attending classes from different places. With that concern in mind, data taken from individual interviews suggest that both teachers tried creating informal social media channels using Whatsapp, Facebook, Instagram, or Telegram groups or a combination of different social media groups to facilitate social communication between learners whether in the target language or their native language(s). Data taken P1'S and P2's interviews suggest that social communication and having collaborative tasks between VC-based EFLlearners participating in each course is integral in boosting learners' motivation and learning performance and breaks the feeling of isolation that learners mostly feel in the VC context. These perceptions were also constructed by P1 and P2 based on their own VC-based EFL teaching experience.

Data collected from P1's and P2's observation notes and individual interviews showed that both teachers reduced their VC-based EFL class session to 60-75 minutes as they have realised the multiple loads that EFL learners need to endure while taking VC-based EFL classes. These loads include language learning load, technical troubleshooting information load, technical load of maintaining internet connectivity, as well as physical fatigue as learners don't have to move while taking EFL classes the VC mode and learners tend to use their small screen devices to attend classes." Additionally, data taken from random observations of P1's and P2 's VC-based EFL classes showed that they have minimised the number of learning goals to be achieved per session compared with classes conducted during the practicum. Data extracted from P1's and P2's individual interviews showed that both teachers' realised the drastic impact of VC fatigue on EFL learners' motivation and learning performance. P2 suggested in his interview that he had decided to "plan their lesson to have two-three maximum learning objectives per session and to add more game-like learning activities." Such intuitions show signs of P1's and P2's teaching professional development as these intuitions can to a great extent impact their future teaching tactics and strategies (Sipman et al., 2021).

Finally, data elicited from P1's and P2's individual interviews suggest that both EFL teachers realised the importance of creating real-life language situations where learners can use their EFL productive skills which match their learners' current language needs rather than following textbook-based activities that may not be relevant to their needs or interests. According to data taken from P1's and P2's interviews, VC-based EFL courses are usually conducted to a small number of learners; 4-8 learners and, therefore, the design of the course should be more learner-centered to stimulate engagement, inclusivity, and skills development. Similar findings were suggested by (Brown et al., 2008) indicating that VC-based EFL teachers should design the VC-based EFL course and lessons in a way relevant to participating learners to boost learners' motivation and interest. P1's and P2's practice-based discoveries are a sign of both teachers' ongoing improvement and ability to reflect upon, analyse, and learn from their own teaching experiences.

Teachers as Self Regulated Learners

Findings indicate that participating teachers' teaching competencies in VC-based EFL teaching have improved thanks to their urge to go on a self-regulated professional development using different sources of teacher education and pedagogical support available to them.

Table below explains how P1 and P2 showed signs of seeking different teacher education opportunities and pedagogical support throughout the training practicum and also one year later.

(Table 2) Teachers seeking external pedagogical support - self regulated learners

Throughout the practicum	A year after the practicum
-EFL Teachers depended on other teacher's peer feedback and asked sometimes for their teacher trainers' guidance. -Explored a list given by the teacher trainer of different VC-based EFL teaching plug-ins and tools as well as other synchronous and asynchronous tools to supplement VC-based EFL teaching and checking how they can be used for different learning objectives.	-Teachers attended online teacher training webinars, other university-led teacher education programmes, and regularly read online sources about VC-based EFL teaching strategies. -Regularly checked recently developed online teaching tools that can supplement VC teaching.

Seeking Pedagogical Support Throughout the Practicum

As mentioned earlier, data taken from P1 and P2's group interview suggest that the teachers often consulted with their peers and their trainer when designing lesson plans and learning how to conduct them via the VC medium. P1 and P2 in this stage recognised the need for evaluation of and suggestions from their peers and trainer regarding the activities and lesson plans they were designing. Taking the initiative to seek peer consultation is vital and some pre-service teachers can be overwhelmed by the real teaching environment or might cling to any previous teaching practices they experienced when they were school students, which can hinder their teaching professional development (Nemser, 2003). Similarly, data taken from

P1's and P2's group interview showed that the teachers took initiative in exploring different online tools and how they can be used during their VC-based EFL classes. P1 suggested that "they did not depend on any ready-made lesson plans or activities designed for VC-based EFL teaching. They improvised their own lesson plans using different synchronous and asynchronous tools they experimented with rather than being over dependent on the trainer". Pre-service teachers' active involvement in their own training is vital for their professional development (Xu & George, 2012).

Seeking Pedagogical Support After a Year From the Practicum

Data taken from P1's and P2's individual interviews suggest that both teachers had the motivation to continue their teacher development after the training ended. P2 suggested that they attended "several webinars, online courses and workshops" delivered by the *British Council, American English, Education First, Coursera*, etc. P1's and P2's motivation to stay informed about the latest VC-based EFL teaching practices and online teaching tools has helped the teachers to continue in different informal professional teaching development programmes. According to the data derived from P1's and P2's individual interviews, the nature of the teacher training programme encouraged teachers not to be passive recipients of knowledge and this active role in their own teacher learning continued on after their training. They were also encouraged to take more formal education programmes although their backgrounds were different (English Literature and Linguistics). One of the teachers (P1) joined a *Masters of Education in Advanced Teaching* provided by an American university. The second teacher (P2) started a PhD in *English Language Teaching* in a university in South Asia. Teachers' self-motivation to start consistent university-led education is vital in regulating their professional development (Mikroyannidis et al., 2015).

Conclusion

The study sheds light on professional teacher development of two pre-service teachers directly after the training to teach using VC tools and after a year from the training. The study showed positive results as both preservice teachers were able to develop their own pedagogical strategies and concepts regarding VC-based EFL teaching. This study is, however, small in scope as only two participants volunteered to be part of both stages which lasted for more than a year. Thus, the findings of this research may not be generalisable or apply to other pre-service VC-based EFL teachers taking similar teacher training courses. Furthermore, professional development of the participating pre-service EFL teachers can occur for reasons that may not be related to the teacher training, such as teachers' motivation and other affective factors. Future research can use more robust research design and a larger number of participants and look in more depth for sources of VC-based EFL teachers' professional development.

Appendix 1: Interview questions in stage 2: a year after the practicum

- Have you been doing VC-based EFL teaching so far after a year from the practicum?
- How do you see your VC-based EFLteaching experience after a year from the practicum?
- What has changed about your teaching strategies since the practicum? Why did you make these changes?
- What teaching strategies were introduced in the practicum are you still using after the practicum? Why did you choose to keep using them?
- Did you change anything about the way VC-based EFL classes are organized? How did you change them and why?
- Are you using any different online tools for VC-based EFL teaching compared with the ones you used in the practicum?
- Are there any other aspects that have changed concerning your VC-based EFL courses since the practicum?
- In case there are some changes that you decided to make to your teaching strategies or the way classes are organized, did you improvise and come up with the changes yourself? Or did you use some teacher education materials? Have any of these changes been helpful so far? How?
- In case there are any changes concerning your VC-based EFL courses? What aspects of the training encouraged and guided you towards the changes you made so far?
- Did you depend on other sources of teacher training? Name them if there are any.

Appendix 2: Observation Checklist

Observation Checklist

Teacher's name:_____Date:

Skills the teacher targeted in this class:

Category	*Response*			*Comments*
General impressions about the online class	**Yes**	**No**	**N/A**	
Topic(s) discussed in class				
Tools used				
Activities implemented in class				
Challenges the teachers faced				
Reasons for these challenges/ barriers				
Teaching reading online	**Yes**	**No**	**N/A**	
Effective use of pre-reading tasks				
Effective use of while-reading tasks				
Effective use of post-reading tasks				

Students have a clear purpose for reading				
The teacher effectively uses online features and tools (breakout rooms/ chat box, share screen) effectively to facilitate student learning during the reading task				
Teaching listening online				
Effective use of pre-listening tasks				
Effective use of while-listening tasks				
Effective use of post-listening tasks				
Students have a clear purpose for listening				
The teacher effectively uses online features and tools (breakout rooms/ chat box, share screen with audio) effectively to facilitate student learning during the listening task				
Teaching writing online				
Effective use of pre-writing tasks				
Effective use of while-writing tasks				
Effective use of rubrics				
Students have a clear purpose for writing				
Students have a model to follow for writing				

The teacher effectively uses online features and tools (Google Doc/ breakout rooms/ chatbox/ blogger) effectively to facilitate students' performance while they do the writing task				
Teaching speaking online				
Effective use of pre-speaking tasks				
Effective use of while-speaking tasks				
Effective use of rubrics				
Students have a clear purpose for speaking				
Students have a model to follow for speaking				
The teacher effectively uses online features and tools (Google Doc/ breakout rooms/ chatbox/ blogger) effectively to facilitate students' performance while they do the speaking task				
Teaching vocabulary and Grammar				
Teacher introduces vocabulary and grammar in context				
Teacher uses both inductive and deductive ways of teaching grammar				
Teacher uses controlled and semi controlled activities to allow students to use the main grammar and vocabulary items introduced in the course				

Teacher uses online features and tools to make grammar and vocabulary practice fun and interactive for students				
Active and Engaged Learning				
Allows students time to process and answer questions				
Creates an interactive learning environment that welcome, challenge, motivate, and support all students				
Creates learning environments that welcome, challenge, and support all students				
Demonstrates effective pedagogies for engaged EFL learning				

Additional Comments:

A. Things that went well for the teacher in the online class:

B. Challenges in this particular online class:

C. Specific suggestions for enhancing this online teaching- learning class:

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Alternative Classroom Design's Relation to Student Satisfaction, Learning Engagement and Perceived Teaching Effectiveness in a Malaysian University Setting

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Abstract
This study collected feedback from students and lecturers regarding "traditional" and "creative" (i.e. non-traditional) classroom designs. A sample of 140 current undergraduate and graduate students (male = 40, female = 100) and four lecturers (male = 1, female = 3) were surveyed regarding their learning experiences and impressions in "traditional" compared to "creative" classroom settings. Participants rated their level of satisfaction with the classroom setting, their level of learning engagement, and perception of teachers' competence in both types of classrooms. Students reported greater satisfaction with creative classrooms as well as greater learning engagement. Lecturers did not have a statistically clear preference between the two settings. Similarly, lecturers did not feel the classroom setting affected their teaching effectiveness while students reported greater teacher effectiveness within the creative classroom setting. It is suggested that more comfortable, student-centered classroom environments, while not necessarily preferred by teachers, may help students feel more involved and engaged in the learning process.

Keywords: Classroom Design, Learning Engagement, Malaysia, Counseling Education, Student Satisfaction

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Introduction

In improving the quality and effectiveness of the learning experience, it has been noted that the use of alternative classroom spaces has lagged somewhat behind the use of alternative pedagogical techniques (Miller, 2008; Scott-Webber et al., 2013). Specifically in Malaysia, the setting of this study, although the use of innovative, interactive teaching and learning techniques is actively encouraged, particularly at the tertiary level, most classroom settings remain relatively "old-fashioned" in design (Yesuiah, 2017). This is despite the fact that environmental psychologists have demonstrated that aesthetic and functional aspects of an environment can strongly influence behavior, mood, and cognition (Pressly & Heesacker, 2001; Scott-Webber, Abraham, & Marini, 2000). Meaning that if we want to change the learning process we should also consider changing the environment in which it takes place (Gifford, 2002).

Traditional classroom layouts are based on a strategy of standardization (Gardner, 2005). Learning in such environments is largely teacher-focused: The layouts are designed so that students can best focus on lessons being delivered by a teacher (Fisher, 2006). Desks and chairs are arranged in rows so that students face, and theoretically attend to, the teacher (Guardino & Fullerton, 2010; Kaya & Burgess, 2007). Such settings assume that class activities will be centered around the teacher's moral or physical authority and quality of learning is implied to relate to an assimilation of information rather than a transformation of thought processes (Betoret & Artiga, 2004). Again, this type of classroom setting remains the standard model in Malaysia (Yesuiah, 2017).This type of traditional classroom layout seems to be ill-served to many types of learning, often leaving students felling bored or constricted (Amedeo and Dyck, 2003), and simply focused on passing exams as opposed to learning (Zapatero, Maheshwari, & Chen, 2012). As most teachers know, students that are actively engaged tend to experience higher quality learning. So, it only makes sense to attempt to design a classroom setting that encourages interactive and cooperative learning processes (Betoret & Artiga, 2004; Gillies and Boyle, 2010). Refer to the setting for traditional classroom of Master of Counselling program (Figure 1 & Figure 2).

Figure 1: Traditional classroom design layout

Figure 2: Traditional classroom design layout

Many different ways of designing a classroom are possible. Open floor plans, group seating, and comfortable furniture are often suggested (Yang, Becerik-Gerber, & Mino, 2013). Cluster-type seating arrangements have been found to facilitate group discussions; U-shaped configurations have been observed to promote a sense of community and improve student–teacher interactions (Kaya & Burgess, 2007; Martin, 2002). Preferences however, will necessarily vary according to the teaching style (e.g., memory based, analytical or practical), as well as the subject material (Betoret & Artiga, 2004). Generally, however, flexibility in layout has been cited as a positive characteristic; allowing for both improved interactions between students and lecturers (White & Lorenzi, 2016), and more opportunity for student creativity (Imms & Byers, 2017; Jeffrey, 2006; Warner & Myers, 2010). Refer to the setting for creative classroom of Master of Counselling program (Figure 3 & Figure 4).

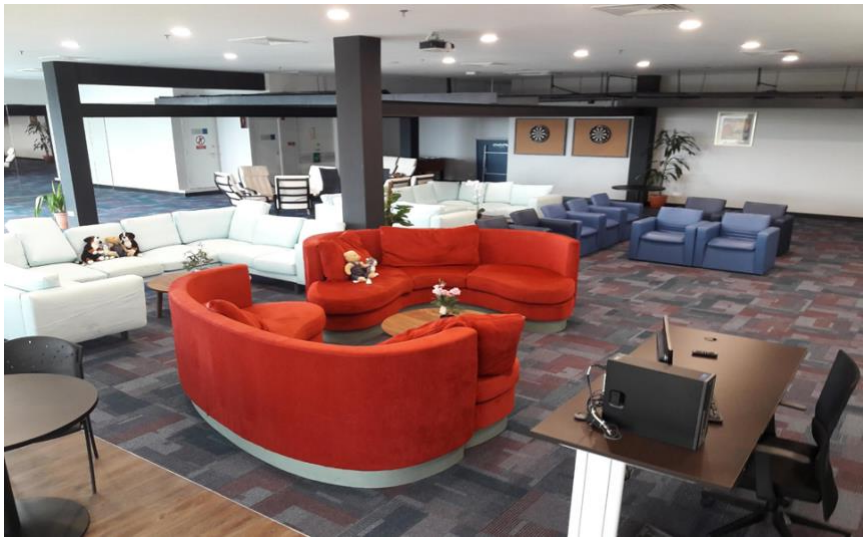

Figure 3: Creative classroom design layout

Figure 4: Creative classroom design layout

Aim

This study surveyed students in a mid-size private Malaysian university regarding their experiences in both traditional and redesigned "creative" classrooms. Feedback from a small group of lecturers was also gathered.

Research Questions

There were several questions this study was intended to pursue.

1) Are students (and teachers) more satisfied with non-traditional vs traditional classroom layouts?
2) Are students (and teachers) more engaged in the learning process in non-traditional vs traditional classroom environments?
3) Do students perceive greater teacher effectiveness in non-traditional vs traditional class environments?
4) What specific aspects of the classroom design are seen as most important?

Participants

A total of 140 students currently enrolled in master's or bachelor's programs at a mid-size private university were surveyed. Three surveys were excluded because of incomplete responses resulting in a final sample of 140 students. Surveys were also completed by four lecturers. Of the 140 student participants, 40 were male and 100 were female. Average age was 25.8 (*SD*=3.1). Lecturers surveyed included one male and three females. Average age for lecturers was 36.2 (*SD*=7.5).

Materials

Design Layouts

A self-designed questionnaire was developed for each classroom setting. All participants provided demographic information including their gender, age and cohort year in their respective courses. Participants rated 8 items on a 5-point Likert scale (1 = very low level of satisfaction to 5 = very high level of satisfaction) regarding their satisfaction towards each of

eight classroom attributes (classroom space, colour, comfort of furniture, flexibility of furniture, acoustics, visibility, portability of technology, and interior ambience) in the traditional and creative classroom. The overall satisfaction scores will assist in determining which classroom environment had higher preference in utilization among students and lecturers.

Participants' responses to open-ended questions regarding the impact of classroom attributes towards their leaning engagement and teaching competency were also collected. This assisted in validating data collected and evaluating factors that potentially impacted the participants for each learning environment. The qualitative data analysis was classified according to each attribute, which will provide aid in future research improvement.

The questionnaire was adapted to versions relevant to the perspective of the participant group but consisted of similar questions. Below shows the following questionnaire variables students and lecturers were required to complete:

Students' Questionnaire

- The satisfaction towards classroom attributes
- The impact of classroom attributes towards students' learning engagement
- Students' perception of the impact of classroom attributes towards lecturers' teaching competence

The students' self-perception of learning engagement had measurements adapted from Yang et al.'s (2013) self-designed questionnaire and Rochester Assessment Package for Schools (RAPS; Klem & Connell, 2004) where questions where extracted and re-structured for the focus of this research. Eight items were rated on a 5-point Likert scale recording the impact of each classroom attribute towards students' learning engagement for each classroom setting. Overall impact of classroom attributes will determine which classroom setting had a significant impact towards students' learning engagement.

Questions from Monash University's (2017) Student Evaluation of Teaching and Units (SETU) and Evaluation of Teaching Performance (CEID; Moreno-Murcia, Torregrosa, & Pedreño, 2015) were also adapted for the questionnaire. Students were required to rate nine items on a 5-point Likert scale (1 = Strongly Disagree to 5 = Strongly Agree) on their perception towards their lecturers' teaching competency for each classroom setting.

Lecturers' Questionnaire

- The satisfaction towards classroom attributes
- The impact of classroom attributes towards lecturers' teaching competence

In the lecturers' version of the questionnaire, measurements were adapted from the Student Evaluation of Teaching Effectiveness (SET; Mortelmans & Spooren, 2009) scales to distinguish the attributes that significantly impacted lecturers' self-perception of teaching competency. Only questions relevant to the focus of this research were extracted. Eight items were rated on a 5-point Likert scale recording the impact of each classroom attribute towards lecturers' teaching competency for each classroom setting. Overall impact of classroom attributes will determine which classroom setting had a significant impact towards' lecturers' teaching competency.

Procedure

The study was carried out after obtaining the low-risk ethics application approval from Monash University Human Research Ethics Committee (MUHREC); and approval from Monash Campus Research and Development. Students and lecturers from the university were invited to participate via announcement in lectures a week before research was carried out. An explanatory statement was distributed to outline details of the study such as the purpose of study, benefits and risks of the study accompanied with contacts for emotional support for those adversely affected, confidentiality of information, and storage of data.

The students chosen were in courses that engaged in activities such as group discussion, presentation, role-play activities and brainstorm activities for lots of sessions of the units. At the end of the following week, questionnaires were distributed to 81 participants in the traditional classroom and 59 participants in the creative classroom. Participants answered questions related to demographics, satisfaction with physical attributes of the classroom, their perception of their own learning engagement and their perception of the competency of the teacher. These concepts were explained to students before they began the questionnaire and they were allowed the opportunity to ask questions if they were unclear on any of the constructs being measured. Upon providing informed consent, participants completed the questionnaire.

For student participants, a hard copy of the questionnaire was distributed during the last 15 minutes of their lectures and was returned at the end of the lecture. Lecturer participants were given an online questionnaire link to be completed and submitted at the end of their teaching day. Lecturers were evaluated based on the criteria: preparedness, enthusiasm, clarity of explanation, useful feedback and opportunity for interaction.

The following week classroom assignments were reversed so that the class from the traditional classroom moved to the creative classroom and vice versa. Afterwards completed the same questionnaire regarding their impressions.

Classroom activities in both classroom settings were also observed by experimenters. Differences in activities and behaviors between classroom settings were noted. Lecturer participants were also asked for their personal opinions regarding the differences between classroom settings. Participants were given a debriefing upon completing the second set of questionnaires.

Overall Students' Satisfaction of Classroom Attributes

An overall satisfaction of classroom attributes was derived from the sum of satisfaction scores for each classroom setting. Paired-samples t-test results showed a mean difference of 5.38, 95% CI [4.14, 6.62] between the overall satisfaction of creative classroom attributes (M = 31.11, SD = 4.75) and overall satisfaction of traditional classroom attributes (M = 25.74, SD = 5.50). This produced statistically significant results, $t(140) = 8.58$, $p < .001$, two-tailed, $d = 1.05$, indicating that students were generally more satisfied with the creative classroom setting.

Overall Impact of Attributes on Learning Engagement

An overall impact of classroom type was obtained by summing learning engagement scores for each classroom setting. Results showed a mean difference of 2.57, 95% CI [1.25, 3.89] between the overall impact of creative classroom attributes (M = 29.87, SD = 6.02) and overall impact of traditional classroom attributes (M = 27.30, SD = 5.76). There was a statistically significant difference in the overall impact of learning engagement between classroom settings; $t(140) = 3.84$, $p < .001$, two-tailed, $d = 1.17$. Thus, students perceived themselves being more engaged in their lessons in the creative classroom.

Students' Perception Towards Lecturers' Teaching Competency

Students' perception of their lecturer's teaching competency was also measured for both classroom settings. Paired-samples t-test were conducted and statistically significant results were obtained; $t(140) = 5.66$, $p < .001$ two-tailed, $d = .59$. The creative classroom (M = 36.36, SD = 5.33) had a higher mean of scores compared to the traditional classroom (M = 32.84, SD = 6.55), mean difference of 3.53, 95% CI [2.30, 4.76]. Students perceived their lecturers as having higher teaching competency in the creative classroom.

Overall Lecturers' Satisfaction of Classroom Attributes

The difference between the overall satisfaction with classroom attributes between the two classroom settings was calculated using Wilcoxon signed-rank test. Results indicated that all lecturers generally were more satisfied with the creative classroom (*Sum of Ranks* = 10.00). However, this was not statistically significant as $T = .00$, $p = .068$, two-tailed, $r = -.91$.

Overall Impact of Classroom Attributes on Teaching Competency

Wilcoxon signed-rank test showed that three lecturers felt a positive impact on their teaching competency from the overall creative classroom attributes classroom (*Sum of Ranks* = 6.00). Only one lecturer felt indifferent towards both classroom settings. However, results obtained were not statistically significant, $T = .00$, $p = .109$, two-tailed, $r = -.93$, large effect size.

Discussion

This study explored preferences in classroom design among Malaysian university students and lecturers, as well as the impact of eight classroom attributes on perceived learning engagement and teaching competency between two different classroom settings. Three hypotheses were examined regarding— satisfaction with classroom attributes; impact of classroom attributes on learning engagement; and, impact of classroom attributes on teaching competency. Significant preferences in all three areas were found for the creative classroom setting among students but not among lecturers.

A breakdown analysis found six out of the eight classroom attributes measured here had a significant relation to student satisfaction. First the size and layout of the creative space provided was preferred by students. As predicted by Scott –Webber et. al. (2000), students were satisfied with the critical distance between lecturer and student while being able to maintain a personal learning space among themselves.

Another important factor was the comfort of furniture. Students could naturally assume a variety of positions on the sofas to get comfortable throughout long hours of learning. Thus, students felt generally more satisfied in the creative classroom as the furniture made sitting through classes more bearable.

The interior ambience of the creative classroom was also preferred by students. Students were impressed with the amenities in the creative classroom. They were given a relaxed learning space that provided features designed to enhanced their learning compared to the plain, more spartan, interior of the traditional classroom.

In regards with the flexibility of the furniture, students appreciated furniture that was easily moveable and could be repositioned when required to face different directions for lectures or demonstrations. This supported Pressly and Heesacker (2001) who stated classroom users would appreciate a sense of control over seating arrangement and furniture to aid their learning.

Besides that, the portability of technology demonstrated significant results. As technology was conveniently relocated when required, students were contented with its function in aiding their learning. However, not too surprisingly, additional power outlets were recommended so they would not need to "compete" for recharging ports.

Students generally reported the creative classroom a "good colour combination". Significant results were shown for satisfaction with the colours of the creative compared to the traditional classroom. Tofle, Schwartz, Yoon, and Max-Royale (2004) reasoned that the same colours could affect people differently due to their culturally learned associations, and physiological and psychological makeup. Future designs could implement Thompson's (2003) suggestion in researching appropriate colours for the age and culture of the student population served.

There were two classroom attributes that did not show significant differences in satisfaction between the two classroom settings. There were audio distractions constantly present in the creative classroom. It was noted that it is important to use door dampers for the classroom doors and to avoid furniture with squeaky polyurethane surfaces. Other comments were made regarding less than optimal visibility at times in the creative classroom. Although the deeper and wider creative classroom had appropriate arrangement of rows of furniture as suggested by (Lei, 2010), the movability of furniture and the size of the screen on which learning material is projected should be noted as factors that affect visibility.

These two results contradicted past research on some level (Gardner, 2005; Hall & Wilczynski, 2005; Hill & Epps, 2010; Lei, 2010; Warner & Myers, 2010; Yang et al., 2013). Likely, however, these are due to idiosyncrasies in the design of this particular classroom setting as opposed to generalizable findings.

As predicted, students expressed higher overall satisfaction with the creative classroom. These results were in accord with much previous research (e.g. Hill & Epps, 2010; White & Lorenzi, 2016), that has found that features such as those in our creative classroom setting improve student satisfaction and performance.

Apart from considering the students' perspective, this study also looked at lecturers' experiences. Lecturers mostly expressed positive views about the creative classroom

compared to the traditional classroom. For instance, remarks on lighting in the creative classroom aligned with past research by White and Lorenzi (2016) expressing that openness and bright décors were preferable. Lecturers appreciated the relative freedom of movement and flexibility of arrangement afforded by the creative classroom, similar to findings from Jankowska and Atlay (2008).

There were, however, conflicting remarks among the lecturers on certain classroom attributes. For example, the multiple colours in the creative classroom had a positive influence on emotions for some (Pearson and Wilson, 2012). But, half of the lecturers were indifferent towards the colours, supporting Tofle et al.'s (2004) contention that the same colours could impact others differently.

Although qualitative data collected from lecturers was generally favorable towards the creative classroom, due to the small sample size, quantitative results did not indicate significant differences. Thus in quantitative terms these results did not replicate previous studies (Amedeo & Dyck, 2003; Jankowska & Atlay, 2008; Scott-Webber et al., 2000; White & Lorenzi, 2016). Hence, the first hypothesis was not fully supported among lecturers.

To investigate the second hypothesis regarding learning engagement among students, results were broken down by attribute. Total mean scores for most attributes of the creative classroom showed statistically higher perceived learning engagement among students, supporting findings from previous studies. On the other hand, students did not see several classroom attributes as contributing to their learning engagement. In spite of expressing satisfaction with the comfort and flexibility of the creative classroom furniture, the students did not perceive this to necessarily support their learning engagement. Some students reported that the furniture "felt overly comfortable" making it "tough to concentrate" and they were prone to "feeling sleepy". Acoustics and visibility in this setting were also deemed not as sub-optimal for learning engagement. Insufficient power sources also hindered the portability of technology, which in turn limited opportunities for students to engage. These differences from previous research could be cultural (e.g. Campbell & Li, 2008) or could be due to idiosyncrasies in the design of this particular creative classroom setting.

Nonetheless, overall analysis demonstrated that the creative classroom attributes had significantly higher impact on students' learning engagement. Students perceived themselves as more attentive, interested, and invested in learning. This in turn positively affected their academic performance in the creative classroom. Overall results in regard to student learning engagement were as predicted in previous research (Doppelt & Schunn, 2008; Guardino & Fullerton, 2010; Jankowska & Atlay, 2008; Scott-Webber et al., 2013). Thus, the second hypothesis was accepted.

Finally, the third hypothesis examined the relationship of classroom attributes with lecturers' feelings of their own competency. Results here showed that there was no significant difference in feelings of teaching competency between the classrooms. This contradicted findings from past research (Cornell, 2002; Imms & Byers, 2017; Martin, 2002). Therefore, the third hypothesis was rejected. Aside from the sample size, one plausible reason for this could be that lecturers were not utilizing the full potential of the facilities provided in the creative classroom to enhance their teaching. For instance, lecturers were satisfied with the furniture but disapproved of the cluster layout arrangement. However, it was observed that lecturers rarely rearranged the layout for their lecture sessions. Rearrangements were mostly carried out during interactive group work and role-play activities by the students. It almost

assuredly would require some adjustment period for lecturers to become fully accustomed to the features of the creative classroom and to adjust their teaching style and techniques to make the best use of it.

In this regard Gillies and Boyle (2010) remarked that because lecturers act as guides in learning, they must be aware of the effects of classroom layouts. Optimal physical organization of the classroom can depend upon the learning activity, mode of teaching approach, patterns of communication and behavior towards students. Lecturers need to abandon the attachment to past practices that pervades many teaching approaches and be creative themselves in how they approach the layout of classrooms as well as different teaching approaches (Imms & Byers, 2017; Wild, 2011).

In contrast, students perceived their lecturers to be more competent in creative classrooms. Past research has indicated that perceived communication is a key factor towards students' perception of teaching competency (Sweeney, Morrison, Jarratt, & Heffernan, 2009). Open communication between students and lecturers, and satisfaction towards instructor and contents of the course were important in determining students' perception of lecturers' teaching effectiveness. This supported Barat, Rajamma, Zolfagharian, and Ganesh (2009), and Parayitam, Desai, and Phelps (2007) verifying the existence of a positive relationship between perceived communications, overall evaluation, and perceived competence gained through the course.

Conclusion

The current pilot study showed that Malaysian students and lecturers generally liked and appreciated creative classroom features. Although limitations of this research were substantial, the results suggest that attention to learning spaces could improve the educational experience in Malaysia. The findings should provide encouragement to Malaysian educational institutions towards investing in classroom layouts that support active learning and innovative teaching (e.g. Scott-Webber et al., 2013). These findings also suggest specific aspects of classroom layout that may be of greatest importance to Malaysian students. Generally, openness, good lighting, flexibility, comfort, and tech-friendliness were highly appreciated by both teachers and students. This suggests that much about the learning experience can be improved through creatively altering the learning environment. These findings also suggest though that it is not enough just to take old pedagogical techniques and put them in a new environment. To really improve the learning experience teachers need to reorient their teaching strategies towards student engagement. Making classrooms more student-centered also means making learning less teacher-centered which may be an adjustment that is difficult for many to make.

Author Contribution Statement

TCL provided the materials of the present study in Monash University Malaysia and supervised the overall process of the research. CY completed the literature review, formulated hypotheses, short-listed appropriate measurements, recruited participants, analyzed the data, and prepared the final manuscript.

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Exploring and Bridging the Increasing Digital Divide for Cambodian Educational System

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Abstract
The usage of information technology (IT) has changed the process of learning and teaching in the last few years significantly. This trend has been boosted by the COVID-19 pandemic. Students not having the needed IT equipment, IT skills or online connections are facing issues in this process: A digital divide in education. This research aims to explore this digital divide for high school students in Cambodia and to highlight ways to bridge the gap. Therefore, it generated primary data using a case study approach. Surveys exploring different perspectives of the research area (IT availability, IT proficiency levels, online connection quality, learning efficacy, and well-being during online learning phases) are created and performed online or onsite with Cambodian high school students in different regions. The findings show, that Cambodia is facing a major digital divide in education. A majority of high school students have no access to computers, which are crucial for an effective online learning process. Smartphones are widely available but cannot offer the same quality within an online learning process. This situation is worse at government schools compared to private schools and more severe in rural areas compared to the municipality. Other findings: IT skills are in the mid-range. Online quality is varying, and results are indifferent. Many students report feeling unwell during phases of online learning.

Keywords: Digital Divide, Education, Cambodia

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Introduction

Covid-19 pandemic caused many stoppages and slowdowns in educational institutions worldwide. Most institutions were forced to close down and switched to online education from late 2019 to early 2022. This phenomenon has caused many hardships for all stakeholders involved including teachers, students and administrative staff members (Gupta and Goplani, 2020). One of the hardest countries that was affected by Covid-19 pandemic in education is Cambodia. Cambodia is one of the less developed countries in Asia and once the pandemic emerged in late 2019 and prolonged until early 2022, the whole educational systems were completely forced to transform into relying on digital infrastructure. To explore today's situation for Cambodian high school students, this research generated primary data from onsite and online surveys. The aim of this exploration is especially to contribute to academia by answering the following research questions: Do Cambodian high school students have the required hardware, internet access, and IT skills? Do they see online learning as efficient as onsite teaching? How do they feel in phases of online learning? To perform this exploration, in an initial step, the relevant existing literature on this matter is reviewed and presented. Based hereupon, the process of designing, testing and using the surveys is described. In the third step, the survey outcomes are analyzed. Following this, these findings are used to answer the research questions. In the final step, recommendations are given based on the findings.

Literature Review

Covid-19 Effects in Education

The Covid-19 pandemic has greatly affected different industries worldwide from late 2019 until 2022 (Pain, 2020). Most physical locations such as restaurants, schools and other businesses were forced to shut down and all people involved were forced to practice social distancing due to the danger of being infected with Covid-19 virus (Aday and Aday, 2020). This has been a major obstacle for most organizations that need interactions between all involved parties. One of the industries that was heavily affected by Covid-19 pandemic was the education industry. Most schools and universities worldwide were forced to close down and all of the teaching and learning activities were abruptly switched to an online mode. Initially, a large number of educational institutions were not prepared to transform all of the activities to online modes (Dhawan, 2020). Many factors such as lack of IT infrastructures, low digital literacy, and lack of reliable internet services in many areas have caused tremendous drawbacks for the shift to online learning for a number of schools and universities worldwide (Dhawan, 2020). Cambodia’s educational system is one of the countries that was drastically affected by Covid-19 pandemic. According to Sothy (2020), more than 113,000 Cambodian educational stakeholders including school personnel, students and staff members were affected. More than 3 million Cambodian students and close to 100,000 teachers from 13,482 schools were affected and forced to switch to online learning due to Covid-19 pandemic. This swift change from face-to-face schooling to online learning has caused major confusion and hardship for most involved stakeholders and especially resulted in the widening of the Digital Divide gap in Cambodia where IT infrastructure was already faced with the discrepancy between different types of school settings such as rural vs urban schools.

Digital Divide and the Importance of IT Usage in Education

Digital Divide is defined as "inequalities in access to computers and the Internet between groups of people based on one or more dimensions of social or cultural identity" (Gorski, 2005). By January 2022, there were close to 14,000,000 internet users in Cambodia which is approximately 79% internet penetration for the total Cambodian population (Datareportal, 2022) However, according to Mr. Chea Vandeth, Minister of Posts and Telecommunication, only 30% of the Cambodian have a basic level of digital literacy. This is a result of poor IT infrastructure as well as the level of digital divide that has been widespread in some of the less developed ASEAN countries such as Cambodia and Myanmar. Since the beginning of Covid-19 pandemic, the number of relevant stakeholders who were affected by the pandemic has risen greatly. Especially in the field of education where many students were forced to study from home, and many lacked the necessary IT equipment and reliable high-speed internet to fully utilize online education while they were studying from home. Thus, this research aims to gain the latest and precise data to explore the actual situation of Cambodian high school students, primary data is generated using a case study approach.

Methods

This exploration employed a mixed methods approach combining the quantitative and qualitative data collection for this research. As described in the previous sections, the availability of IT hardware, sufficient IT skills, and adequate online connections are crucial to perform efficient online learning. The lack of them is leading to a digital divide in education, as demonstrated in the literature review. Nevertheless, the actual status of such a digital divide is a matter of major national and regional differences. Moreover, differences between different groups within society occur, which in education often can be localized in differences between students attending government schools to students from private schools. Additionally, differences in the genders may occur. In any case, the timeliness leads to changing requirements and new or different issues. Following this, this new, broad and very detailed research shall contribute to this need for research.

To gain the basis for this research, this research generated primary data from a large, representative group of Khmer high school students. Following Yin (2011) the case study approach is used, as it covers "a broad variety of subjects, such as community studies, education, public health, businesses and industry, public policy and public administration and social and societal problems and controversies."

Survey Design, Testing and Performance

The primary data needed was generated in surveys with Khmer high school students. The survey was either provided online by posting links on a wide range of relevant websites (e.g. local high schools, Khmer educational websites, and social media groups focusing on Khmer education) or was promoted onsite by visits of researchers in selected Khmer high schools. In this approach, the researchers visited several schools in one urban province (here: Phnom Penh) and one rural province (here: Battambang). With prior approval by the schools, the research has been presented to the students. They were invited to voluntarily fill out the survey files. In any case, the participation was fully voluntary, and consent was given by the participants and/or their legal guardians. As minors were involved, the ethics of this research has been checked and approved by the ethics committee of the Paragon International University in Phnom Penh.

For the online and the onsite approach, the peer group of participants has been defined as follows:

- High school students (lower and upper secondary education students)
- Any nationality and any ethnic group living and being enrolled at a Cambodian high school
- Any form of high school (government, public, other)
- Any gender

The survey which has been used in the onsite and online approach has been designed to cover all perspectives of the previously described research questions in order to provide sufficient primary data to answer them. The different perspectives (e.g., IT availability, online access, IT skills, well-being) have been grouped. Additionally, statistical information has been gathered to filter and evaluate the results for different groups (e.g. urban students vs. rural students, government school students vs. private school students, and male vs. female students). In any case, all surveys were fully anonymous. No names or addresses were collected. Every answer could be skipped by choosing an option "cannot or do not want to answer." As not all researchers were native Khmer speakers, all questions have initially been designed in English language. The final version has been translated into Khmer language by native Khmer speakers experienced in research. Using this translation, a questionnaire has been built up using a professional survey tool. Before starting the field research phase, the survey has been tested by 20 defined persons of the peer group. Their feedback on functionality, language and understandability has been taken into account and was leading to minor adaptions of the final survey.

Field Phase and Received, Valid Survey Answers

A total of 1,797 survey answers were received. One-third (= 614 / 34%) of these surveys were from people outside the defined peer group. Especially the number of university students filling out the forms was unexpectedly high. These surveys have been taken out of the evaluation process.

The remaining number of 1,183 valid surveys has been the basis of the findings in this research. From these valid surveys, 330 surveys (= 28%) came from students in the urban area of the municipal Phnom Penh. 849 surveys (= 72%) came from rural areas. A local focus within the rural provinces was Battambang. From this province, 564 surveys (= 48%) were received. The background for the high number of answers from this rural province is, that it has been defined as one area in which the field research was performed onsite. As also done in parallel in the province of Phnom Penh, researchers visited different schools in the province of Battambang. Here they presented the research project and invited the students to join the survey. Details of this procedure are described in the previous section. Surveys from 18 different provinces of the total number of 25 Khmer provinces were received. 757 surveys (= 64%) came from students visiting government schools. 426 surveys (= 36%) came from private school students. 694 male students (= 59%) and 464 females (= 40%) took part in the survey. The high quantity of answers and the broad spreading over the different Khmer regions, school types and genders provides a solid basis for this research and allows strong generalizability and validity of the findings described in the following section.

	Quantity	%
Received Surveys	**1,797**	**100%**
Surveys outside the peer group	614	34%
Valid received surveys	**1,183**	**66%**

Break-down for valid surveys:

Regions	**Quantity**	**%**
Urban (Phnom Penh)	**330**	**28%**
Rural	**849**	**72%**
thereof: Rural (Battambang)	564	48%
thereof: Rural (Other)	285	24%

School Types	**Quantity**	**%**
Government School	**757**	**64%**
Private School	**426**	**36%**

Genders	**Quantity**	**%**
Female	**474**	**40%**
Male	**694**	**59%**
Other	6	1%

Table 1: Received surveys broken down on regions, school types and genders
(Source: own table based on this research)

Results

In order to describe results from empirical studies, it is necessary to determine "an appropriate sample size is vital to draw valid conclusions from research findings" (Memon et al., 2022). Defining this necessary sample size shall enable to generalize based on basis of a sample and prevent as far as possible sampling errors and biases. Generally speaking, a larger sampling size decreases such risks in empirical studies (Taherdoost, 2017). The basis for the calculation of the necessary sample size for this research is the formula from Taro Yamane (Uakarn et al., 2021). It leads to the result, that a minimum of 400 samples is needed to enable to generalize from the sample size. As this exploration has more than 1,100 valid survey answers, as demonstrated in the previous section, it can be stated that the necessary sample size is exceeded by far and therefore grants a solid basis for generalizability.

Based on the received valid survey answers, the following results highlighted in this chapter can be summarized. To explore the high quantity of received primary data, more than 200 different queries exploring different perspectives of the research have been executed. Examples of such queries were the exploration of the availability of hardware in urban areas compared to rural areas. Or government schools versus private schools. Or female students versus male students. Each of these more than 200 queries received a query number which is highlighted after the relevant finding. The results are grouped reflecting the different perspectives of the research questions.

IT Hardware Availability for Khmer High School Students

Being asked if they had access to desktop computers (or alternatively notebooks or laptops), only 34% of Khmer high school students replied positively. More than half had no access to computers at all. 14% remarked they had access at least sometimes. (query report # S001). In rural areas, this trend is even slightly stronger (query report # S036, # S063). Significant differences can be found when comparing students from government schools with students at private schools: At government schools on average, only 26% of the students had access to computers, compared to a significantly higher share of 49% at private schools (query report # S090, # S117). Unexpected is a higher availability among girls (=38%) compared to boys (=31%), (query # S144, # S171).

Making a cross-country analysis with data on the availability of computers for high school students from neighbouring countries based on Nanthakorn et al. (2022 & 2023), leads to these results: The share of students having access to computers in Myanmar (= 59%) and Thailand (= 62%) is significantly higher compared to Cambodia (= 34#; query report # S001).

Analyzing the availability of smartphones (including tablets) leads to very different results: Nearly 80% of Khmer high school students have access to smartphones. No major differences between rural and municipal students can be found (query report # S002, # S037, # S064). Again, the availability in government schools is as expected lower (= 73%) compared to private schools (= 88%), (query report # S001 # S091, # S118). No major difference between the genders could be found (query report # S145, S172).

Performing the cross-country analysis for the availability of smartphones for students in neighbouring countries based on Nanthakorn et al. (2022 & 2023), the differences are less significant compared to the availability of computers. In Myanmar (= 79%) and in Thailand (= 82%) about the same share of high school students have access to smartphones as in Cambodia (= 79%; # S002).

More than half of Khmer students needed to invest in new IT equipment: 50% in computers and 61% in smartphones (query report # S004, S005). Financial support was received mainly from the family (= 76%) and in very few cases from the school (= 3%) (query report S007). 73% of the students needed to pay for their internet access (e.g. mobile internet) themselves (query report #S006).

Internet Access for Khmer High School Students

When being asked about the internet quality at their homes, about half (= 53%) of the Cambodian students state that it is 'good'. Nearly the complete second half (= 44%) defines the internet quality as 'weak' (query report # S008). The internet in urban areas has been evaluated better (= 61%) compared to rural areas (=50%), (query report # S042, S069).

Significant is also the difference between the different school types: At government schools, 45% of the students report good internet, whereas 66% of public school students came to the same conclusion (query report # S096, S123).

Performing the cross-country analysis on the internet quality at the student’s homes in neighbouring countries based on Nanthakorn et al. (2022 & 2023), the differences are

significant, especially in Thailand. In Myanmar 60% of students evaluate the internet quality at their home as being ‘good’, which is comparable to the result in Cambodia (= 53%). Nevertheless, Thai high school students seem to have superior access to the internet at home (= 83%).

The evaluation of the internet quality in schools was leading to even weaker evaluations: Only 28% of the students saw the quality here as 'good' and a majority of 57% as 'weak' (query report # S009). This conclusion was made both for government schools (= 29%) and public schools (=28%) without major differences (query report # S097, S124).

In a cross-country analysis, the corresponding information is found in the neighboring countries. Nevertheless, also here the results are more positive. 52% of the high school students in Myanmar and 40% of the students in Thailand are rating the internet quality in their schools as being ‘good’ (Nanthakorn et al., 2022 & 2023). In Cambodia, only 28% of the students come to the same conclusion (query report # S009).

IT Skills of Khmer High School Students

The Cambodian high school students were asked to self-estimate their IT skills. A Likert scale from 1 (= very low IT skills) to 5 (= very good IT skills) was provided. In two separate steps the students were initially asked about their skill levels in the usage of computers (including notebooks and laptops) and secondly asked about their skill levels in the usage of smartphones (including tablets).

For IT skills in the usage of computers, Cambodian high school students self-estimate themselves in a mid-field of 2,68 on a Likert scale (query report # S198). Skills in urban areas (= 2,99) are higher compared to rural areas (= 2,56), (query report # S199, S201). Results from government schools (= 2,47) are lower compared to public schools (= 3,05) (query report # S203, S205). Male students (= 2,89) self-estimate their skills higher compared to female students (= 2,52), (query report # S207, S209).

Being asked about their skills in the usage of smartphones and mobile devices the results are strongly differing: The overall skill level is evaluated as being much higher (= 3,56 on a Likert scale) (query report # S211). This is corresponding with the previously described higher access to smartphones compared to the availability of computers. The general trends are nevertheless comparable to the skill levels in the usage of computers: Skills are higher in the city (= 3,79) than in rural areas (= 3,48). Also, private schools (= 3,95) are superior to government schools (= 3,33) and boys (= 3,72) are evaluating their skills higher than in comparison girls (= 3,45), (query report # S200, S202, S204, S206, S208, S210).

Performing the cross-country analysis on the IT skills of high school students in neighbouring countries based on Nanthakorn et al. (2022 & 2023), the results are slightly better compared to Cambodia (= 2,68 on the Likert scale): High school students in Myanmar rate their skills with 3,3 on a Likert scale and Thai students even with 3,5 using the same scale.

When being asked, where the students received support when facing IT issues, the most important source of assistance was their family. 47% were able to receive support from their families if needed. 44% found support on the internet and 33% were able to receive assistance from their teacher (query report # S012, S013, S014). Taking these numbers into

account, it has to be assumed that a major group of students (> 50%) did not find any form of support when facing IT issues.

Online Learning Efficacy of Khmer High School Students

When being asked, if they have learned better before the COVID-19 pandemic, 46% of the students confirmed. Nevertheless, nearly the same amount of students (= 47%) disagreed (query report # S018). The share of students supporting this statement was significantly higher in Phnom Penh (= 52%) compared to students from rural provinces (= 43%) (query report # S050, S077). More public-school students (= 53%) agreed compared to government school students (= 41%). More boys (= 49%) confirmed than girls (= 44%), (query reports # S104, S131, S158, S185).

Performing the cross-country analysis on the online learning efficacy of high school students in neighbouring countries based on Nanthakorn et al. (2022 & 2023), the results are similar. Less Thai students (= 41%) and slightly more students from Myanmar (= 55%) come to the conclusion to have learned better before the COVID-19 pandemic compared to Khmer students (= 46%).

At the same time, most students were rather critical of the advantages of learning onsite. When being asked if they think they learned better being physically in the classroom, only 35% confirmed and 58% disagreed (query report # S019).

In an exploration, teachers stated, that the participation of students in class decreased significantly in online classes compared to onsite classes. Often students were described as 'fully passive' and 'unreachable' during online classes (Nanthakorn et al., 2022 & 2023). When asked about this, the Khmer high school students came to a very indifferent evaluation: 43% of the students stated that they participated more in onsite classes. Nearly the same quantity of students (= 49%) disagree with this statement (query # S020).

Well-Being of Khmer High School Students When Performing Online Learning

Besides exploring technical perspectives of online learning, this research also aimed to explore the well-being of Cambodian students when learning online.

About one-third (= 35%) of Cambodian high school students stated, that they felt depressed during the time they needed to learn online due to the COVID-19 pandemic (query report # S021). This feeling of being depressed was more reported in rural areas (= 38% compared to 30% in the city). No significant difference could be found when comparing government school students (= 36%) with private school students (= 34%) and when comparing boys (= 34%) with girls (= 36%), (query reports # SS053, S080, S107, S134, S161, S188).

Moreover, many students reported feeling lonely (= 43%), under pressure (= 40%), or helpless (= 30%). 11% of Cambodian high school students stated that they needed to consult a doctor in this phase due to not feeling well (query report # S022, S023, S024, S025).

Performing the cross-country analysis on the well-being of high school students in neighbouring countries based on Nanthakorn et al. (2022 & 2023), the data comes to similar results: Thai students (= 29%) tended to report less to be depressed in phases of online learning during the COVID-19 pandemic compared to Cambodian students (= 35%). The

numbers in Myanmar (= 40%) are significantly higher, but other external circumstances (e.g. the civil war at the same time) might have led to this result.

In open questions, Khmer high school students received the opportunity to express their thoughts about online teaching. Many students reported issues in connection with this new form of learning and about financial problems in their families.

> "There were many challenges during the Covid-19 pandemic. For example, students couldn't keep up with their learning: The schools were closed down. Moreover, we were facing financial issues within the family. We lost the income from tourism and did not have enough income to support our family."
> (Female high school student, unknown age, Siem Reap, survey number #63204945)

> "The worst thing about Covid-19 was that the schools all over the country were closed. Everyone had to move to online learning, which was really difficult for some students."
> (Female high school student, unknown age, Phnom Penh, survey number #63243746)

Nevertheless, many students also reported that their relationships with their relatives and siblings in this phase of difficulties got closer and more intense.

> "It had a bad impact on the distance between me and my friends, but it had a good impact on my family. We spend more time together at home."
> (Female high school student, 16 years old, Battambang, survey number #62656769)

When being asked, where they received support when they were not feeling well, most Cambodian high school students mentioned their family including siblings (= 56%), their friends (= 54%), their teachers (= 51%) and the internet including social media groups (= 32%) (query reports # S026, S027, S028, S029).

Discussion

Using the findings described in the previous sections, the research questions can be answered in the following way:

Research Question	Conclusion
RQ 1: **Do Cambodian high school students have the required hardware, internet access, and IT skills?**	Hardware availability In a majority of cases, Cambodian high school students **do not have the required ideal hardware for online learning.** Two third did not have access to computers. At the same time, a high number of Cambodian students have access to smartphones. Nevertheless, smartphones are inferior in the online learning process due to their small screens, limitations in the usage of certain software and the emission of blue light. This situation is worse at government schools and in rural areas. Internet access **The findings are indifferent.** Half of the students had sufficient internet access. The other half did not. Also here, government school students and students in rural areas are facing more issues. IT Skills **IT skills in using computers are only in the mid-range for Cambodian students.** Smartphone skills are superior. Nevertheless, as stated before, in the process of online learning the usage of computers is preferable. Moreover, in many cases, there seems to be a lack of sufficient sources of technical support for Cambodian high school students in situations facing IT issues.
RQ 2: **Do Cambodian high school students see online learning as efficient as onsite teaching?**	**The findings are indifferent.** Half of the students state that they learned better before the COVID-19 pandemic. The second half disagreed. Half of the students remarked that they participate stronger in onsite classes. The second half disagrees.
RQ 3: **How did Cambodian high school students feel in phases of online learning?**	**Many students felt unwell during the phase of online learning.** A high number of Cambodian high school students mentioned emotional issues. One-third reported feeling depressed. An even higher share of students felt lonely or under pressure. About every 10th student mentioned that he/she needed professional medical support due to not feeling well in this phase.

Concluding it can be said that the performed survey delivered sufficient primary data to answer the research questions, as stated above. In cases in which findings were indifferent, more detailed research may be needed to be performed in the future. Based on these findings, the recommendations described in the following section can be made.

Recommendations and Outlook

Based on the findings and conclusion described in the previous sections, the following recommendations are provided:

Recommendation 1:
The Cambodian government, local schools, NGOs and private initiatives should raise programs to increase access to computers. This can be done with financial support programs, scholarships, sharing strategies and re-using initiatives.

Recommendation 2:
Governmental and private initiatives should be raised to improve the internet access, especially in rural areas. Moreover, internet access in all school forms should be a matter of improvement programs.

Recommendation 3:
IT skills should be increased, especially in the usage of computers. The subject 'Information Technology" could be a part of the school's curriculum at an early stage.

Recommendation 4:
The emotions of students should be analyzed and monitored closely. Schooling for students and teaching staff should be performed to realize mental issues at an early point and to react in an appropriate way.

For access to the internet and for learning efficacy the survey data was leading to indifferent results. Here, additional research is needed to provide additional data. Moreover, the topic is a matter of ongoing changes within IT and within the performed teaching forms and requirements. Therefore, regular repetition of gaining new primary data is suggested.

Conclusion

This research aimed to explore the digital divide in the Cambodian educational system. To answer the research questions, primary data from Cambodian students has been collected in a widespread field research approach. Based hereupon, major issues resulting specifically from a lack of adequate IT hardware were identified. Recommendations to bridge the digital divide in the Cambodian educational system were provided and the need for additional research was defined.

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The Significance of Lifelong Learning Against the Spread of Ignorance

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Abstract
Agnotology indicates that ignorance does not only consist of unknown or inaccessible information but also of stored or suppressed information. While the coexistence of ignorance and science might be quite interesting, examining the cases involving ignorance can answer the questions of why and how ignorance exists. This study, it is aimed to explain the formation and expression of knowledge and the meaning of these expressions within the scope of agnotology and the relationship between these concepts and lifelong learning. Based on this, it was aimed to identify the present themes by reviewing the current literature published on ignorance, the subject of agnotology. Accordingly, document analysis, which is one of the qualitative research designs, was conducted through scientific studies, and local and international news sources, and themes of science, politics, health, and media were determined. These themes were addressed in the context of lifelong learning, and the potentially positive role of skills such as learning to learn and information literacy in preventing the occurrence and spread of ignorance was discussed. Consequently, regarding the nature, accessibility, and sustainability of information, these skills are considered to have an important role as a precaution in that they raise awareness of agnotological phenomena and as a correction tool since they evaluate the existing agnotological phenomena.

Keywords: Agnotology, Lifelong Learning, Learning to Learn, Information Literacy

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Introduction

'What people know' is an important matter that is frequently scrutinized in the society; however, 'what they do not know' and 'why they do not know' are also equally important. It is noteworthy that little is known about ignorance, whereas knowledge is well known. 'Agnotology', which is an analytical perspective on the production of deliberate ignorance, draws attention to the relevant issue. The main purpose of agnotology, of which etymological origin is the Greek word 'agnosis' that means 'not to know' (Slater, 2019), is to develop tools in order to understand how various forms of information have not reached the present day, or how they have been lost or detained in the process (Proctor, 2008). In other words, agnotology focuses on available but invisible information, and on the reasons why this information is not seen.

Agnotology is a term used by the historians Proctor and Shiebinger (2008) to review the problems related to ignorance. Agnotology investigates the use, maintenance, experience, and creation of ignorance (Proctor, 2008). Ignorance has many anti-science forms, which are its alternative concepts such as hiding information, stupidity, recklessness, censorship, misinformation, belief, and forgetfulness. Agnotology analyzes these forms as the science of ignorance and produces various cause-effect relationships to understand why ignorance occurs, is created or made insurmountable (Brookes, 1980; Buckland, 2012).

Despite the view that information cannot be examined objectively since it can also be shaped by human opinion (Buckland, 1991), the facts include much more than just apparent truth. Knowledge has various aspects, many of which are obvious, but when it comes to ignorance, several factors play a deflecting role on information (Dossey, 2014). Therefore, it is important to reach information and distinguish the true one. Considering the concepts of knowledge and learning, it is necessary to mention the importance and role of lifelong learning on people and society. Lifelong learning skills are one of the greatest obstacles to ignorance in that they contribute both to personal development, and to information access and learning.

This study seeks answers to the following questions:

- Are agnotological processes a factor in preventing true information and spreading misinformation?
- If agnotological processes constitute a factor in preventing true information and spreading misinformation, what is the role and importance of lifelong learning as a solution?

Agnotology

Agnotology is a concept introduced by Robert Proctor, a science historian, and Iain Boal, a linguist, in order to study ignorance and its cultural production (Bedford, 2010). It was first developed by Robert Proctor in 1995 to investigate the way that some companies deliberately generated misinformation (e.g. about tobacco, asbestos, drugs, etc.), (Warnier, 2013). Especially Proctor's research on the tobacco industry clarified how companies achieved great commercial success despite the overwhelming scientific evidence regarding the harms of smoking since the 1950s. The relevant research results revealed that the truth about the negative effects of smoking on health, including cancer, was withheld, and a campaign was launched to deliberately spread doubt and confusion about this issue (Proctor, 1995), and it

also exposed the social nature of ignorance. Therefore, it was concluded that ignorance was not just ‘not yet known information’ or ‘lack of knowledge’.

Agnotology can be referred to as a widely designed study of ignorance. Stating that ‘the point is to question the nature, causes, and range of ignorance’, Proctor (2008) specifies that agnotology addresses ignorance as a social construct rather than a natural gap. According to Proctor, ignorance occurs as a result of both cultural and political struggles as well as lack of information.

Information science focuses on the problem that human-generated information reaches people (Belkin & Robertson, 1973). Analyzing the non-communicable information and the decrease in information communication is an integral part of advancement in information science. Agnotology should be considered as the sibling of information science. If information science is a discipline interested in the forces that control the flow of information (Buckland, 1991), then agnotology is the other side of the same coin; they are similar and associated, but not the same.

Research Method

Qualitative research is a research method in which qualitative data collection techniques are utilized, and the data are presented in their natural environment in a realistic and holistic way (Yıldırım & Şimşek, 2016). Document analysis, one of the qualitative research designs, was used in this study. Document analysis includes the analysis of written materials on the research subject. In studies where document analysis is used, data can be obtained without the need for observation or interview (Yıldırım & Şimşek, 2016).

Data Collection

The scientific resources used in the research were accessed through databases and indices such as ProQuest Thesis Database, YÖK Thesis Database, Scopus, Taylor & Francis, ERIC, Science Direct, and Dergipark. Besides, local and international news and social media resources were accessed using the search engines.

Data Analysis

The content analysis technique was used to evaluate the data obtained in this study. Relationships between concepts and themes were established through inductive analysis. The relationship of the concept of agnotology with the themes of science, politics, health and media was explained. In addition, situations pointed out by agnotology were discussed in the context of lifelong learning skills.

Agnotological Processes as a Factor in Preventing True Information and Spreading Misinformation

Agnotology stands out in many areas of life including science, politics, health and media.

Agnotology and Science

Buckland (1991) divides information, which is the basis of science, into three categories as ‘information as process’, ‘information as knowledge’ and ‘information as thing’. Information

as knowledge can be described as a message perceived within information as process. A main feature of information as knowledge is that it is intangible and cannot be measured directly, so it becomes a subjective concept based on beliefs and personal opinions. Knowledge that reduces uncertainty by contributing to science can also increase uncertainty by occurring in various forms due to its subjective nature. Physician John Archibalt Wheeler (1994) compares knowledge to an island, and ignorance to the sea, and refers to their connection by stating: *'As our island of knowledge grows, so does the shore of our ignorance'*. Ignorance is inevitable and will always be with man since science will always remain as an incomplete endeavor by nature.

One agnotological case in science emerged as a result of some hidden misinformation and caused many people's death. The event took place about a century ago when glow-in-the-dark watches became highly popular. The watches, which were painted inside, were at a premium in the USA since they shined even without the need for recharge by sunlight. One factory manufacturing such watches came into operation in New Jersey in 1916 and recruited seventy young female employees (Prisco, 2017). These women were requested to paint the watches by sharpening their brushes with their mouths to 'get higher efficiency'. The glow-in-the-dark paint consisted of radioactive radium salts mixed with a zinc compound. Today, it is acknowledged that radium causes bone and skin deterioration and cancer; however, it was used in many areas including watches and even medicine claimed to be good for cancer from the early 1900s to the 1940s (Grady, 1998). Women working at the watch factory with radium in New Jersey began to get sick within a few years, and the first death was reported in 1922 (Prisco, 2017). Research revealed that the cause of the diseases and deaths was radium, and the women who used to work there were called 'Radium Girls' as a result of the lawsuits filed against the factory (Grady, 1998). Using inappropriate materials under improper conditions in manufacture, and hiding the harmful effects of radium caused the death of many people.

Agnotology and Politics

Agnotology, as a field of study, presents political and institutional structures and their powerful roles in communicating messages designed to cast doubts (Proctor, 1995; Proctor, 2008). Agnotology emphasizes the social structure of ignorance and attempts to show the hidden nature of culturally adapted ignorance. Political oppositions and corporations target especially hesitant subgroups by giving misinformation to the society, namely through manipulation, and through propaganda in the construction of messages to change the political and economic agendas (Rose & Baertoli, 2019). It can thus be stated that the main purpose of cultural ignorance is to create scientific confusion and mistrust at a sufficient level to cause denial of the present facts.

Citizens may listen to the source conveying information to them quickly; however, this source may not be giving true information. This situation is as a result of utilitarian politics, and a regime formation that leads people into ignorance is observed (Paul & Haddad, 2019). The existence and prevalence of ignorance is acknowledged in politics, but mostly a limited concept of ignorance is depended on. By being assigned a negative and neutral role, ignorance is perceived only as deliberate manipulation and malicious lies (Paul & Haddad, 2019). Even though ignorance is about deliberate lies, it is also directly associated with unknown or hidden information. Politicians tend to leave forgotten or hidden information in the blind spot. When criticizing the available information, at least it should be discussed

whether the information left in the blind spot is 'suppressed information' or not (Perl, Howlett, & Ramesh, 2018).

Agnotology and Health

The H1N1 swine flu outbreak of 2009, though initially causing panic, revealed flaws in health response. Emerging in California and Texas, major pharmaceutical companies swiftly produced a vaccine, but its limited impact led to surplus stock (CNN, 2010; NTV, 2009). Controversy arose as some claimed collusion between scientists and drug makers. This precedent affected attitudes toward vaccines (CNN Turk, 2010; Cumhuriyet, 2010). COVID-19 further showcased the link between anti-vaccine sentiment and weakened healthcare systems (Engin & Vezzoni, 2020). It is known that individuals use social media to access information, and vaccine-related content fuels the relevant distrust (Jennings, Stoker, Bunting, Valgarðsson, Gaskell, Devine, McKay, & Mills, 2021). Consequently, it can be stated that the past attitude of the World Health Organization, which is affiliated to the United Nations and conducts international studies on public health, may be a factor to foster individuals' indecisive attitude and opposition to vaccines today.

Agnotology and Media

Ever-evolving technology may lead to an increase in ignorance. Societies can be driven into ignorance even though information is easily accessible (Smithson, 1985). Media analysts Sut Jhally, Justin Lewis and Michael Morgan (1991) published a report when they realized the extent to which people were misinformed about the Gulf War via television. In this report, they stated that the USA citizens did not know the main facts about the political situation in Middle East and the policy adopted by the USA, and that the extraordinary support for the war was built upon false or incomplete information. Television, which is a part of daily life for most people, is responsible for accessing and sharing correct information. The findings of Jhally, Lewis and Morgan indicate that news media fails in its role as an information provider.

Harford (2019) discusses fraudulent advertisements of cigarette companies in an article. Even though cigars used to be preferred over cigarettes that were once considered as low-status, cigarettes had become the most preferred tobacco product for Americans by 1923. Lucky Strike, a cigarette brand launched with the slogan 'reach for a Lucky instead of a sweet' included the statement '20, 679 physicians say 'Luckies are less irritating' in one of its campaigns, and it was not based on scientific facts.

The Role and Importance of Lifelong Learning as a Solution to Agnotological Phenomena

The potential role of lifelong learning in preventing ignorance, which is the subject of agnotology, is discussed below.

As Macmurry (1958) states, 'Going to school is a stage in the process during which we learn to live in a society'. Considering that individuals discover and develop their skills and potentials throughout their lives within the scope of lifelong learning, 21st century learners are expected to adapt to changes in this process and thus constantly renew themselves. There are various views regarding how individuals who are expected to adapt to changes in modern times develop interests and skills, and the concept of '21st century skills' can be defined from

different perspectives (Jůvová, Chudý, Neumeister, & Plischke, 2015; White, 2015; Yalçın, 2018). Essentially, these skills are related to a set of cognitive skills enabling individuals to react flexibly and quickly to difficult, unusual or critical situations that may occur in their lives (Jůvová et al., 2015). Acquiring 21st century skills can be considered as a step for individuals to reveal their potential and improve their problem solving skills.

Learning to Learn

Learning to learn is referred to as a skill due to its two basic functions, the first of which is that it is the lifelong learning skill required to survive in the individual and social context (Stefani, 2006). It includes the ability to learn and work both collaboratively and autonomously, to organize and maintain learning, to evaluate and share, to seek support where appropriate, and to effectively manage career and social interactions (European Commission, 2019). Therefore, learning to learn can be considered as a set of skills that contains working skills, critical analysis, time management, planning, goal setting, etc. (Candy, 1991).

Bateson (1987) considered learning to learn skill as a level of learning rather than a set of skills necessary to survive, and indicated four learning levels regarding the subject. Zero learning (0) refers to recognizing and memorizing information, and Learning I to learning by conditioning, namely classical conditioning. Learning II is the changes in the Learning I process. At this level, cognitive learning occurs as the information received from outside is processed. This level may involve conceptualizing, adapting and transferring learning from one situation to another. Learning III is the level where the learner comprehends the concepts in general, how they are created, and how they can be changed. Since change at this level requires active efforts of the individual, Bateson argues that changes at this level can be considered as learning to learn, and it requires the ability to question and criticize the individual's present worldviews.

Bruner (1987) supports the gradual extension or 'decentralization' of one's frame of reference in order to create meaning and understand. It justifies the necessity of personal change or transformation based on the expansion of consciousness. This view is not only related to understanding the development of an inquiring stance regarding the individual's external and internal worlds. It may also include the desire to understand the mutual interaction of these worlds. Based on these, it can be concluded that the contribution of learning to learn to personal development is an obstacle to ignorance. How learners access and evaluate information is directly related to the skill of learning to learn.

Dewey (1938) emphasizes learners shaping goals for learning, crucial in a changing world. A learning society, akin to Senge's (1993) organization, requires empowered individuals. Development involves the dialectic between self and society. Daily life's upkeep, a facet of learning, curbs agnotological issues through an expanding personal-to-societal network. It initiates lifelong personal growth, the key to a thriving learning society. Prevention of agnotological effects hinges on healthy individual learning, promising a robust learning society.

Information Literacy

Association of College and Research Libraries (2016) defines information literacy as the use of knowledge by paying attention to ethical principles in understanding how information is

produced and evaluated, and in creating new knowledge within learning groups. Information literacy is the acquisition of information on a subject or the provision of information required for problem solving (Aşkın Tekkol & Demirel, 2018), and information literate individuals are expected to be able to realize that they need information, to access information using the necessary tools, and to evaluate and use this information effectively (ACRL, 2016). Information literacy education can be used in the transformation of individuals from novice to skilled researchers, not only in their own field but also in all the knowledge that they have acquired throughout their lives. For this reason, information literacy is important as a part of lifelong educational objectives. It can be stated that a person who knows how to reach and access information will be an obstacle to the production of ignorance by making use of true information.

When it comes to information literacy, it is possible to refer to the effect of culture. Hofstede (1980) mentioned the Five Dimensions of Culture. 'Individualism and Socialism', included in these dimensions, is about whether priority is given to individual or social welfare within the organization. It can be predicted that how education is perceived in individualist and socialist societies is important in information literacy education. Hofstede (1980) noted that education in individualist societies was considered as learning to cope with new, unknown and unpredictable situations. On the other hand, in socialist societies, education was considered as adapting to the skills and virtues required for being an acceptable group member. Education in socialist societies is reserved for young people who have to learn how to do things, whereas education in individualist societies is '*about knowing how to learn something, not about how to do it*'; therefore, learning never ends (Hofstede, 1986). Learning how to learn and maintaining this learning involves the skill of learning to learn. Accordingly, it can be concluded that the skills of learning to learn and information literacy are associated. People need these skills to live in today's world. In societies, where learning is not limited to young people, and learning is constant, information is questioned. In societies where information is questioned, the main purpose is to learn how to catch fish. Therefore, it can be stated that acquiring information literacy skills supports lifelong learning, and vice versa.

Conclusion

In this study, the relationship of agnotology with various fields is mentioned, and the potential role of lifelong learning in preventing agnotological phenomena is discussed. While doing this, particularly the connection of the concepts of learning to learn and information literacy with ignorance and lifelong learning is addressed.

There are various resources in the literature that offer solutions regarding how people can get rid of ignorance. Within the context of these solution offers, it is emphasized that learning often refers to a 'learning process'. Lifelong learning is a process that continues throughout the entire life of an individual. Education systems developed for individuals, knowledge and competences to be obtained, and skills envisaged to be acquired promote holistic and transformational learning in the lifelong learning process. Communities thus achieve a sustainable change, which can prevent the construction and spread of ignorance by taking conscious decisions and accountable actions.

The lifelong learning process involves a good number of knowledge and skills, from basic to complex. These include literacy competence, multilingual competence, mathematical competence and competence in science, technology and engineering, digital competence, personal, social and learning to learn competence, citizenship competence, entrepreneurship

competence, and cultural awareness and expression competence, as well as the types of literacy related to these concepts, such as information literacy, digital literacy and mathematical literacy. These interrelated concepts contain new skills and competences in order to have a place in modern society and to be successful. For example, digital literacy, which is one of the most important prerequisites of being a digital citizen (Ribble, 2011), can be achieved through digital competence, one of the key competences that lifelong learning focuses on.

Learning to learn, one of the important concepts in lifelong learning, consists of knowing where, how and why to receive information, continuing learning, and improving cognitive and affective aspects, as well as individual and collaborative work. Learning to learn also enhances problem solving skills. For this reason, since the contribution of learning to learn to personal development can also be considered as a social achievement, it can be stated that a person who has this skill will be aware of agnotological phenomena.

Before acquiring information, individuals need to be able to realize that they require information, to reach information using the necessary tools, to evaluate and use this information effectively. This is called information literacy. One of the information literacy skills is to know how to learn information. This skill is a basis of lifelong learning. At this point, it can be indicated that information literacy skills and learning to learn skills complement each other. A person with information literacy is expected to be able to read between the lines in the acquired information. The information which is obtained should be questioned in social, political, economic and many other contexts, and true information should be acquired. Due to all these functions, information literacy is important to prevent agnotological phenomena.

News literacy, which is closely related to information literacy, refers to the development of critical thinking skills of individuals in order to judge the reliability and credibility of information conveyed in print, video or online (The Center for News Literacy, 2016). In her research conducted within the scope of her doctoral thesis, Şencan (2020) aimed to develop a Turkish training program on news literacy based on the available news literacy programs and related literature, and to evaluate its effects on information users' ability to distinguish false information from true information. As a result of the research, it was found out that receiving prior training for the processes of accessing information could raise awareness on the subject. From this viewpoint, it can be concluded that training programs should be shaped in accordance with the changing needs of information users and changing environments of information.

Consequently, agnotology investigates cases where the truth is distorted or hidden. Agnotological phenomena can be encountered in every area where people and information exist, such as science, politics, health and media. It is also observed that these phenomena have created current concepts such as post-truth entering our lives with the changes in the world. Knowing how and why agnotological phenomena occur is important to produce analytical measures and solutions in this regard. The importance of lifelong learning can be referred to at this point. Lifelong learning contributes to education through many dimensions included in the field, such as the 21st century skills, European Union Key Competences and modern literacies. Considering the nature, accessibility and sustainability of information, these dimensions are believed to have an important place as a precaution by raising awareness of agnotological phenomena, and as a correction tool by evaluating the present agnotological phenomena. In this study, the potential importance of learning to learn, which

is one of the EU Key Competences, and information literacy, which is one of the modern literacies, in information-related processes are discussed. In addition, it can be noted that the change of individuals is one of the main factors in the change of societies. Furthermore, it can be assumed that the awareness raised in individuals brings societies closer to 'true information'.

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Exploring Student Interest in Global Health as a Component of Medical English Education

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Abstract
This work looks at student interest in the concept of global health as a component of medical English education. With the rise of global pandemics and the increasing interconnectedness of the world, understanding global health has become more critical. In Japan, various aspects of global health such as public health, epidemiology, social medicine, and cross-cultural awareness are taught in different medical subjects. However, Global Health as a standalone course does not seem to be part of the medical education curriculum. The results of a Global Health lecture conducted in English for medical students at a Japanese university show that students were eager to learn more about the topic, including topics like non-communicable diseases, global health burden, social factors affecting health, and health equity, as well as how to work in international settings. This suggests the need for a Global Health course taught in English for medical students in Japan to produce well-rounded, globally competent healthcare professionals.

Keywords: Cross-Cultural Awareness, Global Health, Medical English Education

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Introduction

Several papers have contributed to our understanding of the current state of medical education in Japan (Kozu, 2006) and the efforts being made to internationalize medical education. Challenges faced by the Japanese medical education system are issues such as the overcrowded curriculum, the dominance of lecture-based teaching, and the need for greater integration of clinical and basic sciences (Teo, 2007). In the educational reforms to meet the changing healthcare needs, it's important to emphasize on competency-based education, development of communication skills, and integration of clinical training with community healthcare (Suzuki et al., 2009). The review of these papers provides insights into the current state of medical education in Japan, highlighting the need for reforms, including a shift towards competency-based education, the integration of clinical training, and a greater emphasis on communication skills. Furthermore, internationalization efforts are recognized as an important aspect of medical education, with various approaches being implemented to promote global competence among medical students. Additional papers were also found that touch on related topics, such as the importance of learning English for Japanese clinicians (Kuroda et al., 2022) and the implementation of English language education in specific medical disciplines (Hoshina et al., 2022; Rodis & Locsin, 2019). These papers contribute to the broader discussion on language proficiency and internationalization efforts in medical education.

Up until now, there has been limited academic focus on internationalization in medical education. However, with the increased significance of comprehending current internationalization efforts during the COVID-19 pandemic, there is a growing trend towards identifying effective practices in this field. The motivations that drive internationalization of medical education plays a critical role in equipping healthcare professionals with cultural competence and global awareness to meet this objective (Wu et al., 2022). There are various practices of internationalization in medical education, including approaches such as student mobility programs, collaborative research, and international curriculum development (Wu et al., 2022).

Medical education in Japan is undergoing reforms to address challenges and adapt to changing healthcare needs. The incorporation of competency-based education, enhanced communication skills, and internationalization efforts are key components of these reforms (MEXT, 2017). Further research and efforts are needed to evaluate the impact of these reforms and ensure the development of globally competent healthcare professionals in Japan. Given the ongoing transformation in medical education in Japan, with medical schools adopting new curricula to align with global standards, there is an increasing need for greater internationalization and improved practical medical English education (Jego & Amengual, 2017).

Medical English Education in Japan is an evolving field that has gained increasing attention in recent years (Kuroda et al., 2022). The integration of Medical English (ME) into the medical curriculum has become more prevalent, reflecting the recognition of the importance of English proficiency in the medical profession. The National Medical Examination (NME) has also started incorporating ME questions into the competency test, emphasizing the significance of language skills for healthcare professionals. However, despite these developments, Medical English Education (MEE) in Japan still lacks standardization, posing challenges in terms of assessment methods and learning resources. Additionally, there is a notable lack of motivation among medical students when it comes to learning English, hindering their ability to engage in lifelong learning and independent language development.

Simultaneously, Global Health has emerged as an essential subject in the context of increased globalization and the rise of global-scale pandemics and diseases (Bentley, 2021). In Japan, various aspects of global health such as public health, epidemiology, social medicine, and cross-cultural awareness are taught in different medical subjects (Sato, 2002). However, Global Health as a standalone course does not seem to be part of the medical education curriculum. There is a need for a comprehensive and standardized approach to teaching Global Health in medical education in Japan to equip future healthcare professionals with the necessary knowledge and skills to address global health challenges effectively.

This paper aims to explore the intersection of medical English education and Global Health in the context of medical education in Japan, looking at student's interest in the concept of global health as a component of medical English education. It examines the current state of MEE, highlighting the challenges and motivations surrounding language learning, and discuss the importance of incorporating Global Health as a distinct subject within the curriculum. By addressing these issues, this paper seeks to contribute to the ongoing discussions on enhancing language proficiency and global health education among medical students in Japan.

Conceptual Framework

We designed a conceptual framework to make clear the goals and purpose of this attempt. This conceptual framework you have described illustrates the relationship between Medical Education, Medical English, and Global Health. According to this framework, Medical Education is the overarching concept, encompassing both Medical English and Global Health as sub-components (Figure 1).

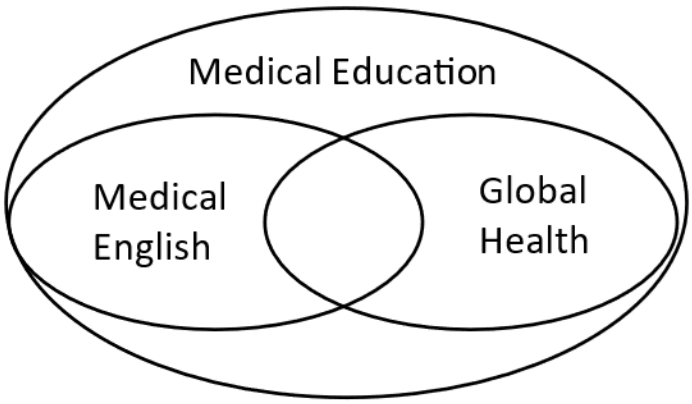

Figure 1: Conceptual Framework

Medical English refers to the specific language skills and knowledge necessary for effective communication in the medical field. It focuses on developing the language proficiency required for medical professionals to understand and communicate complex medical concepts, interact with patients, collaborate with colleagues, and engage in research and academic activities. Global Health, on the other hand, is a multidisciplinary field that addresses health issues and challenges that transcend national boundaries. It emphasizes the interconnectedness of health and healthcare systems across the globe and aims to improve health outcomes for populations worldwide. Global Health encompasses a range of topics such as epidemiology, public health, healthcare policy, infectious diseases, and social determinants of health.

The intercept between Medical English and Global Health suggests a point of intersection or overlap between these two sub-components. In this case, the intercept can be in the form of

lectures or classes conducted in English, known as English as a Medium of Instruction (EMI), specifically focused on global health topics. These lectures or classes would provide an opportunity for medical students or professionals to learn about global health issues while simultaneously enhancing their English language skills. By incorporating global health content into the Medical English curriculum, students can develop a deeper understanding of health challenges faced by diverse populations around the world. They can also explore the impact of language and cultural factors on healthcare delivery, develop cross-cultural communication skills, and broaden their perspectives on global health issues.

This conceptual framework recognizes the importance of both language proficiency and global health knowledge in medical education. By integrating Medical English and Global Health, students can acquire the necessary language skills while gaining a comprehensive understanding of global health challenges and their implications for medical practice. This approach prepares them to navigate the increasingly interconnected and multicultural healthcare environments they may encounter in their careers. It is worth noting that this conceptual framework provides a general overview and can be further expanded and adapted based on the specific context and goals of a medical education program.

Observations

According to the above framework, we expected that medical students already possess a fundamental understanding about various aspects of global health via the subjects studied during the first academic years. Expanding on the framework, it is valuable to identify specific subjects within medical education that play a crucial role in developing knowledge and skills related to global health. Some of the relevant subjects that can be enlisted include epidemiology, medical statistics, research methodology, public health, hygiene, environmental health, social health etc.

This section presents our observations during a class where we assessed the students' level in several key areas: general knowledge, terminology understanding, and motivation, as well as our insights from the feedback session. In a full class of medical students who have the English reading proficiency ranging from intermediate to advanced levels. Interactions showed that the participants had sufficient language skills to comprehend and respond to the class content.

Knowledge

The students have shown a high level of understanding of the concept of health. Two thirds of the respondents demonstrated a good understanding of what health entails. Over half of the class scored correctly on the question “Public health aims to provide the right to be healthy to whom?”. The question “How many % of people do you think have no health problems” was answered correctly by half of the classroom. These results provide insights into the participants' general knowledge related to health concepts and public health targets. While there is a considerable level of understanding regarding the definition of health, there appears to be room for improvement in accurately estimating the percentage of people without health problems and identifying the target population of public health initiatives.

We observed the familiarity of the students to the vocabulary of global health. Common terms such as public health, primary healthcare, universal health coverage, health system… are well known by the students. However, we discovered a range of vocabulary which is less

known, such as non-communicable diseases, global burden of diseases, stakeholders, global South… are less familiar among the students.

We suspected that there is an association between knowing vocabulary on global health and knowledge on public health. The results presented a significant positive correlation ($p=0.038$) between knowledge on Health and vocabulary proficiency. This indicates that participants who understand more about Health tend to know more vocabulary.

The post-lecture reflection data indicates that, on average, participants reported an overall understanding of the English content delivered in the lecture at a rate of 53%±SE18%. This finding suggests that the participants had a moderate level of comprehension of the English language used in the lectures. However, the margin of error indicates that individual understanding levels may vary. Many factors could contribute to the participants' reported understanding, including their prior English language proficiency, familiarity with the subject matter, the clarity of the lecturer's delivery, and the level of difficulty of the lecture content.

Motivation

Our observation regarding the motives of studying Medical English indicate that the goals for studying Medical English are predominantly centered around enriching knowledge, hobbies related to travel and conversation, and the ability to communicate with foreign patients in the future. These motivations received high percentages, suggesting that students recognize the value of Medical English for personal development and enhancing their communication skills within a global healthcare context. Surprisingly, motivations such as studying abroad, working abroad, or conducting research in the future received low percentages. This finding suggests that a smaller proportion of students in the study expressed explicit aspirations for international academic or professional pursuits. However, it is possible that factors such as individual interests, career plans, or personal circumstances influenced the varying motivations reported.

We found a significant positive correlation between the variables "Love to Study English" and "Familiarity of Terms" in the context of Medical English. The correlation coefficient of 0.242 ($p<0.05$) suggests a moderate positive relationship, which indicates that students who express a higher level of enjoyment or enthusiasm for studying English also tend to have a greater familiarity with medical English terms. These findings highlight the potential influence of positive attitudes towards studying English on the acquisition and retention of medical English terminology. Students who genuinely enjoy studying English may be more motivated to engage with the subject matter, invest more time and effort into their learning, and consequently, have a better grasp of medical English terms.

Interest and Needs for Further Leaning

Based on the feedback received after the session, we gained insights into the specific aspects of the content that captivated learners' attention and identified their desire to delve deeper into the subject. This feedback has provided us with a clear understanding of what resonated with the learners and the areas they expressed a keen interest in exploring further. We identify the key elements of the session that sparked curiosity and engagement. This feedback has not only affirmed the relevance and value of the session but has also highlighted the potential for further exploration and expansion of the topic.

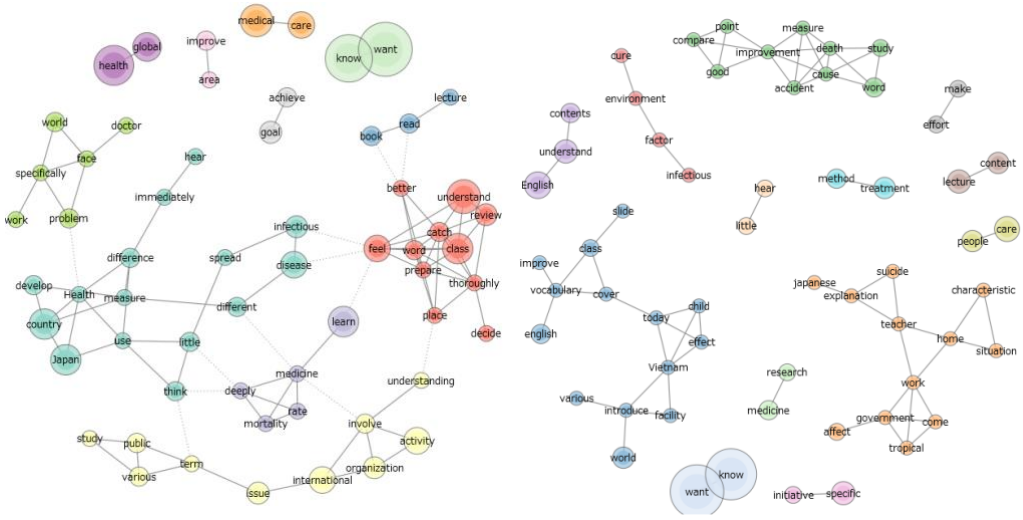

Figure 2. Co-occurrence network analysis

The co-occurrence network analysis revealed important nodes representing topics of interest:

- English Terminology: Signifies the presence and significance of English terminology in the analyzed content.
- Determinants (of health): Indicates the recognition of factors influencing health outcomes.
- Diseases, Issues: Represents discussions or references to specific diseases and associated concerns.
- Mortality: Focuses on understanding death or mortality rates within a specific context.
- Medical Care: Identifies discussions or references related to healthcare services and interventions.
- Measurement (of healthcare): Recognizes the importance of quantifying variables in the healthcare context.
- Stakeholders (of healthcare): Reflects the involvement and relevance of various healthcare stakeholders.
- Review (about healthcare): Highlights the evaluation and summary of existing literature and research in healthcare.

These results provide valuable insights into the main themes addressed in the analyzed content, particularly in the context of healthcare.

Considerations

The association between health knowledge and global health vocabulary proficiency suggests the need for further investigation into other influencing factors. Future research with larger samples or different methodologies could provide comprehensive insights into the relationship between health term familiarity and outcomes in public health quizzes. The study also highlights the opportunity to raise awareness about the value of international experiences in the medical field, inspiring students to broaden their perspectives. Additional qualitative research, such as interviews or focus groups, can explore the underlying motivations behind students' preferences for studying Medical English. Tailoring language instruction to align with students' needs and aspirations can be informed by understanding these factors. Providing information and resources on studying abroad, working abroad, and international

research can increase awareness and promote interest in pursuing global opportunities. Further research is needed to explore the connection between positive attitudes towards studying English and the acquisition of medical terminology. Incorporating teaching strategies that promote enjoyment and engagement can enhance familiarity and proficiency with medical English terms.

There is a need for ongoing efforts to improve participants' understanding of English in the lectures. To further enhance participants' understanding of English in the lectures, it may be beneficial to implement strategies such as providing lecture materials in advance, incorporating visual aids, and utilizing interactive teaching methods. These approaches can help facilitate comprehension and engagement among students with varying levels of English proficiency. Encouraging active participation and providing opportunities for students to ask questions or seek clarification during and after the lectures can contribute to a deeper understanding of the lecture content. Regular feedback and assessment of students' comprehension can also help identify areas that require further support or clarification.

To enhance understanding of specific areas, address lesser-known vocabulary through vocabulary expansion, interactive learning, additional resources, contextual examples, regular assessments, integration into the curriculum, and guest lectures/experts. These actions facilitate students' development of a stronger grasp of global health vocabulary, improving their communication skills and ability to navigate complex challenges in the field.

The findings and reflections presented in this paper shed light on the outcomes of a lecture on Global Health concepts delivered in English to medical students at a university in Japan. The aim of the lecture was to familiarize the students with the English vocabulary associated with the evolution and formation of Global Health. The results indicate that the students displayed a notable level of interest in delving deeper into various concepts, including but not limited to non-communicable diseases (NCDs), the global burden of diseases, social determinants of health, and health equity. This keen interest suggests their recognition of the importance of these topics in the field of medicine and their willingness to expand their knowledge in these areas.

Furthermore, the students' expressed need to work as professionals in international settings adds a crucial dimension to the discussion. It highlights their recognition of the increasingly interconnected nature of healthcare systems worldwide and the importance of global competence in their future careers. This need aligns with the evolving landscape of healthcare, where healthcare professionals are frequently required to collaborate with colleagues from diverse backgrounds and address health challenges that transcend national boundaries. By recognizing and embracing the significance of working in international settings, these students demonstrate their foresight and readiness to contribute to global health initiatives.

The implications of these findings are noteworthy. Firstly, it emphasizes the importance of incorporating Global Health education into medical curricula, especially with a focus on Medical English proficiency. By equipping future healthcare professionals with the necessary linguistic skills and knowledge of Global Health concepts, universities can better prepare them to address health issues on a global scale. Moreover, integrating such topics into the medical curriculum not only broadens students' understanding of health systems worldwide but also fosters cultural sensitivity and an appreciation for the social determinants of health.

To further enhance the students' learning experience, it is crucial to explore various teaching strategies and resources. Incorporating interactive discussions, case studies, and practical experiences can deepen their understanding of Global Health concepts and promote critical thinking. Additionally, incorporating real-world examples and emphasizing the practical application of these concepts can enhance students' motivation and engagement.

The future perspectives of teaching Global Health within Medical English are promising and hold significant potential for enhancing healthcare education. The results obtained from various studies indicate a clear need for the introduction of an English as a Medium of Instruction (EMI) Global Health course for medical students, aiming to cultivate globally competent healthcare workers. However, further consideration is required to identify specific areas of need and measure students' motivation towards such a course. To ensure effective integration of Medical English and Global Health topics, it is essential to revise the course content and create stronger links between the two disciplines. Additionally, developing a comprehensive question/quiz pool with diversified content will enable a more comprehensive assessment of students' knowledge and understanding. By implementing an EMI Global Health course for medical students, medical education can take a significant step forward in preparing future healthcare professionals to meet the challenges of a globalized world.

Conclusion

This paper highlights the importance of integrating Global Health education into medical curricula. The positive outcomes observed when introducing Global Health concepts in English to medical students in Japan indicate the students' interest in learning more about these topics and their recognition of the need to work in international settings. By combining Medical English and Global Health, universities can foster global competence and prepare healthcare professionals to address global health challenges. This framework can be applied beyond Japan, allowing students worldwide to acquire language skills and a comprehensive understanding of global health. It is adaptable to different contexts and goals of medical education programs.

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Third Spaces and Benefits of Designing Food Safety Curriculum for Science Classes: Using Third Space to Promote Food Safety Learning

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Abstract
Food safety is one of the most important dimensions of food. With the growing number of food-borne illnesses, it is imperative to design curricula that address this important issue and equip students with the necessary knowledge to combat food-borne illnesses. Scholars have discussed the idea of using third spaces to bridge the gap between students' primary and secondary discourses. This idea that these kinds of informal and formal discourses can be welcomed in the classroom not only builds a fertile ground for dialogue on the safety of food but also gives students agency. When it comes to issues of food, it is important to note that food is very personal and specific in nature. What is food to one person can very well be poison to the next. Food also has cultural and historic dimensions. Encouraging students to bring their cultural selves to the classroom can foster inclusivity, and achieve high retention of knowledge taught, whilst instilling lifelong behaviors that are necessary for the prevention of food-borne illnesses. In this discussion, we will describe third space and how it can be used to promote food safety learning.

Keywords: Food Safety Education, Third Space, Science Classroom, Science Curriculum

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Introduction

Food safety is one of the most important dimensions of food. With the growing number of food-borne illnesses (Nyachuba, 2010), it is imperative to design curricula that address this important issue and equip students with the necessary knowledge to combat them. Scholars such as Bhaba (1994), and Soja (1996) discussed the idea of using third spaces to bridge the gap between students' primary and secondary discourses. This idea that these kinds of informal and formal discourses can be welcomed in the classroom not only builds a fertile ground for dialogue on the safety of food but also gives students agency.

When it comes to issues of food, it is important to note that food is very personal and specific in nature. What is food to one person can very well be poison to the next. Food also has cultural and historic dimensions. Encouraging students to bring their cultural and or food selves to the classroom can foster inclusivity, and achieve high retention of knowledge taught, whilst instilling lifelong behaviors that are necessary for the prevention of food-borne illnesses.

Methods

This paper uses a literature review to examine past and present literature on third spaces and food safety in science curricula.

Literature Review

Third Spaces have been looked at in education (for example, Whitchurch, 2012; Gutiérrez, 2008; Klein, Taylor, Onore, Strom & Abrams, 2013; Potter & McDougall, 2017). Third Spaces are ‘spaces which are neither solely academic spaces nor solely creative and cultural production spaces but an open, creative and generative combination of the two’ (Comunian & Gilmore, 2015, p. 18). They have also been defined as ‘the in-between, or hybrid, spaces where the seemingly oppositional first and second spaces work together to generate new third space knowledges, Discourses, and literacy forms’ (Pane, 2013, p.79).

Third Space theory has been used in different disciplines and for various reasons (Clifton & Jordan, 2016). For example, the theory has been used by teacher education researchers as a conceptual method of perceiving the connection between practice and theory (Clifton & Jordan, 2016). There are various advantages of using third spaces. One of them is that ‘they provide an opportunity for the academic communities (staff, researchers and students) to engage with creative producers and arts knowledge and for further exchanges to happen’ (Comunian & Gilmore, 2015, p. 18). Scott and Palincsar (2013) noted that some researchers;

> Advanced the idea that educators work to develop a third space in which students' primary discourses (those used in the home, community, and informal social interactions) and students' secondary discourses (those endorsed in school and other formal institutions) intersect to form this third space, where primary and secondary discourses are Merged’. (p.6)

The same authors point out that ‘were educators to be more attentive to the creation of these third spaces in the school, greater attention would be paid to incorporating students' prior knowledge and experience, as well as current literacy practices in the school curriculum’ (p.6). In one study, researchers saw that;

> Bringing together of discourses and knowledges in third space as a productive scaffold for young people to learn the literacy practices that are framed by the Discourses and knowledges privileged in the content areas. With this scaffold, students would be able to better access and negotiate the privileged texts of upper level, content area classrooms. We also believe that explicit engagements with the texts of competing discourse communities will help youth learn to navigate multiple texts and communities successfully. (Moje, Ciechanowski, Kramer, Ellis, Carrillo & Collazo, 2004, p.44)

Third Spaces require evaluation and adjustments. According to Beck (2020), 'third-space programs require continuous reflection on evidence and outcomes as well as ongoing adjustment—a process of experimentation, data collection, and reflection in endless iterations' (p.382).

Discussion

Food safety includes practices that ensure the safety of food. This can include washing hands, separating raw foods from cooked foods, and proper storage of food. As seen above, third spaces bridge the gap between home life and the classroom. This makes food safety an ideal facilitator in this type of knowledge, particularly in science classrooms. Third spaces undo the binary that is often restricting in science classrooms. One way that science classrooms can utilize food safety in this third space is to welcome student contributions about their home or community experiences with food and its preparation.

Using third space in educational settings fosters greater retention of information for students. Combining this with food safety encourages students to bring their *food selves* to the classroom whilst encouraging creativity and learning. In the science classroom, students can conduct experiments, collect data and reflect on how the foods they consume can be kept safe. Societies tend to prefer education that helps students in their life outside of the classroom, in their future work, and life in general. When learning is not practical nor is it relevant to the context of cultures, societies suffer. In some instances, science education is blamed for incompetence of society (Yager, 2000). This makes producing a scientifically literate society of utmost importance and using food safety as a necessary vehicle to arrive at that. Understanding scientific concepts is necessary as it is a way of knowing the world (National Academies of Sciences, Engineering, and Medicine, 2016) and when this knowledge is attached to eating habits, it makes it even more relevant.

Food safety has technological, engineering, mathematical, cultural, and social components. For instance, using thermometers to measure the temperature of cooked foods to ascertain how close the food is to the danger zone (40-140 degrees Fahrenheit) is a component of food safety. Culturally, people tend to eat foods that differ in their components, whether they are fresh or dry. This means that consumers and, in this case, students should have a cultural approach to food safety or rather an approach that is relevant to the kinds of foods they consume. Using third spaces allows students to bring these different perspectives and components of food safety together and fosters an inclusive learning environment.

Designing Curricula That Accommodate Third Spaces

Using instructional design technologies (IDT), courses can be designed to accommodate both food safety and third spaces. Instructional design technology refers to the methods that

include physical and digital experiences for those that need them (University of Arizona, 2018). Instructional design, therefore, is essential in learning because when skillfully implemented, can lead to effective and efficient means to meet the learning goals established (Rowland & DiVasto, 2013). In this sense, third spaces can be used as a bridge between home life and the science classroom through the designing of science courses that afford these practices. For example, courses can be designed to use the ADDIE model (Analyze, Design, Develop, Implement, and Evaluate) that reflects STEM-appropriate measures. Using the ADDIE model (see figure 1) can benefit both students and instructors when developed as follows:

Analyze

Here, STEM courses, specifically science classes can be designed using the food and cultural contexts of the students. This includes the utilization of design-based learning that seeks to use projects as a means of teaching and learning where students are assigned a particular design challenge that can include anything of interest to them. Several scholars have argued for the necessity of incorporating life outside the classroom into science learning, as this makes the learning process more practical and meaningful. They have particularly advocated for the use of design-based Learning in the science classroom (Fortus et al., 2004; Bethke Wendell and Rogers, 2013, Chusinkunawut et al., 2021). In this case, students can design food safety devices that are appropriate to their food cultures and or desired foods. For the instructor, this provides them with the opportunity to use inclusive assessment strategies that recognize student differences.

Design

For the design aspect. This includes the selection of appropriate delivery methods. It can mean using design-based learning and or any other appropriate delivery methods that would be most appropriate for specific learners and classroom environments. This would also include the use of appropriate food safety technologies that enhance student learning and knowledge of safety practices.

Develop

The development stage is where the delivery methods are pilot tested and improved upon. Here instructors can use design-based learning where projects are used as a form of assessment and learning. Students can conduct experiments, collect data and reflect on how the foods they consume can be kept safe.

Implement

Here, instructors implement pedagogical practices that are most appropriate to the grade level and to the content being taught. For example, as a method of learning, instructors can incorporate videos, simulations, animations, and any other technologies that are appropriate and beneficial to the learning environment. Instructors can further use design-based learning to bridge the gap between school life and home life for the students by allowing students to explore their food cultures and how to keep their most consumed foods safe.

Evaluate

In the Evaluate stage, instructors can examine how well their implemented strategies work and how well the assessment methods are working.

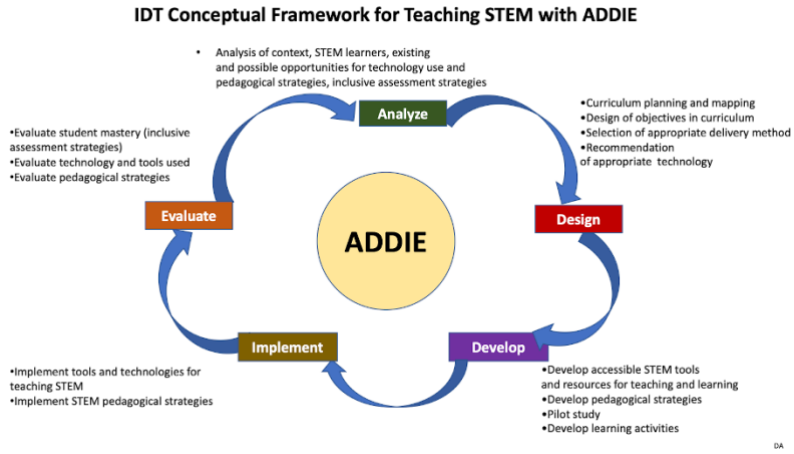

Figure 1: ADDIE, IDT Conceptual Framework

The ADDIE model is a sample IDT framework that can be used to teach food safety in conjunction with third spaces. Food safety lends itself to a discipline/field/topic that encompasses several disciplines such as science, technology, literacy, and engineering. In this manner, food safety can be the vehicle through which important scientific concepts are learned.

Since food and food safety are central to the human experience, they can be utilized as a third space topic to bridge the gap between classroom knowledge and home life. Using third spaces in conjunction with food safety encourages learners to bring their food selves to the classroom whilst encouraging creativity and learning. This can create an inclusive learning environment as students can benefit from feeling included as lessons encourage them.

Benefits of Using Third Spaces

Third spaces can aid and facilitate student learning, as they give learners a sense of ownership of the learning process (Stevenson and Deasy, 2005). Third spaces when combined with food safety, can also encourage a sense of identity along with social and cultural belonging (Fischler, 1988). This is because third spaces in conjunction with food safety allow students to explore who they are both at home and in the classroom and also in a *third space.*

Another benefit of using third spaces to teach food safety is that it makes science more accessible by allowing for connections between formal and informal discourses to be made by students. Overall, this benefits students as it helps them acquire lifelong learning behaviors whilst equipping them with methods of preventing food-borne illnesses.

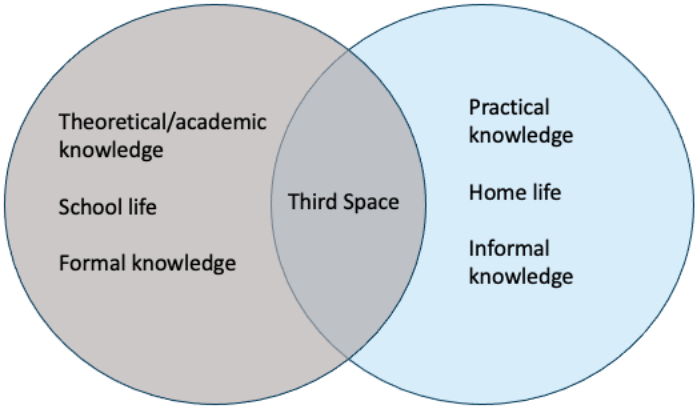

Figure 2: Conceptualizing Third Spaces

Food, Culture and the Classroom

Geographic locations have long played a role in the kinds of food that is available and consumed in different places. This is because food production is directly tied to the physical, environmental, and human ability to convert farm outputs into food products (The Geography of Food Article Selection, n.d.). These factors in turn affect the kinds of foods that are supplied to local communities and consumption patterns. This greatly shapes food preferences as some geographic locales may not have a supply of certain foods especially those that are seasonal. Science classrooms can use food preferences to teach food safety as it encourages students to bring their food selves to the classroom. Using a model like the ADDIE model above can help students experience a sense of belonging whilst encouraging healthy behaviors. This sense of belonging can be fostered by welcoming diverse food cultures in the classroom and using them to teach scientific concepts that would otherwise be abstract.

Conclusion

Creating curricula that address foodborne illnesses whilst creating an inclusive learning environment can be beneficial to students. Providing a third space by which students make connections between their lives outside the classroom and scientific concepts helps make science topics more accessible. It is imperative to have a scientifically literate society as this helps in naming and knowing the world. Food safety provides a fertile ground for using third spaces in the science classroom as it encourages students to make connections between their lives outside the classroom and the scientific concepts they are learning whilst encouraging behaviors that prevent foodborne illnesses.

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Challenges of Implementing Social Justice in University Classroom

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Abstract
The purpose of this study was to explore the challenges that university teachers face while implementing social justice in their classrooms. It also examined teachers' conceptions regarding social justice teaching. Implementation of social justice in stereotypical classrooms is a task that needs examination at both the micro and macro scales. This study pursued to find out the answer to the question: what are the challenges of university teachers while implementing social justice in their classrooms? This study investigated the perspectives of 18 university teachers from nine public sector universities in Punjab. A qualitative technique was used that included semi-structured interviews and a thematic analysis process. According to the findings, university teachers encounter numerous challenges like raising voices against institutional policies, lack of professionalism, lack of social justice knowledge, stereotypical classroom, grade-oriented mindset, and lack of uniformity in education. In the light of these findings, the study entails that university teachers need to be trained according to global demands and defined methodology embedded with their motivation to teach for social justice. The written curriculum must be linked with the social justice agenda. Teachers must play a part in improving the classroom environment for effective learning by putting social justice values into practice.

Keywords: Challenges, Identification of Challenges, Implementing Social Justice, Teaching for Social Justice, University Teachers, University Classroom

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Introduction

Higher education has a role to play in both supporting and contributing to the attainment of social justice in society. Education is the only sector that enables youth to support, promote, and contribute to a just society (Welton, 2015). Universities, in particular, have a vital role in the context of social justice because they can provide understanding to the students to face social justice challenges. Universities must support and contribute to the social justice agenda by ensuring that education programs are socially inclusive and trying to impart social justice values (Haq et al, 2020).

Teaching for social justice is a technique to promote social fairness and prepare students for real-world situations (Anderson, 2019). In other words, it is a method of teaching pupils how to speak up, and to have an inclination toward recognizing and eradicating all types of discrimination practices (Andrew, 2017). Social justice teaching entails incorporating democratic ideas through an independent approach that allows teachers to exercise fairness, as well as offering a classroom where students can speak up and passionately participate in the learning process (Dover, 2017).

Teachers must be aware of individual disparities in terms of color, class, sexual identity, gender, and ability, as well as the necessity to teach using techniques that are appropriate for students with diverse needs (Kubat, 2018). It is critical for teachers to select instructional approaches that cater to a wide range of students, from those who work hard to learn to those who are creative thinkers (Gilham &Tompkins, 2016).

Several studies (Ali, 2017; Ashraf, Hafiza, 2016; Ahsan, 2003) have been conducted in Pakistan to examine social justice education. These studies relate to policy documents, five-year plans, reforms, and programs associated with social justice education. Many guidelines have the purpose of character-building the nation from the standpoint of Islamic doctrine. An economically disadvantaged country like Pakistan has to increase equity in the educational sector in order to build a fairer society.

Review of Literature

Teaching in higher education entails teaching at colleges and universities from graduation to post-graduate levels (Riaz et al., 2017). There is no doubt that teaching at the university level entails more than just knowledge transfer, it also involves facilitating students' aspirations. Students must put those aspirations to achieve learning tasks by connecting new knowledge to previous knowledge and real-life to good use for the sake of society (Chaudhury, 2016). Teachers can assist students to combine their cultural and intellectual identities in a good way, rather than thinking of them as separate entities.

It is necessary to critically evaluate unjust treatment as it manifests in day-to-day encounters in order to improve social fairness (Al-Zubi, 2018). As educators working to achieve fairness in classrooms, they must ensure that each student understands the importance of their own experience. Equity encourages students and teachers to broaden their horizons and open their hearts to new experiences and people. It promotes discussions about privilege and bias, as well as the sharing of personal stories about inequity and identities (Anderson, 2019).

Students' participation in classroom activities can be transformed by these motives for teach (Sleeter & Zavala, 2020). Students have the opportunity to open up and share their personal

experiences with unfairness while also informing others about injustices they have seen or experienced when encouraging equity debates.

Challenges of Implementing Social Justice in University Classroom

In many ways, social justice education is entirely opposed to our society's traditional educational methods (Welton et al., 2015). In a system defined by a hierarchical structure, student voice and choice do not match well. Students, teachers, and the institution as a whole face numerous challenges when it comes to implementing social justice in the classrooms.

Challenges Related to Institutions

Traditional educational institutions are also significant hurdles to the implementation of just practices. Attempts by teachers to bring democracy to previously undemocratic locations may face challenges unless the entire institution is democratic (Dover, 2017). One such challenge is the "deep structures" of schools, which are generally held preconceptions about what schools are for and how they should operate. The traditional schools believe that knowledge exists outside and apart from human mediation and creation (Chaudhary, 2016). Building institutional structures and practices that give time to investigate the concepts of negative and positive freedom can address the valid concern (Anderson, 2017).

The traditional grading system is another institutional restriction. How grades might lead students away from establishing personal meaning and toward simply performing for the sake of achieving a goal e.g., diploma, college acceptance, scholarships, praise, lack of penalty, etc (Dover, 2017). This performance focus confuses the teacher-student communication; students tend to feel helpless in regard to the teacher and subsequently act servilely to earn high scores. Students' obsequiousness manifests itself in a failure to question or criticize the teacher in any meaningful way; in other words, students have learned that in order to succeed in the classroom, they often leave their democratic rights at the door. Grading has unknowingly concentrated many students weak and dependent. (Gorski & Dalton, 2020).

The aim of this research was to identify the social justice challenges in the university classroom. Teaching for social justice encourages students to identify prejudice, injustice, and biases. It also allows pupils to see their own preconceptions toward others, helping them to become closer to those around them. The aim of this research was to explore social justice challenges that university teachers face while implementing social justice knowledge in classrooms.

Globally, social justice is the main focus of university education to promote an equitable society. On the other hand, teaching social justice is the least focused in developing countries due to many hurdles. Teachers are the main source at the university level who provide training to future teachers but periods passed away and progress is still very slow. The challenges that stand in the way of implementing the social justice agenda need to be addressed.

Challenges Related to Teachers

Students are not the only ones that resist change; teachers are as well. Few instructors have any prior experience with social justice education, thus attempting to integrate democratic approaches in their classrooms is a significant risk (Marylin, 2020). Teachers may be afraid

of the unknown, worrying that including students' voices and choices in course administration may lead to misunderstanding. Teachers have gotten accustomed to viewing most students as lazy and uninterested, people who must be pushed into doing "what's best for them," and as a result, they are concerned that students will effort to escape issues by taking the easy way out. (Sanchz, 2021).

There are numerous examples of social justice education being used in the classroom. Many of the research looked at how various issues are presented in various educational contexts (Evans et al., 2017). Whatever the classroom's demographics, the teachers and students both bring their own histories and socially, culturally and politically built experiences in the classroom, which form the dynamic forces.

Teachers must not be reluctant to engage in meaningful debates about social issues in diverse classrooms, given the potential for racial politics to emerge. It is difficult to discuss racism and privilege, but it is essential if we want to attain equity (Chaudhary, 2016). There is less research that provides instructional resources for teaching about social justice in the classroom and even fewer studies that reveal real challenges and issues. (Flynn, 2012).

Challenges Related to Students

One of the most fundamental problems with social justice education is students who have spent most of their lives in traditional schools (Welton, 2013). Because allowing students to express themselves and make choices in the classroom goes against our society's educational norms. The majority of the students are accustomed to being told what to do and passively perform in the classroom. They are seen as safe-deposit boxes awaiting information deposits, and they may regard themselves as such. (Feris, 2012).

It might be difficult to locate concrete examples of social justice implications in university classrooms. It necessitates an analysis of systems of oppression and power, as well as a sustained focus on social change (Hui et al, 2021). Students get the knowledge to address social injustices by mastering the content and contextual information. By acquiring justice knowledge, students can begin to see how the topic is linked to larger societal challenges at the micro and macro levels (Ahsan, 2019).

Students who go from traditional schooling to democratic classes or institutions may feel unsettled or even fearful of jeopardizing their only way of life (Bengtsson & Fynbo, 2018). They may become "Siberians," who move to the periphery of society, sitting silently and disconnected from democratic processes. They may be stumped when asked to contribute to content development (e.g., explain what they are generally interested in studying or a specific topic), as many have never studied their own interests (Hui et al., 2021).

Significance of the Study

Education for social justice is transformative. It is delivering education that has the potential to transform people's values and behaviors, encouraging them to live more just lives. It can also help to stop the poverty cycle. With the help of teacher education, the successful implementation of social justice values could take place. For achieving a just agenda teachers must be responsible and accountable for educational reform and long-term development. Literature reports that teachers face challenges in implementing social justice knowledge in students (Hui et al, 2021). For achieving social justice agenda, university teachers need to

address many challenges. This study examined university teachers' challenges while implementing social justice knowledge in the classroom. The findings could help to develop a strategy how to overcome these challenges.

Research Question

1. What are the challenges university teachers face while implementing social justice in their classrooms?

Methodology

The interpretivism paradigm was used in this investigation. For this study, a qualitative research approach was applied. Qualitative research requires obtaining and analyzing non-numerical data in order to grasp concepts. The qualitative research approach encourages the kind of flexibility that is essential for a researcher who needs to be able to adjust their line of inquiry and go in new areas when new facts and knowledge become available. Its major goal is to obtain in-depth information about a situation (Bengtsson & Fynbo, 2018).

A semi-structured interview protocol was used to obtain data. The target population was university teachers working in education department of teacher education universities in Punjab. Purposive sampling was used as sampling technique (18 university teachers). The interviews were audio-taped and lasted between 15-20 minutes. The interviews were informal and open-ended, and were done in a conversational style. The data was analysed using the theme analysis technique. The goal of the thematic analysis is to uncover themes in content, as well as significant or fascinating patterns, and then apply these themes to the research study. Thematic analysis is more than just a summary of the data (Castleberry & Nolen, 2018).

Campus	Department	Faculty Members	Designation
1: Bank Road Campus, Lahore	Education	1	Lecturer
2: DG Khan Campus	Education	2	Lecturer Assistant Professor
3: Faisalabad Campus	Education	2	Assistant Professor
4: Joharabad Campus	Education	3	2 Lecturer 1 Assistant Professor
5: Lower Mall Campus, Lahore	Education	2	Lecturer Assistant Professor
6: Multan Campus	Education	3	Assistant Professor
7: Township Campus, Lahore	Education	3	Professor Associate Professor Assistant Professor
8: Vehari Campus	Education	2	Assistant Professor

Table 1: Participation demographic

Interpretation and Data Analysis

The themes were emerged during data analysis based on teachers' considerations of the challenges of teaching for social justice in their classrooms. These themes were grouped into three categories: (1) Institution related challenges; (2) Teachers related challenges; and (3) Student related challenges. The thematic analysis technique was followed to analyse the data. All of the interviews were initially transcribed. For analysis, the researcher used Braun and Clarke's steps for thematic analysis (2017).

The respondents were asked to share which challenges they face in practicing social justice. Their views regarding challenges were analyzed under three main domains set under social justice. Social justice in this study was characterized by democracy, diversity, and equity. The themes were derived under three main categories i.e., institutions, teachers, and students. These themes are discussed below:

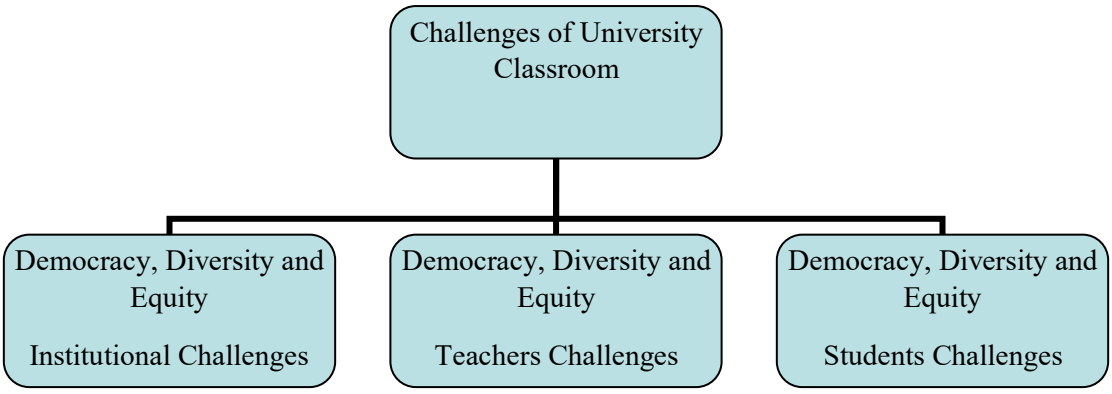

Figure 1: Interpretation and data analysis

Challenges Related to Institution

The participants' views related to institutions emerged in the below themes:

Raising Voice Against Institutional Policies

Eleven participants emphasized that there is a need to raise their voices against injustice. Some participants reported that restricted administration policies are a hurdle to employing a just agenda. The most significant statements were as follows:

Participant 9 said *"I think nothing is impossible for teachers. If they have sense of social justice, they can tackle every situation related to social justice at any time. One more thing I want to add is this please speak up against injustice because no one knows about your experience, you have to tell, I also advise my student that be aware of admin policy to take any step."*

Like other participants, p14 also highlighted that *"in my opinion, if you do not feel comfortable to ask for your right so it is fair with you to be unprivileged. The logic behind is embedded with your silence, break your silence but be careful of policies."*

P2 stated "*I feel no change so my thinking is the same since my childhood. I am sorry to say but yes it happens sometimes teachers are bound by the policies of the administration. They cannot take decisions by their selves. For example, if a teacher asks the student to raise their voice against injustice sooner or later, he will catch by the administration."*

Challenges Related to Teachers

The demographic divide between teachers and students is widening and is likely to widen further. Of course, the demographic divide is not the issue. The issue is that the majority of teacher candidates entering teacher education programs have inadequate knowledge of the democratic environment, cultural differences, and inequalities. As a result, they have little ability for working with a varied group of students and frequently encounter many challenges:

Lack of Professionalism

Like individual differences in students' teachers do have different capabilities. Many teachers commented on this challenge:

P5 stated *"Teacher's excellence in performance requires training. Teaching is a most challenging profession especially when you training future teachers. In our country there are rare opportunities for teachers to have training."*

P9 stated *"for me the actual challenge is to address the technological competencies, I have experienced that student are more aware of technology being used in classrooms besides then teachers. The Covid 19 days remind me the difficulties we as a teachers face during online sessions. I think it is not justice with students. As a teacher educator I strongly recommend that technology competencies must be part of teachers training."*

P13 mentioned *"I observed many teachers force students to memorise their materials. They want to see the handwritten photocopy (laugh) in exams. It is non-professional. Our students are unconscious of the importance of libraries in educational settings they are more competent in using cell phones."*

Lack of Interest and Motivation

A noteworthy challenge of social justice teaching is lake of interest and motivation in teachers. There are several reasons behind like fulfilment of course outline before semester, time constraints and many more. The weightiest comments were:

P3 revealed "*you wouldn't have any motivation to teach for social justice if you skipped social injustice, create a welcoming and inclusive environment for students in the classroom. We must build a culture that accepts all of them if we want to create an inclusive classroom where students care for one another."*

The p5 specified *"the primary challenge, I believe, is the requirement for a mentality shift because students also are resistant to change. I mainly run into this problem when I am trying to raise student understanding on social justice, such as when I give them tasks about to write words on justice. Students argued that this was not related to our course outline."*

P18 stated *"I don't have enough time to discussed social justice issues, with the passage of time students learn such things. It is not mandatory to elaborate it in classroom. I have to finish my course outline in given period because exams are taken from it. Rest are the only leisure time topics."*

Lack of Social Justice Knowledge

It was frequently noted during interviews that even many senior teachers are unaware of the term social justice and especially its application in classroom. After probing they understand it and reply.

Participant 7 who was a senior teacher stated "truly *I never heard about teaching for social justice and you are asking about how challenging is to address this in classroom?"*

P3 commented *"being a teacher it is our duty to bring justice in our classrooms, but to be honest social justice in classroom is new to me. I do believe that indirectly we are observing it but direct application of social justice knowledge is rare."*

P16 highlighted *"to be very honest I know the term social justice but in context of classroom I don't know how to translate it in real sense."*

Many other participants have same comments that they are not so familiar with the term teaching for social justice.

Challenges Related to Students

Many challenges related with students attributed with social justice practices:

Grade Oriented Mindset

Almost 11 participants discussed that students only involved in marks-oriented activities. It is due to our exams system which deals with high or low grades with awarded marks. The students pay attention to gain marks instead of actual learning which is mandatory for their social life. Most frequent replies are noted as:

P3 discussed *"The main goal of assessment is to assess students' performance. Our examination system is not only out-dated, but it also deficiencies the ability to properly assess student attainment. This grading system only assesses students' memory. It does not measure them in all elements of their learning. Unfortunately, our students are use to of this exercise."*

P1 stated *"many times I try to go out of box to involve students in other learning activities but they pay attention only marks related actions. I think our education system nurturing our students to take part only in marks race."*

P7 argued that *"unfortunately our university students are also playing number games, their only asset is their achieved marks, on the basis of these marks they get grads to found better jobs. So, their ambition is only achieving good marks. You get surprised that even my PhD students in course work do same exercise."*

P16 held a belief that *"I had an experience of teaching in abroad, where social justice in classroom mater a lot the reason is diversified nature of classroom. But in Pakistan students looks forward only obtain marks other then any activity. Many times, by utilising my abroad experience I try to held different activities but, students do ask "mam is k marks hain?" For this reason, I usually avoid to do novel things."*

Stereotypical Classroom

Many decades have been passed to argue about bring change in stereotype classroom but the situation is nearly same with same arguments. Almost every participant highlighted that we are following the lecturing methodology. Although they mentioned different strategies or self-efforts to bring change in typical classroom. Some of these participant views recorded as:

P3 stated *"We have the potential to show our children that the world is wider, more complex, and more beautiful than they realise, one small step at a time. There are genuine difficulties, but there are also people who choose to work together to overcome them."*

P16 commented *"our students are habitual of lecture method or you can say traditional methods. They relate every thing with exams point of view. For them scoring high marks in every subject is only criteria of success. They do not welcome the new topics or any change. Only few of them accept change."*

Discussion

The major goal of this study was to comprehend the social justice challenges in university classroom. Pakistan is a developing country, and social justice is a relatively a blur concept there. The participants in this study were the 18 university teachers. To better understand the challenges of social justice in university classroom, 18 teachers were chosen at random from the University of Educations campuses.

The debate has highlighted that social justice matters genuinely in education. According to the majority of university teachers, they are under pressure due to work load, research, and syllabus fulfilment. They stated that some modifications in the current academic setting are essential for equal teaching approaches. However, they are limited by time in this aspect. Equity pedagogy is necessary to address students' educational requirements and to relieve teachers of non-academic responsibilities (Kubat, 2018).

After gaining information via interviews, the category lack of motivation was emerged. Teachers consider less motivated to be the most important factor in keeping pupils on task and achieving their goals. Students are more content and inclusive when they have a sense of being useful. Studies undertaken by Alkis, etic, De Castella, and Dover (2015), as well as Marilyn and Abdullah (2019), back up the findings. Social justice pedagogy entails providing students with learning experiences that are equally significant and beneficial to them. This study discovered a strong link between equity pedagogy and satisfying students' needs in order to foster an inclusive institutional culture.

To describe the logical breadth of social justice challenge in higher education in Pakistan, findings from various literature have proven that educational policy does not play a significant role in fostering social justice in Pakistani education. According to a study, educational policy played an adverse role in promoting educational equity from 1947 to 2000 (Siddiqui, 2019). As a result, social roles may believe in an unequal educational environment. Nevertheless, equality policies in higher education are defined in such a way that institutions can grasp them.

Conclusion

The study concluded that practicing social justice in university classroom is difficult tasks. The topic is not only an important aspect of research, but also a significant part of policy. One positive element of higher education is that various academics have characterized equity issues from a different perspective, which was really useful in understanding this study. Furthermore, difficulties have been addressed using facts and information so that important outcomes might provide a direction for improvement.

However, this study reveals a problem with social justice in higher education, indicating that equity ensures equality in the educational system. It can be defined as scientific research that can assist in policy reform so that research gaps can be filled in Pakistan, which is confronted with numerous issues. Finally, fostering fairness in higher education is a challenging, but necessary, undertaking.

The findings stated that university teachers as such do not implement social justice pedagogy directly. It is also extracted that many university teachers were unfamiliar with the term of social justice. Additionally, they have idea of its values like democracy, diversity and equity indirectly but the direct concept of social justice in classroom was ambiguous to them. Social justice is seen as an abstract and complex topic. The main challenges were found based on exploration stated as; discrimination in society, need to raise voice, disparate competencies, fear of administration, time constraints, lack of social justice knowledge, stereotype classroom, development of cross-cultural awareness and need of more equitable education system.

In nutshell, social justice education must implement in a wide range, in both depth and breadth. Education for social justice is less focused in our universities. Governments and universities must plan and establish plans to handle the challenges mentioned above to successfully adopt social justice values. To ensure consistent social justice implementation across the universities, these challenges would be tackled at all levels.

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Knowledge, Attitude, and Perception Towards ChatGPT Among University Students and Faculty: A Preliminary Exploration

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Abstract
Launched on November 30, 2022, ChatGPT has taken the world by storm with its ability to generate human-like text in a conversational style. The reactions varied from enthusiasm about its potential to enhance learning to concerns about its threat to students' cognitive development and academic integrity. This exploratory study aims to (1) gauge the level of Knowledge, Attitude, and Perception (KAP) towards ChatGPT among university students and faculty, (2) determine if there is a significant relationship among the three KAP indexes and (3) explore the effect of some demographic characteristics on participants' KAP. To achieve this goal, we use a cross-sectional survey research design based on questionnaires distributed to 145 faculty members as well as 855 students at ESPRIT Schools of Engineering and Business. We present the statistical analysis of our data and discuss the implications of our research findings. Our study revealed that compared to students, the surveyed faculty demonstrated a higher level of knowledge, a more reserved attitude with a wide range of variations, and a more negative perception towards ChatGPT. More than 40% of surveyed respondents expressed trust in the reliability of ChatGPT responses, a perception that does not align with reality. To the best of our knowledge, this is the first reported study assessing the levels of knowledge, attitude, and perception of students and faculty towards AI-driven conversational models. The results of our research can guide towards developing effective institutional policies, strategies, and actions to leverage the opportunities and counter the threats posed by these models.

Keywords: ChatGPT, Generative Pre-trained Transformer, Knowledge, Perception, Attitude, Academic Integrity, Student Ethics, AI-Driven Conversational Model, Technology Adoption

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Introduction

On November 30th, 2022, OpenAI released a new AI-powered conversational model named ChatGPT and made it freely available to the public. ChatGPT is a Natural Language Processing (NLP) model that enables users to engage in coherent, human-like conversations that can exhibit some forms of humor, intelligence, creativity, and emotion. ChatGPT is based on a language model architecture known as the Generative Pre-trained Transformer (GPT) (OpenAI, 2023).

On March 14th, 2023, OpenAI announced the release of GPT-4. GPT-4 is a 100 trillion parameter, multimodal, large-scale conversational model that takes images and text as input to generate text output. ChatGPT has currently over 100 million users and its website generates over one billion visitors per month, making it among the most popular AI-driven conversational models (Nerdy NAV, 2023). ChatGPT can perform several tasks such as providing answers to a variety of questions, generating human-like responses, generating code, performing language translation, simulating conversations with different characters, engaging in creative writing and storytelling, synthesizing long text, expanding short sentences, paraphrasing ideas, performing sentiment analysis, acting as a recommender system, performing spell checking and language editing, and engaging in various interactive learning scenarios, among many others. Although ChatGPT can perform these tasks, it may not always generate correct, accurate or optimal results, as it is limited by the amount and the diversity of the data it has been trained on.

During the past few months, there has been a growing concern regarding the potential threats that AI-powered conversational models present to the field of higher education. Some universities have developed formal responses, comprehensive suggestions, and resources to promote the efficient, responsible, and ethical use of generative AI conversational models (Montclair, 2023), while many others are still struggling to assimilate the implications of AI-driven chatbots on teaching, learning, and assessment. Among the band-aid solutions that have been put in place to address the potential threats, we cite the implementation of third-party AI-based content detection systems and the complete ban of on-campus use of AI-driven conversational models.

This study aims to probe student and faculty Knowledge, Attitude, and Perception (KAP) towards ChatGPT. We argue that such an inquiry is crucial in proactively addressing the multifaceted aspects of this cutting-edge technology. The lack of it can potentially lead to a blurry adoption strategy as well various forms of misconceptions and stigmatization among students, faculty, and Higher Education Institutions (HEIs). To achieve this objective, we have conducted an empirically study whose main objective was to gain insights into the KAP towards ChatGPT among students and faculty so that appropriate actions could be formulated to close the gap between the potential merits of AI-powered conversational models and the institutional readiness to tap into these benefits in a responsible and ethical manner.

The remaining of this paper is organized as follows: Section 2 presents a literature review of related studies. Section 3 details our research methodology. Section 4 presents the results of our study, while section 5 discusses the main research findings. Finally, section 6 presents a summary of this contribution and its limitations.

Literature Review

Petress (2003) considers plagiarism as a virus to the educational profession that eradicates the ethic of hard work, the moral value of honesty, while degrading the role of assessment. This construction of plagiarism assumes that knowledge has a history and that past authors must be acknowledged.

Marsden, Carroll, and Neil (2005) emphasized that plagiarism hinders graduates' training and readiness for the workplace, which could harm society in various ways. Public safety, well-being, and financial decisions could be at risk due to inadequately trained graduates.

Trushell et al. (2012) attributed the increase in the number of reported plagiarism cases to technology-facilitated electronic access and the effortless process of copying and pasting text from the Internet.

Susnjak (2022) conducted several experiments to probe the potential misuse of ChatGPT as a tool for academic misconduct in online exams. The study revealed that ChatGPT demonstrated insightful critical thinking skills and generated human-like text with minimal effort, making it a potential menace to the integrity of online exams. The study highlighted the need for further research to better apprehend the implications ChatGPT on higher education and to devise strategies to mitigate its misuse for online exam cheating.

Ul Haque et al (2022) conducted an empirical study using 10,732 tweets from early ChatGPT users. They found that most of the early adopters have demonstrated overwhelmingly positive sentiments related to topics such as disruptions to software development, entertainment, and exercising creativity. Only a few users expressed concerns about misuses such as the potential role of Chat- GPT in stimulating plagiarism among students in take-home assignments and essay writing tasks.

The aim of this empirical study is to systematically investigate student and faculty knowledge, attitudes, and perception towards ChatGPT. The potential merits of such an investigation are manyfold:

- Uncover biases and misconceptions around the usage of ChatGPT among students and faculty. This might assist in promoting trust and facilitating the acceptance and adoption of ChatGPT and other AI-powered conversational models, while addressing the underlying ethical issues.
- Facilitate the development of innovative instructional approaches to integrate ChatGPT into curricula and existing pedagogical practices in a responsible way, while stimulating students' engagement and learning experience.
- Stimulate further research on the impact of AI-powered conversational models on teaching, learning and assessment.

Sample Selection

Our prospective cross-sectional empirical study was conducted over a three-month period from February to April 2023 at ESPRIT (Tunisia), which comprises two major schools, namely ESPRIT School of Engineering (ESE) and ESPRIT School of Business (ESB). The student sample was selected via a combination of stratified sampling (classification based on field of study and educational level, followed by random sampling) and convenience

sampling (due to ease of access by two co-authors) methods. The faculty sample was selected via a census sampling approach targeting the entire full-time engineering and business faculty.

Data Collection Procedure

Student surveys were conducted via paper-based questionnaires that have been distributed during class-time. Respondents were briefed about the objectives of the study and were made aware that their participation is completely voluntary and that they have the right to opt out without any consequences or negative impact on them. Students were also duly informed that all collected data is anonymous and will be treated with confidentiality.

Faculty surveys, on the other hand, were conducted online via Google forms emailed to all ESE and ESB full-time faculty members. Participants were also informed about the purpose of the study as well as the voluntary, confidential, and anonymous nature of their participation.

Instrument and Measures

The instrument employed consisted of surveys that covered three main domains: *Knowledge (K)*, *Attitude (A)*, and *Perception (P)* towards ChatGPT.

The first (*K*) domain aimed to probe student and faculty knowledge about ChatGPT. Each knowledge item response score was either 0 (false answer) or 10 (correct answer). One specific item (K1) asked responders if they have heard about ChatGPT before, while another item (K4) prompted students to indicate for what purpose they have used ChatGPT. The remaining items (K2-K3 & K5-K9 for students and K2-K10 for faculty) had a total score from 0 to 70 and from 0 to 90 for students and faculty, respectively. In both cases, the percentage of correct responses r_k was computed by dividing the score by 70 or 90 as applicable and multiplying by 100%, and this measure was used to group the knowledge scores on a 5-point Likert scale as follows: $r_k < 20 = 1$, $20 \leq r_k < 40 = 2$, $40 \leq r_k < 60 = 3$, $60 \leq r_k < 80 = 4$ and $r_k \geq 80 = 5$. Knowledge scores were interpreted as follow: 1 = very low, 2 = low, 3 = moderate, 4 = high and 5 = very high. A good knowledge was regarded when the overall average score, out of 5, and across all the items is greater than or equal to 4.

The second domain (*A*) probed student and faculty attitude towards ChatGPT and contained thirteen 5-point Likert items (A1-A13) and sixteen 5-point Likert items (A1-A16) for students and faculty, respectively. The responses ranged from strongly agree, agree, neutral, disagree, and strongly disagree; each weighting 5, 4, 3, 2, and 1, respectively. High index scores reflect more positive attitude towards ChatGPT and vice-versa. To reduce bias, we have reverse-coded some items such that a response of "strongly agree" truly represents “strongly disagree”. For these reverse-coded items, scores were also reversed and recomputed accordingly. Attitude scores were interpreted as follows: 1 = very negative, 2 = negative, 3 = indifferent, 4 = positive and 5 = very positive. A positive attitude was noted when the overall average score, out of 5, and across all the items is greater than or equal to 4.

The third domain (*P*) probed student and faculty perception towards the ethical and academic usage of ChatGPT and contained fifteen YES/NO items (P1-P15) and ten YES/NO items (P1-P10) for students and faculty, respectively. Each item asked respondents to rate their agreement or disagreement with a given statement. Some student survey items were not

related to ChatGPT but rather to personal perception towards plagiarism in general and these were not included in our perception scoring. For the case of student survey, seven items (P4, P7, P10, P12-P15) conveyed a negative perception towards ChatGPT, while five items (P5-P6, P8-P9, P11) conveyed a general positive perception. For the case of faculty survey, four items (P1, P4, P6, P8) conveyed a negative perception towards ChatGPT, while six items (P2-P3, P5, P7, P9-P10) conveyed a positive perception.

Each perception item is evaluated on a binary scale (YES=1, NO=0), except for the reverse-coded items that conveyed a negative perception where the scores are reversed and recomputed accordingly. The perception items under consideration have a total score range from 0 to 12 (student case) and from 0 to 10 (faculty case). In both cases, the positive perception rate r_p was computed by dividing the score by 12 or 10 as applicable and multiplying by 100%, and this measure was used to group the adjusted (positive) perception scores on a 5-point Likert scale as follows: $r_p < 20 = 1$, $20 \leq r_p < 40 = 2$, $40 \leq r_p < 60 = 3$, $60 \leq r_p < 80 = 4$ and $r_p \geq 80 = 5$. Perception scores were interpreted as follow: 1 = very negative, 2 = negative, 3 = indifferent, 4 = positive and 5 = very positive. A positive perception was inferred when the overall average score, out of 5, and across all the items is greater than or equal to 4.

Statistical Analysis

This study used Statistical Package for Social Sciences SPSS (IBM Corporation, NY, USA, version 17) for data analysis. Demographic data was analyzed descriptively and depicted as frequencies as well as percentages. We applied the χ square test for goodness of fit to analyze single categorical variable. We present general KAP levels descriptively in terms of means and standard deviations and we use independent t-test for KAP score comparisons based on demographic variables which we illustrate in terms of means, standard deviations, and *p* values.

Table 1: Demographic characteristics of sample student respondents (*n*=855)

Demographic variable	Frequency (*n*)	Percentage (%)	p value*
Gender			0.007
Male	475	55.6	
Female	380	44.4	
Age			
18-22	446	52.2	
23-25	336	39.3	
> 25	73	8.5	
Field of Study			0.16
Management	300	35.08	
Bachelor	180	21	
Master	120	14	
Engineering	555	64.9	
Informatics / Telecom	318	57.3	
Electro-mechanical	187	33.7	
Civil	50	9	
Year of study			0.00
1	244	28.5	
2	161	18.8	
3	207	24.2	
4	243	28.4	
Nationality			0.00
Tunisian	836	97.8	
Other	19	2.2	

** χ-square test for goodness of fit. (Significance level p <0.05)*

Faculty Demographics

One hundred and forty-five faculty members (94 from the School of Engineering school and 51 from the School of Business) participated in this study. Females constituted the majority with 70.3%, compared to 29.7% male participation. Majority of respondents (66.9%) have less than 6 years of work experience at either school and the majority of faculty participants were from the School of Engineering (64.9%). Further details are shown in Table 2.

Table 2: Demographic characteristics of sample faculty respondents (*n*=145)

Demographic variable	Frequency (*n*)	Percentage (%)	p value*
Gender			0.001
Male	43	29.7	
Female	102	70.3	
Affiliation			0.00
School of Engineering (ESE)	94	64.9	
School of Business (ESB)	51	35.1	
University rank			0.00
Lecturer	58	40	
Assistant professor	70	48.3	
Associate professor	14	9.7	
Full professor	3	2.1	
Working experience at ESPRIT			0.041
< 3 years	53	36.6	
3-5 years	44	30.3	
6- 10 years	29	20	
> 10 years	19	13.1	

* *χ-square test for goodness of fit. (Significance level p <0.05)*

Reliability of Students' KAP

Internal consistency reliability (Cronbach's α) for overall and each domain in student KAP emerged as high (0.711–0.860) whereby: Knowledge (Cronbach's α = 0.860), Attitude (Cronbach's α = 0.715), Perception (Cronbach's α = 0.711) and total KAP (Cronbach's α = 0.742). All areas have a Cronbach's α > 0.7. Refer to Table 3 for further details.

Reliability of Faculty's KAP

Internal consistency reliability (Cronbach's α) for overall and each domain in faculty KAP was relatively high (0.701–0.715) whereby: Knowledge (Cronbach's α = 0.715), Attitude (Cronbach's α = 0.701), Perception (Cronbach's α = 0.713), and total KAP (Cronbach's α = 0.710). Refer to Table 4 for further details.

Validity of Students' KAP

Principal Component Factor (PCF) analysis was performed to provide evidence on the construct validity of the student KAP instrument. Refer to Table 3 for details. As may be seen, most of the items loaded highly as expected ($r > 0.4$), except for items K7, A1, A2, A7, P7, and P10. In addition, evidence of convergent validity was demonstrated whereby the correlation between subscales Knowledge, Attitude, and Perception with the total KAP score was relatively high and significant ($r > 0.5$ & $p < 0.05$).

Validity of Faculty's KAP

Similarly, PCF analysis was conducted to provide evidence on the construct validity of faculty KAP instrument. Refer to Table 4 for details. As may be seen, all the items loaded highly as expected ($r > 0.4$), except for item K9. In addition, evidence of convergent validity was demonstrated whereby the correlation between subscales Knowledge, Attitude, and Perception with the total KAP score was relatively high and significant ($r > 0.5$ & $p < 0.05$).

General KAP Levels

The student general KAP level was in the moderate category (mean = 3.1 ±0.61). Among the three KAP domains, Perception (mean = 3.6 ±0.65) emerged with the highest mean, followed by Attitude (mean = 3.2 ±0.64) and lastly Knowledge (mean = 2.4 ±0.6). Based on the mean scores, the sample of student population demonstrated moderate positive attitude and perception towards ChatGPT and a level of knowledge that is below average. Refer to Table 5 for further details.

The faculty general KAP level was in the moderate to neutral category (mean = 3.0 ±1.05). Among the three KAP domains, Knowledge (mean = 3.6 ±0.93) emerged with the highest mean, followed by Attitude (mean = 3.0, ±1.33), and lastly Perception (mean = 2.8 ±0.96). Refer to Table 6 for further details. We also note that faculty members had varied opinions around the KAP as reflected by the dispersion of the responses around the mean. This is particularly noticeable for the attitude.

Table 3: Internal consistency reliability and validity of students' KAP

KAP index	**Reliability* (Cronbach's α)**	**Validity****	
		Construct (Rotated component matrix)	**Convergent (Correlation with total KAP)**
Knowledge	**0.860**	0.564 (Item K2) 0.512 (Item K3) 0.502 (Item K5) 0.546 (Item K6) **0.381** (Item K7) 0.772 (Item K8) 0.493 (Item K9)	0.652
Attitude	**0.715**	**0.271** (Item A1) **0.330** (Item A2) 0.975 (Item A3) 0.452(Item A4) 0.452 (Item A5) 0.529 (Item A6) **0.330** (Item A7) 0.524(Item A8) 0.589(Item A9) 0.526(Item A10) 0.479(Item A11) 0.772(Item A12) 0.493 (Item A13)	0.652
Perception	**0.711**	0.681(Item P4) 0.736(Item P5) 0.671(Item P6) **0.285**(Item P7) 0.417(Item P8) 0.677(Item P9) **0.315**(Item P10) 0.594(Item P11) 0.648(Item P12) 0.630(Item P13) 0.609(Item P14) 0.548(Item P15)	0.520
Total KAP	**0.742**	-	-

* For Reliability, Cronbach's α >0.70

** For validity, values quoted with p< 0.05

Table 4: Internal consistency reliability and validity of the faculty's KAP

KAP index	Reliability (Cronbach's α)	Validity	
		Construct (Rotated component matrix)	Convergent (Correlation with total KAP)
Knowledge	**0.715**	0.716 (Item K2) 0.741 (Item K3) 0.610 (Item K4) 0.522 (Item K5) 0.521 (Item K6) 0.490 (Item K7) 0.599 (Item K8) **0.390** (Item K9) 0.727 (Item K10)	**0.735**
Attitude	**0.701**	0.719 (Item A1) 0.621(Item A2) 0.526 (Item A3) 0.540 (Item A4) 0.549 (Item A5) 0.626 (Item A6) 0.625 (Item A7) 0.663 (Item A8) 0.643 (Item A9) 0.592 (Item A10) 0.608 (Item A11) 0.607(Item A12) 0.574 (Item 13) 0.688 (Item A14) 0.654(Item A15) 0.634 (Item A16)	**0.696**
Perception	**0.713**	0.664 (Item P1) 0.722 (Item P2) 0.601 (Item P3) 0.560 (Item P4) 0.522 (Item P5) 0.640 (Item P6) 0.694 (Item P7) 0.467 (Item P8) 0.594 (Item P9) 0.461 (Item P10)	**0.705**
Total KAP	**0.710**	-	-

* For Reliability, Cronbach's α >0.7

** For validity, values quoted with p< 0.05

Table 5: Overall faculty's Knowledge, Attitude, Perception, and total KAP level (1-5)

Domain	Mean	Standard deviation	Median (Inter quantile range)	Interpretation
Knowledge	2.4	0.600	2	Low to moderate
Attitude	3.2	0.643	3	Moderately positive
Perception	3.6	0.650	4	Moderately positive
Total KAP	3.1	0.615	2.8	Moderately positive

Table 6: Overall students' Knowledge, Attitude, Perception and total KAP level (1-5)

Domain	Mean	Standard deviation	Median (Inter quantile range)	Interpretation
Knowledge	3.6	0.931	4	Moderate
Attitude	3	1.332	2.8	Moderate to neutral
Perception	2.8	0.960	3	Low to moderate
Total KAP	3	1.054	3	Moderate to neutral

Knowledge

The knowledge level of the students' sample was low to moderate (mean = 2.4 ±0.6). 42.5% of sampled students did not recognize that the failure of ChatGPT to provide correct responses is among its main limitations (*K8*), while 61.4% did not recognize that a key strength behind ChatGPT resides in its extensive "training" on a substantial volume of textual data (*K9*). Refer to Table 7 and Figure 1 for more details.

The knowledge level of the faculty sample regarding ChatGPT was moderate (mean = 3.6 ±0.93). When asked if ChatGPT can help in the automatic grading of assignments, 46.9% answered "No". Among all faculty respondents 42.5% did not recognize that the failure of ChatGPT to provide correct responses is among its main limitations (*K8*), while 46.9% did not recognize that a key strength behind ChatGPT resides in its extensive "training" on a substantial volume of textual data (*K7*). Refer to Table 8 and Figure 2 for more details.

Table 7: Students' knowledge regarding ChatGPT (*n*=855)

Question	% of correct answers
K2- What is ChatGPT?	38.6
K3- Have you used ChatGPT before?	88.9
K5- Who is the developer of ChatGPT?	89.7
K6- Can ChatGPT write computer programs?	89.7
K7- Can ChatGPT write poetry or song lyrics?	84.2
K8- What is the MAIN limitation of ChatGPT?	57.5
K9- What is the key strength behind ChatGPT?	38.6

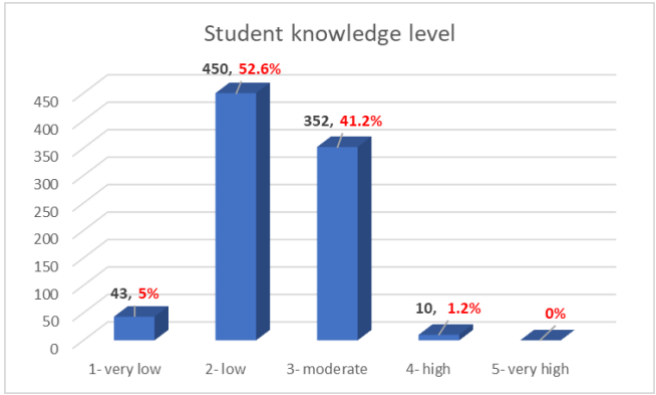

Figure 1: Distribution of students' knowledge scores (*n=855*)

Table 8: Faculty's knowledge regarding ChatGPT (*n*=145)

Question	**% of correct answers**
K2- What is ChatGPT?	62.1
K3- Have you used ChatGPT before?	91.7
K4- When was ChatGPT released?	60.7
K5- Who is the developer of ChatGPT?	89.7
K6- What is the MAIN limitation of ChatGPT?	51
K7- What is the key strength behind ChatGPT?	53.1
K8. ChatGPT can be used to create content including quizzes, and exam questions	77.9
K9. I am familiar with plagiarism detection tools for ChatGPT-generated content	77.9
K10- ChatGPT can help me in the automatic grading of assignments.	46.9

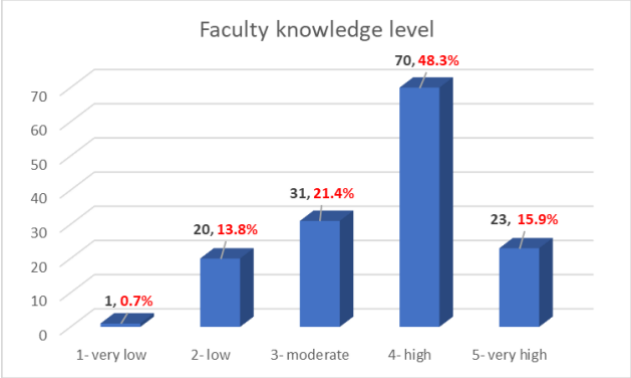

Figure 2: Distribution of faculty's knowledge scores (*n=145*)

Figure 1 suggests that most students had knowledge scores concentrated around the lower end of the scale, suggesting that there is ample room for improvement. On the other hand, the distribution of faculty knowledge scores, depicted in Figure 2, is rather skewed to the right, suggesting that faculty have a relatively higher level of knowledge compared to that of students.

Attitude

The mean student attitude score towards ChatGPT was 3.2 $\pm$0.64 and the median was 3 out of 5, implying a moderately positive attitude. Refer to Table 9 for details. As mentioned before, in both cases (Tables 9-10) while calculating the descriptive statistics of the attitude scores, we reversed the scores for statements that implied a negative attitude so that a sore of 5 reflects the highest positive attitude, while a score of 1 represents the highest negative attitude.

Combining the percentages of strong agreement and simple agreement results, we observe that while 63.2% of students agreed that ChatGPT enhances the quality of knowledge attained (*A4*), and 62.7% concurred that it should be integrated as a supplementary learning resource (A6), nevertheless, 45% agreed that ChatGPT inhibits critical thinking (*A3*) and 46.8% agreed that it favors students' plagiarism (*A2*). 77% of surveyed students agreed that ChatGPT is easy to use (*A5*) and 47.2% enjoy reading academic writing produced by ChatGPT. Further, only 25.5% of students agreed with the statement that ChatGPT is an unreliable source of knowledge that should not be trusted (*A8*).

For the case of faculty, the mean attitude score towards ChatGPT was 3 ± 1.33 and the median was 2.8 out of 5 implying an overall moderate to neutral attitude. Refer to Table 10 for details.

As may be seen, while students exhibited a moderately positive attitude towards ChatGPT, the faculty's attitude appeared to be comparatively more reserved. Combining the percentages of strong and simple agreement results, we observe that 78.6% of surveyed faculty agreed with the statement that ChatGPT favors students' plagiarism (*A2*), 61.4% concurred with the argument that it inhibits students' critical thinking (*A3*), 74.5% agreed that it will make traditional homework obsolete (A14), and 45.6 % believed that ChatGPT can harm the reputation of the institution (*A10*). Looking forward, 42.8% of faculty agreed that ChatGPT can eventually question the future role of faculty (*A15*), 35.8% concurred with the statement that it is a real threat to the profession (*A12*), and 60% agreed that it will open new opportunities for innovative pedagogical practices (*A16*). Further, 83.3% of surveyed faculty agreed that ChatGPT is easy to use (*A5*) and only 37.3% of surveyed faculty agreed with the statement that ChatGPT is an unreliable source of knowledge that should not be trusted (*A8*).

Table 9: Students' attitude towards ChatGPT**

Statement	5. SA	4. A	3. N	2. D	1. SD	Mean*	SDev*	Median*
A1. ChatGPT enhances students' creativity	153 17.9%	266 31.1%	219 25.6%	147 17.2%	70 18.2%	3.3	1.190	3
A2. ChatGPT favors students' plagiarism	84 9.8%	316 37%	303 35.4%	110 12.9%	42 4.9%	3.3	0.987	3
A3. ChatGPT inhibits students' critical thinking	125 14.5%	261 30.5%	295 31.5%	121 14.2%	54 6.3%	3.3	1.083	3
A4. ChatGPT enhances the quality of knowledge attained	223 26.1%	317 37.1%	189 22.1%	85 9.9%	41 4.8%	3.7	1.105	4
A5. ChatGPT is easy to use	376 44%	282 33%	103 12%	50 5.8%	44 5.1%	4	1.121	4
A6. ChatGPT should be integrated as a supplementary learning resource	250 29.2%	286 33.5%	186 21.8%	72 8.4%	61 7.1%	3.7	1.181	4
A7. The usage of ChatGPT should be banned at ESPRIT	84 9.8%	116 13.6%	198 23.2%	161 18.8%	296 34.6%	2.4	1.343	2
A8. ChatGPT is an unreliable source of knowledge - I do not trust it	69 8.1%	149 17.4%	300 35.1%	208 24.3%	129 15.1%	2.8	1.141	3
A9. I enjoy reading academic writing produced by ChatGPT	121 14.2%	282 33%	303 35.4%	91 11.1%	54 6.3%	3.4	1.058	3
A10. Use of ChatGPT for academic writing can harm the reputation of ESPRIT	87 10.2%	226 26.4%	239 28%	170 20.6%	127 14.9%	2.9	1.213	3
A11. ChatGPT will help develop my skills in asking good questions	230 26.9%	342 40%	173 20.2%	69 8.1%	41 4.8%	3.7	1.082	4
A12. ChatGPT can be my personal tutor	168 19.6%	276 32.3%	243 28.3%	126 14.7%	43 5%	3.4	1.114	4
A13. ChatGPT is a real threat to the engineering / management profession	109 12.7%	178 20.8%	264 30.9%	192 22.5%	112 13.1%	2.9	1.212	3

**Greyed cells convey negative attitude statements. Descriptive statistics (mean, SDev and median) were adjusted accordingly*

*** SA: Strongly Agree, A: Agree, N: Neutral, D: Disagree; SD: Strongly Disagree. SDev: Standard deviation*

Table 10: Faculty's attitude towards ChatGPT**

Statement	5. SA	4. A	3. N	2. D	1. SD	Mean*	SDev*	Median*
A1. ChatGPT enhances students' creativity	9 16.2%	32 22.1%	20 13.8%	34 23.4%	50 34.5%	2.42	1.386	2
A2. ChatGPT favors students' plagiarism	67 46.2%	47 32.4%	16 11%	8 5.5%	7 4.8%	4.10	1.108	4
A3. ChatGPT inhibits students' critical thinking	32 22.1%	57 39.3%	18 12.4%	16 11%	22 15.2%	3.42	1.352	4
A4. ChatGPT enhances the quality of knowledge attained by students	18 12.4%	52 35.9%	27 18.6%	29 20%	19 13.1%	3.14	1.253	3
A5. ChatGPT is easy to use	63 43.3%	58 40%	12 8.3%	12 8.3%	--	4.19	1.905	4
A6. ChatGPT should be integrated as a supplementary learning resource in my courses	31 21.4%	38 26.2%	35 24.1%	25 17.2%	16 11%	3.30	1.286	3
A7. The usage of ChatGPT should be banned at ESPRIT	15 10.3%	17 11.7%	31 21.4%	38 26.2%	44 30.3%	2.46	1.312	2
A8. ChatGPT is an unreliable source of knowledge - I do not trust it	12 8.3%	32 29%	46 31.7%	39 26.9%	16 11%	2.90	1.123	3
A9. I enjoy reading academic writing produced by ChatGPT	13 9%	42 29%	50 34.5%	21 14.5%	19 13.1%	3.06	1.150	3
A10. The use of ChatGPT to produce academic writing can harm the reputation of ESPRIT	23 15.9%	43 29.7%	32 22.1%	32 22.1%	15 10.3%	3.19	1.242	3
A11. ChatGPT will help develop my skills in asking good questions	23 15.9%	53 36.6%	40 27.6%	15 10.3%	14 9.7%	3.39	1.161	4
A12. ChatGPT is a real threat to the engineering / management profession	17 11.7%	35 24.1%	35 24.1%	36 24.8%	22 15.2%	2.92	1.253	3
A13. I believe that ChatGPT will make unsupervised online exams impossible	36 24.8%	47 32.4%	27 18.6%	27 17.6%	8 5.5%	3.52	1.208	4
A14. I believe that ChatGPT will make traditional homework obsolete	40 27.6%	68 46.9%	13 9%	18 12.4%	6 4.1%	3.81	1.099	4
A15. ChatGPT can eventually question the future role of instructors	19 13.1%	43 29.7%	25 17.2%	32 22.1%	26 17.9%	2.98	1.331	3
A16. I believe that ChatGPT will open for me new opportunities for innovative pedagogical practices	37 25.5%	50 34.5%	29 20%	18 12.4%	11 7.6%	3.58	1.211	4

** Greyed cells convey negative attitude statements. Descriptive statistics (mean, SDev and median) were adjusted accordingly*

*** SA: Strongly Agree, A: Agree, N: Neutral, D: Disagree; SD: Strongly Disagree. SDev: Standard deviation*

Perception

Student perception level towards the ethical usage of ChatGPT was moderately positive (mean = 3.6 ±0.65). Across all respondents, 63% considered that the usage of ChatGPT for plagiarism can be acceptable under certain circumstances (*P12*), 63.6% considered that academically weak students are more likely to plagiarize with ChatGPT (*P15*), and 56.1%

believed that in the absence of university rules, using ChatGPT for plagiarism would be acceptable (*P13*). While around half of the surveyed students are not aware of the institutional policy regarding the usage of ChatGPT (*P5*), 60% claimed that they know that they are not allowed to use ChatGPT for graded assessments (*P4*). The fact that 48.2% of surveyed students disagreed with the statement that using ChatGPT without proper attribution would be considered plagiarism (*P6*) strongly corroborates with their general perception towards what constitutes plagiarism in the first place, as reflected by their responses to statements (*P2*) and (*P3*). Refer to Table 11 for further details.

Table 11: Students' perception towards the ethical usage of ChatGPT*

Statement	**YES** *Frequency* *Percentage*	**NO** *Frequency* *Percentage*
P1. Plagiarism is a form of academic dishonesty because it involves presenting someone else's work as one's own, without giving credit to the original author or source.	637 74.5%	218 25.5%
P2. Rewriting or paraphrasing the material from any source without saying where the original material comes from is plagiarism	450 52.6%	405 47.4%
P3. Cutting and pasting material from various sources without referencing where it comes from is plagiarism	491 57.4%	364 42.6%
P4. I know that I am not allowed to use ChatGPT for graded assessments	513 60%	42 40%
P5. I am fully aware of ESPRIT policy regarding the usage of ChatGPT	435 50.9%	420 49.1%
P6. Using ChatGPT to produce academic writing without proper attribution would be considered plagiarism	443 51.8%	412 48.2%
P7. Reliance on ChatGPT discourages critical thinking, problem solving and creativity	389 45.5%	466 54.5%
P8. Plagiarism from ChatGPT can be detected by my instructor using special plagiarism detection software	495 57.9%	360 42.1%
P9. ChatGPT can infringe copyright because the generated text can violate the rights of the original creators and authors	454 53.1%	401 46.9%
P10. For academic writing, it is better for students to use their own knowledge, skills, and research than relying on ChatGPT	525 61.4%	330 38.6%
P11. ChatGPT should be used to complement my own research and writing and not to complete my assigned homework	584 68.3%	271 31.7%
P12. Using ChatGPT for plagiarism can be acceptable under certain circumstance (e.g., extreme financial pressures, or low learning value of the assignment)	539 63%	316 37%
P13. In the absence of university rules, using ChatGPT for plagiarism is acceptable	480 56.1%	375 43.9%
P14. It is no big deal if I submit a homework using ChatGPT generated text and with no referencing	440 51.5%	415 48.5%
P15. Academically weak students are more likely to plagiarize with ChatGPT	544 63.6%	311 36.4%

** Green-shaded cells are statements related to student perception towards plagiarism in general. These were not covered in our descriptive statistics*

** Greyed cells convey negative perception statements*

Faculty perception level towards ChatGPT was low to moderate (mean = 2.8 ±0.96). Across all respondents, 65.5% considered that students are aware that they are not allowed to use ChatGPT for graded assessments (P1), 82.8% believed that using ChatGPT without proper attribution would be considered plagiarism (P3), and only 42.8% would accept ChatGPT-generated homework if it is credited (P9). Further, only 40.7% of surveyed faculty believed that students are fully aware of the institutional policy regarding the usage of ChatGPT (P2).

The fact that 83.4% of surveyed faculty (1) were concerned about the potential copyright violations induced by ChatGPT (P5), (2) considered that academically weak students are more likely to plagiarize with ChatGPT (P8), and (3) believed that students ought to rely on their own knowledge, skill and research than counting on ChatGPT (P6) is yet another indication of their higher degree of reservation and skepticism compared to that of students. Refer to Table 12 for further details.

Table 12. Faculty's perception towards ChatGPT*

Statement	YES *Frequency* *Percentage*	NO *Frequency* *Percentage*
P1. Students know that they are not allowed to use ChatGPT for graded assessments	95 65.5%	50 34.5%
P2. Students are fully aware of ESPRIT policy regarding the usage of chatGPT	59 40.7%	86 59.3%
P3. Using ChatGPT to produce academic writing without proper attribution would be considered plagiarism	120 82.8%	25 17.2%
P4. Reliance on ChatGPT discourages critical thinking, problem solving and creativity	112 77.2%	33 22.8%
P5. ChatGPT can infringe copyright because the generated text can violate the rights of the original creators and authors	121 83.4%	24 16.6%
P6. For academic writing, it is better for students to use their own knowledge, skills, and research than relying on ChatGPT	121 83.4%	24 16.6%
P7. The information generated by ChatGPT is accurate and reliable	69 47.6%	76 52.4%
P8. Academically weak students are more likely to plagiarize with ChatGPT	121 83.4%	24 16.6%
P9. I would accept ChatGPT-generated homework as long as it is credited	62 42.8%	83 57.2%
P10. ChatGPT is likely to have a significant impact on university education (e.g. teaching and assessment)	122 84.1%	23 15.9%

** Greyed cells convey negative perception statements (descriptive statistics for mean and SDev were reversed accordingly)*

Comparison of KAP Levels Based on Demographic Characteristics

Table 13 illustrates the associations between students' key categorical demographic variables and their knowledge, attitude, and perception towards ChatGPT, based on an independent t-test. A $p < 0.05$ was considered statistically significant to reject the null hypothesis and infer that there is significant evidence that the demographic variable under consideration influences the mean K, A, or P level. As may be seen, at a 95% CI, apart from gender, the remaining demographical variables have some impact with varying degrees on students' reported knowledge, attitude, and perception. For instance, older students demonstrated better knowledge about ChatGPT and less positive attitude towards it. In terms of field of study, Management students demonstrated better knowledge than their Engineering counterparts, yet they reported lower positive attitude and perception. While international students showcased lower knowledge about ChatGPT, they reported a more positive attitude towards it. Clearly, there were no significant difference in the reported KAP levels between male and female respondents.

Table 14 illustrates the comparison of the reported KAP levels, for the case of faculty, based on demographic characteristic and using again an independent t-test. As may be seen, at 95% CI, none of the faculty demographic variables had a significant impact on the KAP level.

Correlation Analysis

We performed a Pearson correlation test to investigate if there is a relationship between the reported knowledge, attitude, and perception levels among student and faculty participants. The results are shown in tables 15 and 16, respectively.

Table 13. Association between students' demographic information and their KAP towards ChatGPT (*n*=855)

Demographic variable		Knowledge			Attitude			Perception		
		Mean	**SD**	**p-value***	**Mean**	**SD**	**p-value***	**Mean**	**SD**	**p-value***
Gender	Male	2.4	0.555	0.839	3.8	0.657	0.452	3.6	0.670	0.330
	Female	2.4	0.650		3.9	0.639		3.6	0.645	
Age	18-22	2.3	0.589	0.000	4.1	0.632	0.000	3.6	0.642	0.001
	23-25	2.4	0.598		3.9	0.645		3.6	0.659	
	> 25	2.5	0.575		3.8	0.655		3.5	0.606	
Field of Study	**Management**	--	--	0.000	--	--	0.003	--	--	0.002
	Bachelor	2.2	0.668		3.2	0.551		3.6	0.567	
	Master	2.4	0.684		3.4	0.592		3.4	0.716	
	Engineering	--	--		--	--		--	--	
	Informatics / Telecom	2.3	0.542		3.8	0.632		3.6	0.661	
	Electro-mechanical	2.3	0.532		3.5	0.631		3.7	0.617	
	Civil	2.4	0.597		3.6	0.658		3.6	0.728	
Year of study	1	2.3	0.555	0.001	3.5	0.666	0.000	3.7	0.652	0.001
	2	2.2	0.661		4	0.687		3.8	0.586	
	3	2.4	0.564		3.2	0.672		3.6	0.658	
	4	2.4	0.616		3.8	0.683		3.5	0.663	
	5	--	--		--	--		--	--	
Nationality	Tunisian	2.4	0.604	0.040	3.6	0.642	0.04	3.6	0.648	0.005
	Other	2.1	0.315		3.7	0.31		4	0.621	

** Independent **t-test** ($p<0.05$ is considered statistically significant to confirm the impact of the demographic variable on the domain)*

Table 14: Association between faculty's demographic information and their KAP towards ChatGPT (*n*=145)

Demographic variable		Knowledge			Attitude			Perception		
		Mean	**SD**	**p-value* inter group**	**Mean**	**SD**	**p-value* inter group**	**Mean**	**SD**	**p-value* inter group**
Gender	Male	3.7	0.989	0.233	3.5	0.983	0.217	2.9	0.995	0.760
	Female	3.5	0.904		3.6	0.945		2.8	0.958	
Affiliation	School of Engineering	3.8	0.854	0.140	3.8	0.998	0.235	2.9	0.988	0.678
	School of Business	3.4	1.021		3.7	0.991		2.8	0.966	
University rank	Lecturer	3.7	0.917	0.750	3.7	0.873	0.341	3	1.040	0.260
	Assistant professor	3.5	1.003		4	0.912		2.8	0.905	
	Associate professor	4	0.267		4.1	0.932		2.5	0.854	
	Full professor	4.3	0.577		4	0.945		3.3	1.154	
Working experience at ESPRIT	< 3 years	3.4	1.011	0.298	3.7	0.885	0.221	2.7	0.863	0.328
	3-5 years	3.7	0.883		3.8	0.881		2.9	0.976	
	6- 10 years	3.7	1.023		3.7	1.021		2.7	1.099	
	> 10 years	3.9	0.567		3.6	0.994		2.8	0.966	

** Independent **t-test** ($p<0.05$ is considered statistically significant to confirm the impact of the demographic variable on the domain)*

Table 15: Correlation among students' KAP levels*

Variable	Knowledge	Attitude	Perception
Knowledge	1	0.000	0.010
Attitude	0.000	1	0.010
Perception	0.010	0.010	1

** Pearson correlation coefficients – Correlations are significant at the 0.01 level (two-tailed)*

Table 16: Correlation among faculty's KAP levels*

Variable	Knowledge	Attitude	Perception
Knowledge	1	0.075	-0.028
Attitude	0.075	1	0.065
Perception	-0.028	0.065	1

** Pearson correlation coefficients – Correlations are significant at the 0.01 level (two-tailed)*

In the case of students, a very weak positive association exists between their knowledge and perception, as well as between their attitude and perception.

In the case of faculty, the correlation coefficients are also generally low, implying subtle associations among the KAP variables. Nevertheless, we can infer a tendency for increased knowledge to induce a slightly higher positive attitude towards ChatGPT. We also observe that faculty knowledge and perception are mildly inversely related, while attitude and perception have a modest positive association.

Discussions

Our results indicated that faculty demonstrated a higher level of knowledge than students. Yet, more than 40% of surveyed students and faculty expressed unwavering trust in the

reliability of ChatGPT's responses, a perception that doesn't align with reality (see for example, Amaro et al [2023]).

Surveyed students showcased a moderately positive attitude towards ChatGPT. On the positive side, the majority perceived it as being useful (e.g., enhancing quality of knowledge), easy to use, and reliable. On the negative side, the fact that 46.8% of surveyed students believed that ChatGPT favors plagiarism is aligned with earlier research findings (see e.g., Lovett-Hooper et al (2007) that highlighted the mediating role of Information Technology in tempting students to engage in plagiarism.

Faculty attitude towards ChatGPT was comparatively more reserved compared to that of students and our results showcased varying opinions as reflected by the dispersion of the responses around the mean attitude score.

Students' predisposition to what constitutes plagiarism in general influenced their perception towards the ethical usage of ChatGPT. For instance, 48.2% of surveyed students did not believe that using ChatGPT without proper attribution would be considered plagiarism.

The surveyed faculty showcased a more negative perception towards ChatGPT than students and they expressed a greater degree of skepticism (e.g., concerns about potential copyright infringement (83.4%), belief that weak students are more likely plagiarize with ChatGPT [83.4%], perception that ChatGPT inhibits critical thinking, problem solving, and creativity [77.2%], and reluctance to accept ChatGPT-generated homework even if it is credited [57.2%]).

The fact that students will most likely utilize AI text generators in their future workplaces, suggests that formulating relevant queries and engaging in meaningful conversations with AI chatbots are likely to become lifelong learning competencies. We therefore recommend the introduction of a specialized course to train students on the art of formulating and refining queries when interacting with AI-driven conversational models while adhering to the principles of ethical and responsible usage. Students should also be made aware that ChatGPT responses are not always reliable, and they should be trained on challenging the responses and cross-examining them against other available online and offline sources.

Conclusion

The findings presented in this study provided some insights into the lower-than-expected KAP levels concerning ChatGPT among students and faculty. These insights can serve as a basis for effective interventions in terms of institutional policies, guidelines, awareness campaigns, and training programs. Enhancing the KAP level can potentially disperse misconceptions, biases, worries and mistrust that would impede the adoption of ChatGPT.

We argue that Higher Education Institutions (HEIs) must find the right balance between leveraging ChatGPT to enhance students' learning and the need for the assessment to authentically reflect the students' competences. HEIs should facilitate constructive open forums and dialogues among students, faculty, and other key stakeholders to debate on the impact of AI-driven conversational models on students' learning and to collaboratively devise appropriate strategies to tailor ChatGPT to meet the educational needs of students ethically and responsibly.

Like many other empirical studies, this research has several limitations:

First, the findings of this contribution were based on surveys conducted in a particular educational setting at a private higher educational institution in Tunisia and therefore it is not sure whether these are also applicable elsewhere.

Second, this study was conducted just two months after the official launch of ChatGPT and hence it captures the initial KAP among students and faculty. It would be interesting to conduct a longitudinal study to examine the evolution of the KAP levels as students and faculty gain more exposure to ChatGPT.

Third, the computation of the KAP statistics was based on the simplified "equal weighting assumption" among the KAP items which can lead to skewed interpretations. Future research can focus on introducing appropriate weighting techniques to reflect the actual significance of each individual KAP item.

Finally, the exclusive reliance on a quantitative approach limited the in-depth interpretation of our empirical results and hence a qualitative study is warranted to delve deeper into understanding the individual attitudes, perceptions and opinions among the surveyed participants.

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For School Turnaround in Centralized Systems of Education: A Case Study of Bahrain Public Schools

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Abstract
The past decades have witnessed a remarkably consistent effort by educational policy makers and the Ministry of Education of Bahrain to reform schools by holding them more publicly accountable for enhancing student performance and overall school improvement. With the establishment of the Education & Training Quality Authority (BQA) in 2008, public schools went under intensive inspection reviews conducted by the BQA. Public schools are currently under their fourth cycle of school reviews (with each cycle averaging 4 years). Within the period of the school review cycles, were underperforming schools able to improve to good or better? If so, what are the best practices and common trends of these turnaround schools? The study reported in this paper considers this issue within a highly centralized education system, using the example of Bahrain. This study utilized a qualitative multiple case study approach to gain a better understanding of how the district, school leadership and staff managed to successfully turn schools around within a centralized system of education.

Keywords: School Turnaround, School Improvement, Bahrain, Centralized Education System

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Introduction

Recent international literature offers convincing evidence that enhanced school autonomy, accountability and school led improvement strategies can be effective, especially when promoting equity across schools (Deppeler & Ainscow, 2016; Ehren & Perryman, 2018). This approach calls for educational practitioners to be given a certain level of autonomy in order to assess their own contexts and enact school led improvement plans, however for school leaders in more centralized systems of education this can be difficult to achieve (Constantinou & Ainscow, 2020).

School principals' role as "change agents" or "turnaround leaders" has gained importance over the years, playing a central role and link between government-driven reforms and school internal innovation (Brauckmann & Schwarz, 2014). However, school leaders do not operate in isolation and contextual factors and educational governance structures have to be considered as well. In a school system characterized as centralized, the form of a model of school change undertakes top-down directives, where the Ministry or state leads and the practitioners implement, while the majority of stakeholders are often passive recipients of schooling for as Constantinou & Ainscow (2020, p. 5) state *"decisions to do with the curriculum, books, student registration or, even, the selection, recruitment, promotion, transfers and training of staff, are all prescribed and managed centrally."*

Even within centralized systems of education, one of the most prominent global policy trends is the devolution of powers to site level, where responsibilities have been shifted from local or national bureaucracies to school principals (Bush, 2018). With this responsibility comes an increase in leadership scope as principals have to exercise administrative functions such as financial management and staffing issues which were previously undertaken centrally. Furthermore, top-down and more centralized forms of accountability do not factor in the position of schools that operate within networks and the collaboration between schools towards a common goal, often discounting the fact that collaboration is built on lateral non-hierarchical relationships and structures (Ehren & Perryman, 2018).

However, it is important to note that school structures should not be simply conceptualized as either 'centralized' or 'decentralized' because school organizational structures often combine elements of both modes of governance (Boyd & Crowson, 2002). For even within a school system perceived and often characterized as centralist, examples can be found where school leaders achieve agency and take action to promote school transformation and turnaround. School-based action research, with an emphasis on inquiry, collaboration and networks can increase a school's capacity to improve despite the barriers created by centralized policy making (Burns & Köster, 2016). This study utilizes a qualitative case study approach to gain a better understanding of how a school leader was able to improve their school from within a centralized system of education in Bahrain public schools.

School Improvement & Turnaround in the Arab Region

Across the Arab region efforts towards improving schools have been heightened by unsatisfactory student standard achievements and the collective realization that schools have been failing to reach their most important goal – that of student learning (Al-Barwani, 2011). Schools across the Middle East face key challenges that can be summarized by three main points according to the UNDP (2016): an increase in educational disparity between countries; a persistent decline in the quality of education (despite a constant increase in per capita

education expenditure) and finally a mismatch and gap between labor market needs and educational outputs.

School turnaround in the Arab region is a relative concept because the improvement and development of schools across the region is still an ongoing issue. Furthermore, in the majority of Arab states and more specifically countries of the GCC, planning and decisions related to the school curriculum, syllabus, teacher recruitment, training and examinations are highly centralized in ministries of education. The hierarchies established in a centralized system ultimately give little power or accountability to teachers or school communities (Chapman & Miric, 2009). This centralization makes school turnaround a difficult notion to achieve on a school level, and instead is mainly linked to overall systemic education reform and school improvement initiatives across the districts or governorates.

Educational reform in Arab countries, as mentioned previously, is seen as the sole responsibility of governments and ministries of education and not of educators at the school level (Akkary & Rizk, 2014). Hence, planning for education reform and ultimately school turnaround and improvement is left to government officials, politicians and educational consultants. As such educators and school leaders simply act as executors of top-down educational reform initiatives without displaying a real sense of accountability in the school improvement process (El-Amine, 2005). As educational reform and school turnaround policies are mainly rooted on perspectives taken from Western literature and practice, educators across the Arab region question their applicability in their local contexts because these reforms disregard many local values and social perspectives in education (Oplatka & Arar, 2017). Furthermore, numerous scholars argue that the majority of the current reform initiatives across the Arab region are driven by political agendas that are not linked with the priorities and needs of educational practitioners and school cultural contexts (Abi-Mershed, 2010; Akkary, 2014; Mazawi, 2009).

Over the past thirty years, countries across the Arab region have adopted neoliberal economic policies to various degrees that included privatizing state owned industries, opening up to foreign investment flows, relaxing trade barriers and reforming tax regimes (Hanieh, 2015; Morgan, 2017). According to Bogaert (2013, p. 215) *"this shift away from state-developmentalism to neoliberal governance has undermined the quality of public schools, eroded the teaching profession, and contributed to increases in social inequities."* Additionally, the shift to market oriented economic policies is linked to the emergence of an educational market place in the Arab region, the spread of privatization of education and the decrease of public expenditure on education (Hartmann, 2013; Sobhy, 2012). Class and social inequalities are intensified when families purchase education in the form of private schools and tutoring, where parents across the Arab region believe that private schools deliver an enhanced learning environment and instruction as opposed to public schools (Buckner & Hodges, 2016; Morgan, 2017). As such socio-economic and geographic inequalities are exacerbated across the Arab region when students from disadvantaged backgrounds are concentrated in low-quality public schools while more well off students attend private schools (Jorman & Murray, 2010).

Bahrain Public Schools Context

Public schools in Bahrain are centralized and free of charge for all Bahraini citizens with educational facilities and services financed by the Government of Bahrain. The public school education system comprises nine years of basic instruction, split into primary and

intermediate education, followed by three years of secondary education on either a general or vocational track (Oxford Business Group, 2020). Public schools across the Middle East and the Arab Region are segregated by gender due to cultural and religious factors (Robinson et al., 2021), however higher education institutions and private schools are usually coeducational.

There has been a current drive towards private school enrollment to pursue an international curriculum and a higher quality education. Private school enrollment rates have increased to 32% of total students in 2018 compared to 28% in 2012 (GFH, 2020). The private education sector has also been growing to meet the increasing demand from expatriate students who are not eligible to attend local public schools which ultimately creates socioeconomic differences in terms of access to education and shared parental concern over the affordability of schooling (Ridge et al., 2015). In regards to student demographic and socio-economic status, 26% percent of the total population fall below the poverty line according to the Bahrain Expenditure and Income Survey (Central Information Organization, 2018). However, it is important to note that countries measure poverty in different ways internationally, and in terms of Bahrain the poverty line falls below any household with an income less than half of the national average income, which amounts to 500 BHD *(approximately £1000)* per month/per household (Abdelbaki, 2011). Furthermore, Bahrain stands out as the only Gulf country that provides free public education to all nationals and non-nationals without any restrictions, with expats making 50% of public school students (UNESCO, 2019) this creates a unique dynamic of student diversity in public schools across the Arab Region.

Overview of Case Study School A

School A is a primary boys school that includes grades one through five. This primary school was established in 1996, and caters to the majority of primary male students in its vicinity. It is a large school, with a large campus catering to over 1000 students. The school is located in one of the most densely populated cities in the Southern Governorate, with a population of roughly 38,000 (Ministry of Information Affairs, 2020). The city is one of two large housing projects developed in Bahrain to meet the increasing demand for housing, as a welfare state, by providing small houses and apartment units to national citizens of low income (Remali et al., 2016).

The school's enrollment in the 2019/2020 school year was 1120 students. There are 93 staff members, a principal, and two fulltime assistant principals. Thirty percent of its student qualify for free school meals. Its ethnic demographics are: 72% Arab (Gulf Region), 22% Middle-Eastern (Yemeni 11%, Syrian 5%, Egyptian 4%, Jordanian 2%), and 6% South-Asian.

The Principal

Before being appointed as the current principal of School A, principal A had been serving as a principal for another boys primary school with a track record for improving that school (according to inspection reports) from Satisfactory (3) to Good (2). As such, she was assigned to School A since there was an upcoming follow up inspection to be held the following year by the BQA after the school had received its rating as Inadequate (4) in 2015.

Principal A is very energetic and active, several who work with her state that she hardly ever sits down. She makes it a point to be visible and available to parents and students during drop

off and pick up, and highly emphasizes the importance of instructional leadership. Because there are two fulltime assistant principals assigned to School A, most of the administrative matters such as overseeing facilities, student discipline and matters related to technology management are assigned to the assistant principals, thus freeing Principal A to fulfill the role of an instructional leader.

Methods

The collected data was based on an original qualitative empirical research study undertaken though the examination of a successful 'turnaround' case study school as indicated by inspection reports. The school was selected based on its inspection report rankings, focusing on schools that have rapidly improved (two ratings higher) between the previous school review cycles from either 'Inadequate' or 'Satisfactory' to 'Good' or 'Outstanding.' A multi-perspective study methodology was followed where data were gathered from a wide range of school stakeholders, such as ministry officials, inspectors, the school leader and teachers employing a common, semi-structured interview protocol for the case study school. Table 1 summarizes the characteristics of the case study school:

Data	School A
School Stage	Primary
Gender	Boys
Governorate	Southern
Number of Students	1162
Previous Inspection Ranking	4
Latest Inspection Ranking	2

Table 1 Characteristics of Case Study School

Main Findings

Even though schools in Bahrain operate in a more restrictive centralized system, without the ability or autonomy to enact various school improvement initiatives or policies at a local school level, examples of school leadership turning schools around prove that leaders do leave an impact. In regards to this study's case school, the biggest factors that have led to the school's improvement are the influence of a newly appointed 'turnaround leader' (Liu, 2020), addressing the needs of diverse students (Harris, 2009) and an overall sense of resilience and agency (Wosnitza & Peixoto, 2018).

Turnaround Leadership

For over almost four decades, school effectiveness literature has recognized the vital role of the school principal and leader in managing the school, facilitating effective teaching practices and striving to attain satisfactory outcomes for students (Chapman et al., 2016; David et al., 2000; Edmonds, 1979). Research suggests that leadership is the second most important school-based factor for student achievement after teacher quality (Leithwood, Patten, et al., 2010). Turnaround leadership is related to the kind of school leadership required for turning around and improving a consistently low-performing school (Fullan,

2005). Even though school principals and leaders might not directly impact student achievement, they do set the vision and goals for the school, develop professional learning communities, engage stakeholders and make important organizational decisions that affect student's achievement through a "ripple effect" (Hitt & Tucker, 2016).

In regards to School A it was noted by several accounts, including inspection reports, that since 2008 there has been instability in school leadership and staff, especially that of the school's principal. A new principal in 2015 was appointed after the school received a rating of Inadequate (4), this was a principal with a previous track record in turning around another poorly performing school and was appointed in order to attempt to improve the school:

I had experience with school turnaround in the school I was working for previously and on that account I was requested by the Ministry of Education to be transferred to my current school and improve it for the upcoming inspection visit (School Principal, October 20, 2022). Furthermore, not only did the principal had the necessary experience in school turnaround, but she also made herself visible and was an avid instructional leader. Many studies have captured the importance of instructional leadership, however in general work on this topic indicates that the closer leaders are to teaching and learning processes, the more likely they are to make a difference in student learning (Robinson et al., 2007). Not only did school staff comment on how visible and involved the new school principal was in teaching and learning processes but this was also reflected on by a BQA Inspection Agency official:

> *The principal was characterized by understanding the strengths and areas for improvement within her school. Why? Because she went into the classrooms, she observed, she participated in some aspects, she gave feedback and that was a very positive practice. We don't want the principal to be sitting in her office all day long.*
> (BQA Inspection Agency Official Interview, August 13, 2022)

Underperforming and turnaround schools need to be staffed with educators and leaders who are inclined and able to make essential changes, and at times leaders must be reassigned for a successful reform to occur (Liu, 2020). Leadership change has constantly been a topic of much discussion and a key factor in turnaround literature; the entire school staff in an underperforming school may not need to be replaced but often it is essential that the school leader does (Hassel & Hassel, 2009). As such pressure on school principals and leaders have never been more intense, with some school systems requiring that school principals need to rapidly build school capacity and improve student achievement outcomes to maintain employment (Meyers & Hambrick Hitt, 2017).

Ultimately, there is no denying the importance of high-quality leaders to the success of any school, and it is possible that chronically low-performing schools need those types of leaders even more (Meyers & Hambrick Hitt, 2017). The noteworthy work by Leithwood, Harris and Strauss (2010) examined the successful impact of leaders in low-performing schools, looking into what turnaround leaders did to achieve this and how they did it. Furthermore, Duke (2015) studied the challenges school leaders faced in preventing decline, his work led to producing a guide for leaders to use during the school turnaround process.

Student Diversity

Bahrain stands out as the only Arabian Gulf country that provides free public education to all nationals and non-nationals without any restrictions, with expats making 50% of public

school students (UNESCO, 2019) this creates a unique dynamic of student diversity in public schools across the Arab Region. Overall, the non-national population across the Gulf States are largely expat workers, given the relatively high labor force participation rates: 80% in Bahrain, 55% in Qatar and an average of 47% in Saudi Arabia and the United Arab Emirates (Mohammed, 2017). Furthermore, research has shown that students from the poorest homes and of lower socioeconomic status are more likely to have worse school results and to drop out of school more frequently than students that come from better off families (Sirin, 2005). In the case of the majority of Bahrain public schools, non-national students and those of diverse backgrounds tend to be of lower socio-economic statuses with the majority being eligible for free school meals.

What was unique about this case study school is that despite the large number of students and large percentage of diverse students with low socioeconomic statuses, the overall school climate remained unaffected. As such, an investigation of how a school has managed to reduce the impact that student background factors have on academic achievement and learning outcomes can be a useful measure of overall school effectiveness (Kyriakides et al., 2019). The school leadership made an active effort to build the organizational capacity of the school in ways that were culturally appropriate:

> *Our school has a large percentage students from different cultural backgrounds and we tried to ensure that they received the appropriate support which was a program specifically for Arabic as a second language learners which was called "I love Arabic". Even though the Ministry does not provide Arabic as a Second Language Teachers, staff members within the Arabic Department were dedicated to work with students who needed further support. Students would receive extra support during breaks, free periods or extra curriculars to focus on learning Arabic as a second language.*
>
> (School Improvement Team Focus Group, November 23, 2022)

However, the successful work of highly dedicated educators cannot alter the fact that students of diverse backgrounds in Bahrain Public schools are disadvantaged. Firstly, because the majority of students come from lower socio-economic statuses and speak Arabic as a second language. Secondly, because they often attend schools in deprived districts with large housing projects and fewer resources that better off schools in neighboring districts. Furthermore, the student demographic in schools keep changing year after year depending on intake for as highlighted by one Ministry of Education official:

> *Schools are a very complex environment. Sometimes the student demographic in a school can change entirely year by year. One year you have the majority of students who are local, Arabic speakers and then the next year you can have up to 80% non-Arabic speakers who come from other nationalities. This shift can completely take the school leadership off focus since they will be dealing with the new student demographic.*
>
> (Ministry of Education Official Interview, August 15, 2022)

Studies focusing on ethnic inequality across various school settings have outlined that a broader provision for linguistic and socio-cultural diversity is necessary (Ainscow, 2016; Harris, 2009). A transformation of Bahrain Public Schools toward increased inclusiveness demands comprehensive strategies of whole school reform to tackle ethnic inequalities. Such

strategies must affect not only schools at a local level, but also their wider institutional settings on a macro level.

Agency & Resilience

According to (Wosnitza & Peixoto, 2018, p. 335), *"resilience should not be understood as something someone has or does not have but as a toolbox an individual brings to a specific situation, a box of tools and resources that helps a person to solve a problem."* It was made clear through case study observations and interviews with school staff that the school leadership's unwavering sense of resilience and agency was a key factor, or 'tool', to the school's turnaround. As mentioned earlier, because the schools operated within a centralized system, school leaders did not have the autonomy or power to enact change directly in many areas required for overall school improvement such as human resources, facilities and curriculum changes. As such, it was up to the school leadership to pursue those changes no matter what it took, with whatever resources or tools that was within their reach as demonstrated by this quote from the school's principal:

> *I think that one of the biggest factors that might have made me have a good track record in improving schools is the fact that I was "relentless and resilient" to the point where Ministry officials had a nickname for me "حنانة" (which is a local dialect term for the word 'nagger'). Where there was a matter of shortage of staff or resources needed I would actively try to seek that out from the central district and even when the Minister of Education would visit our school I would clearly state our needs and shortages. Whereas other school leaders might not actively speak up or seek out the shortages and resources the school might need.*
>
> (School Principal, October 20, 2022)

Steiner, Hassel, Hassel et al. (2008) indicated four underlying competencies of successful turnaround principals which include a motivation to achieve the end results, strong influence on others, problem solving and high confidence in leadership. However, what is interesting about leaders within the current context is that not only did they need to have the ability to problem solve within their 'toolbox' of skills but they needed the ability to think 'outside of the box', maneuver bureaucratic hurdles, lead with limited resources and the lack of autonomy of working within a centralized system of education. Leadership is stressful, even more so for principals tasked with the burden of turning around a perceived failing school according to inspection reports. Flintham (2008) outlines the need for school leaders to have 'high levels of resilience'. Definitions of resilience include references to persisting in the face of adversity, staying positive, having inner resourcefulness and showing the ability to bounce back and recover quickly from setbacks (Steward, 2014). These traits were demonstrated and observed not only by the feedback received from research participants within the case study school but also outlined in inspection reports:

> *During the first two weeks of her appointment, she did not lock herself up in the office or hold endless meetings. She was actually out and about the entire school. Visiting classrooms and holding informal discussions with staff across the campus related to school improvement.*
>
> *(School Staff Member, November 24, 2022)*

> *The school principal and overall leadership were able to display a 'cultural change' across the school. Especially when it came to organizational and administrative*

> *matters of school improvement, enhancing professional learning communities and ensuring the overall professional development of teachers while linking its effect in classrooms and overall student achievement.*
>
> *(BQA, 2019)*

The concept of agency, is crucial in exploring roles and identities in relation to school change and improvement. According to Biesta (2015, p. 626) *"agency is not something that people can have but is something that people do. More specifically, agency denotes a quality of the engagement of actors with temporal–relational contexts-for-action, not a quality of the actors themselves."* In other words, it is important to acknowledge the ecological conditions, context and circumstances to fully understand the phenomenon of agency and how agency can be achieved in educational settings (Biesta & Tedder, 2007). Capacity building for overall school improvement must therefore consider the ecological relationships between educators and their organizational environment (Priestley et al., 2015). In hierarchy governance systems which are more often based on authority as opposed to trust and accountability, this level of agency can be hardly achieved for as Ehren and Bachmann (2020) conclude *"when an accountability exercise is riddled with deception, in transparent decision-making, blame games, hidden agendas or misuse of power on the side of the accountability agent, trust in the accountability system is clearly broken."* Furthermore, research has highlighted that hierarchal control reduces teachers and school leaders' flexibility to adapt their work to local context and needs; where ultimately they are more motivated to hold on to their positions as opposed to their commitment to their work (Freidson, 2001).

Conclusion

This study has briefly explored how a case study school was able enact school improvement strategies and turnaround within a centralized education system. Central to this discussion was the ability of the school leadership to enact agency despite the restrictions set upon them, tackle student diversity and demonstrate attributes of 'turnaround leadership.'

When considering the process of school improvement and turnaround in more hierarchical, centralized systems of education, it is important to understand how trust, accountability and capacity feature in the governance of such education systems (Ehren & Baxter, 2020). Hierarchical centralized systems of education, such as that of where this study's case study school presides in, are those which are closely managed and monitored from the center with strong top-down control of all aspects of the educational system (Levy, 2018). Within such a state model of centralized accountability and control, head teachers, teachers and members of the education community become significantly reliant on central authority for decisions and initiatives concerning their work and teaching role with little room for accountability and agency (Fullan, 2016). As Ehren & Baxter (2020, p. 37) further elaborate *"holding teachers accountable for standards without providing them with resources to implement these standards is also a guarantee for trust-relations to break down."*

When educators and professionals can fully participate in the development and execution of formal accountability measures, have choices and discretion of their own initiatives, and the hierarchical relations are experienced as meaningful relationships based on trust, only then can a system improve even if operating under a more centralized system of education.

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Quality Early Childhood Education Enhancement Through Teachers' Qualification and Training in South Africa

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Abstract
The United Nations Sustainable Development Goal Four was on the provision of quality education for all. The meaning of quality education has been controversial among authors. However, studies on early childhood education conclude that to have quality education for young children two indicators must be available – structural and process indicators. This study aimed at exploring how early childhood education centres' practitioners' qualifications and training promote quality education for young children. Six participants (three ECD principals and three ECD practitioners) were selected from the three-township early childhood development centres in Kwazulu-Natal Province, South Africa. An interpretive, qualitative research approach was chosen. Face-to-face semi-structured interviews were used to gather data, which was then analysed thematically. The findings indicate that the practitioners are aware of the importance of having gained the knowledge and skills to teach young children through the earning of qualifications and how it would improve the quality of teaching. The findings also show the challenges that hinder practitioners from acquiring ECE qualifications and training. Therefore, it is recommended that higher learning institutions develop a practical programme to enhance practitioners' educational experiences, with funding from the government and international scholarship.

Keywords: Quality Early Childhood Education, Qualification, Training, ECE practitioners

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Introduction

Quality Early Childhood Education Indicators

Governments all around the world as well as international organizations have acknowledged the value of high-quality education and have put emphasis on it. The provision of quality education for students is one of the 2023 Sustainable Development Goal's main objectives (SDG 4) to end poverty, safeguard the environment, and ensure that everyone has access to freedom and peace by 2030 (de Villiers et al., 2021). To guarantee that every child and citizen has access to quality education, UNESCO encourages national links, cultural legacies, and the equality of all nations (Addey, 2021). Van der Gaag and Putcha, (2015) expanded on quality education by saying quality Early childhood Education (ECE) is essential for safeguarding children from a wide range of socioeconomic difficulties, including subpar living conditions, a lack of educational opportunities, and inadequate health care. In addition, Moore, Qaissaunee and Sherretz (2019) also echo that quality education for young children is essential for raising academic standards, health and employment prospects, eradicating poverty and inequities, and enhancing opportunities for future employment. The novel aspect is that there is a strong emphasis on achieving quality education; however, difficulties can arise when defining quality and describing how crucial indicators would promote quality education.

According to Myers (2010), it can be a challenging and contentious subject to describe quality early childhood education metrics, especially when one considers the uneven distribution of resources. However, researchers on early childhood education have found that two indicators, known as structural and process indicators, are necessary for young children to receive a quality education (Ishimine & Tayler, 2014; Bonetti & Brown 2018). Structural quality is referred to as input that is easily observed and measurable in determining quality such as ECD centre facilities\resources, ECD practitioner-to-child ratio, and ECD practitioner qualifications, training and wages (Bonetti & Brown, 2018; Slot, Leseman, Verhagen, & Mulder, 2015). Process quality is described as the nature of interactions between children and teachers, among children, and among adults — practitioners, parents, and staff, and the nature of leadership and pedagogy (Ishimine & Tayler, 2014). This study sought to understand how early childhood education centres' practitioners' qualifications and training promote high-quality education for young children since ECE teachers' qualifications and training are one of the structural quality indicators.

ECE Teachers' Qualification as a Quality Indicator

The education and training that ECE instructors receive are crucial in the pursuit of good teaching standards that should improve students' math and language abilities during the initial years of schooling (Myers, 2006). Gashaw (2014) added that it is critical that ECD educators and practitioners obtain current information and abilities about children's development. As such, the South African Qualifications Authority (2007) offers several accredited qualifications for ECE practitioners, particularly those who work directly with children, as well as community development qualifications with ECE specialists that cater to the needs of practitioners who work directly with parents. Nevertheless, researchers found that a significant number of ECE teachers did not have appropriate qualifications in a national study that included assessing the quality of ECD teachers (DSD & EPRI, 2014). Biersteker et al. (2016) argue that ECE teachers' qualifications may not always indicate increased children's achievement or higher-quality instruction in the classroom. Hence, it is important to

understand how ECE teachers' qualification promotes quality early childhood education from the practitioners' perception.

ECE Teachers' Training as a Quality Indicator

Would ECE teachers' training and development promote quality ECE if their qualifications did not necessarily affect the ECCE's quality? Specialized training programs for ECD teachers, according to Fukkink and Lont (2007), can greatly raise teacher skills and hence raise promote quality ECE. Similarly, Biersteker et al. (2016), emphasise that ECE teacher training is generally used as a quality indicator. As a result, the South African, Department of Basic Education [DBE] and Department of Social Development [DSD] mandate that ECE teachers receive the necessary training (RSA, 2014). Furthermore, ARNEC (2011) states that ECE teachers' training programs should be participatory to include parents, families, and community members. Therefore, practical training should be provided by delivering empowering programs for all stakeholders and should include pre-service and in-service training as well as ongoing support and guidance.

The objective of this study is to explore how township South African early childhood education centres' teachers' qualifications and training promote quality education for young children. The research question to achieve this objective is "*How do ECE teachers' qualifications and training promote quality early childhood education in South Africa*?" The results of this study are meant to fill information gaps regarding quality early childhood education and teachers' qualifications and training. Along with details on achieving one of the Sustainable Development Goals set forth by the United Nations in 2030. As a result, this study is well-positioned to offer practical suggestions to ECE practitioners and decision-makers.

Methodology

An interpretative research paradigm with a qualitative technique was employed to explore ECE teachers' credentials and training in promoting high-quality early education since it allows for a comprehensive and in-depth exploration of the research question Creswell (2014). In order to better comprehend the research phenomenon from many perspectives, a multiple case study research approach was used (Creswell & Poth, 2018). Three ECE principals and three ECE practitioners were chosen from three-township ECE centres in the Kwazulu-Natal Province, South Africa, using the purposive sampling technique. In Table 1, participant profiles are displayed.

ECE centres	Pseudonyms	Rank within the ECE Center	Highest qualification	Years of experience
Vine	Apple	Principal	No qualification	16 years
Vine	Mango	Teacher	Diploma in ECE	5 years
Delta	Orange	Principal	Certificate in ECE	12years
Delta	Banana	Teacher	Diploma in ECE	8years
Lee	Grapes	Principal	No qualification	10 years
Lee	Berry	Teacher	Certificate in ECE	4 years

Table 1: Participants' Profile

At the participants' centre, data was gathered through face-to-face, semi-structured interviews. To provide information for reliability tests, the interview sessions were audio-recorded and transcriptions were made. The generated data were coded and classified thematically into themes that arose from the data. Before any data is collected, consent forms are signed by all participants and the study's purpose is communicated to them in order to uphold ethical standards. Permission to conduct research was also acquired from the centre's directors.

Findings and Discussion

The subheadings below illustrate two themes that emerged as a result of the data analysis.

Factors of ECE Teachers' Qualifications and Skills as a Quality Indicator

The findings showed that the qualification and expertise of ECE teachers are crucial and would raise the quality of education and care given to young children. The data reveals the factors that indicate signs of quality enhancement at the participating centres. For example, participants (ECE principals) described the improvement in children's performance after employing teachers with ECE qualifications and also enrolling them in training sessions. Participated ECE teachers also state that the knowledge acquired from their education helped them to apply learning resources in the growth and development of the children. As a result, from teachers' qualifications and training, indications of ECE quality include factors like children's overall growth, teachers' confidence in connecting with children, and teachers' increased skills. Below is the verbatim of the participants' narrations.

> **Mango:** *Before I obtained my Diploma in ECE, I do not have the understanding that outdoor learning resources should be used to engage and build children's physical, mental and social skills through play. With my ECE qualification, my work with young children has really improved I can say.*

> **Banana:** *ECE qualification is even more important to teach children now than before because from it you will learn more new things and also meet people that can help you with information and materials.*

> **Berry:** *By attending short courses and training, I improve my skills on how to teach the children in my class. So regular training is an important thing to improve the quality of our work as children's teachers.*
>
> **Apple:** *I do not have the opportunity to go to college to learn about my job as the head of my centre but I have gathered a lot of knowledge from my years of experience in attending several trainings. If I hear of any training I register myself and my teachers because I know that it will help a lot in teaching the children in our school.*
>
> **Orange:** *As the principal of the centre, I can tell you from the feedback of parents about children with a qualified teacher and those without a qualified teacher. Although it is expensive to employ qualified teachers but qualified teachers help with a lot of things in children's growth and development.*

The findings agree with Zulu et al., (2022) which indicate that for practitioners to provide young children with high-quality teaching and learning, there is a need for some sort of advanced training in ECD. The study's findings also concur with those of Thao and Boyd (2014), who found that certified ECE teachers are generally comfortable presenting and putting new concepts into practice. However, the findings disagree with Biersteker et al. (2016) who state that ECE teachers' qualifications may not always indicate increased higher-quality instruction in the classroom. Despite the findings demonstrating the importance of ECE qualifications as an indicator to improve the quality of teaching, participants talked about the barriers that keep them from obtaining ECE training and qualifications. These barriers are discussed in the theme below.

Obstacles That Prevent ECE Practitioners From Obtaining ECE Qualification

The study found that obstacles such as a lack of funding, a heavy workload, a lack of flexibility with their schedules, and a lack of understanding of distance learning prevent ECE teachers from completing an early childhood certificate, diploma, or degree. These were described by the participants in the following way.

> **Apple:** *Honestly, I like to go to school to learn more and obtain a qualification but I can't afford it. College or University education is expensive for us. Another problem that I have is also the time to study is not there for me.*
>
> **Grapes:** *I started this centre because of my love for young children not because I have a qualification, I enrolled on a certificate programme before but the workload and my family responsibility do not allow me to complete the program.*
>
> **Berry:** *I obtained my diploma in ECE two years ago and my plan is to proceed to obtain a degree so that I can earn more but the challenge is that I need sponsorship, my salary here is not enough to sponsor myself for a degree program.*
>
> **Orange and Banana:** *Stated their fear of coping with distance education because of their limited knowledge of technology and online learning.*

In South Africa, ECE teachers are urged to obtain at least the minimum qualifications outlined in the National Qualifications Framework (NQF) (South African Qualifications Authority, 2007). The findings of this study indicate a contrary outlook due to some factors

like a lack of funds, a demanding workload, an inability to be flexible with their schedules, and a lack of knowledge of distance learning which prevents the participants of this study. According to Shaeffer (2015), bad working conditions, low pay, and long hours are obstacles for ECE teachers, and these factors, along with a hard workload, make it difficult for them to obtain qualifications. This implies that, despite ECE teachers' recognition of qualifications and training as an ECE quality indicator, the quality of education provided may suffer since the teachers were unable to obtain the necessary training and qualifications.

Conclusion and Recommendation

In the attempt to answer the research question 'How do ECE teachers' qualifications and training promote quality early childhood education in South Africa', findings reveal teachers are aware of the importance of having gained the knowledge and skills to teach young children through the earning of qualifications and how it would improve the quality of teaching. The findings also show the challenges that hinder teachers from acquiring ECE qualifications and training. Therefore, it is recommended that higher learning institutions develop a practical programme to enhance practitioners' educational experiences, with funding from the government and international scholarship. It is also recommended that the Government, NGOs, universities and private organisations offer flexible ECE training.

As a result of the study's restriction to township ECD centres in South Africa's Kwazulu-Natal Province, its limitations are mostly related to the generalizability of its findings. A larger sample size and other data collection techniques might have helped to produce deeper conclusions, but the study's time constraint does not allow for that. The researchers conducted in-depth semi-structured interviews in order to overcome this constraint.

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Respond to Diversity: Study of a Japan Nonformal Learning Program's Remote Effect Fostering Cross-Generational, Multicultural Relationships, and Disruption of Stereotypes

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Abstract
In response to the cumulative consciousness of learners' diversity, it is vital to study the format of learning to better address the needs of learners today. Japan, where secondary education remains conventional, the study has been conducted since 2015 to examine the proposed nonformal learning program. The program, comprised of voluntary-based facilitators whose ages range from 22 to 63, is premeditated to retort learners' diversity by empowering facilitators with a high degree of autonomy to tailor each session. The learning experience of meeting dissimilar facilitators on every occasion aligns with the Eastern philosophy of "Ichigo Ichie" (一期一会), emphasizing the significance of seizing the moment and cherishing encounters with others. The program utilizes a two-stage approach, where facilitators' training is specified prior to individual sessions. With the design intention of fostering a learning environment that encourages interpersonal communication, it flattens the power dynamics among facilitators and students. This intention aligns with the Eastern philosophy of "San ren xing bi you wo shi" (三人行必有我师), highlighting the importance of learning from others through interactions regardless of hierarchical positions. In this case, the program's approach creates a novel learning experience for participants who have not yet experienced nonformal learning prior. The study found that the program facilitated incremental learning, particularly in generating learning atmospheres that inspire cross-generational and multicultural student-facilitator relational interaction. This socialization creates a remote effect that positively influences students' motivation. Participants also perceived the designed program disrupted their pre-existing stereotypes towards each other.

Keywords: Nonformal Learning, Eastern Philosophy, Empathetic Social Interaction, Two-Stage Approach, Cross-Generational, Multicultural Relationships, Disruption of Stereotypes

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1. Introduction

1.1 Rising Trend in Welcoming International Residents

The recent report published by the Japan Ministry of Internal Affairs and Communications, "Population, Population Dynamics, and Number of Households as of January 2023," highlights a significant growth in the trend of international residency within Japan (MIC, 2023). Specifically, the foreign resident count rose by 289,498 from the prior year, marking an increase for the first time in three years, despite having decreased for two consecutive years since 2021 (MIC, 2023). This trend is particularly prominent in major prefectures such as Tokyo, Aichi, and Osaka (MIC, 2023), where individuals from diverse backgrounds are increasingly visible in workplaces, residential neighborhoods, and schools. This growing international presence is not only shaping the demographic landscape but also fostering multicultural interactions. Notably, the increase in foreign residents has led to a rise in the number of international households, now reaching 1,772,890 households, indicating an increase of 15.57% from the previous year (MIC, 2023). This presents an excellent opportunity for local Japanese students to engage with peers from diverse backgrounds, contributing to a more enriched cultural exchange and understanding within their communities.

1.2 Increased Use of Social Media and the Internet

With the progression of technology, Japan, like many, has also been advancing in its network infrastructure as well as hardware such as smartphone adoption (Tateno et al., 2019). In addition, data indicates that Japanese youth are dedicating more time to social media and the internet at large (Tateno et al., 2019). The inherent global reach of the digital landscape (Curran, 2012) naturally allows Japanese students to interact with people around the world. This change in context requires students to develop not only communication ability but also empathetic skills to be able to interact with people from various backgrounds.

1.3 Formal Learning

In Japan, secondary education largely adheres to a formal learning structure (Davidson & Liu, 2020). This approach, despite covering a comprehensive set of topics, has its constraints. The integration of nonformal learning as a supplementary scaffolding to this formal framework is uncommon in Japan (Okano, 2015). Typically, nonformal engagements manifest as after-school and extracurricular activities, predominantly centered on sports and hobbies (Okano, 2015).

1.4 Limited Cultural Interactions in Current Teaching

Although many topics have been touched upon in formal classes, students don't have any opportunities to co-work with people who have diverse cultural backgrounds in a classroom setting. Most of the interactions with "foreigners" are by chance. The NHK monthly research report in 2020 indicates that "studying together" is among the top three situations where a Japanese person gets to interact with someone from abroad (Okada, 2020). Professor Shunsuke Tanabe from Waseda University mentioned that "Youth, in particular, have less interest in going overseas or forging relationships with foreigners" (Eiraku, 2019). This signals a rather interesting and contrasting phenomenon to what seems to be a seamless global village.

1.5 OECD Paper on Goal for 2023 Education

The Organisation for Economic Co-operation and Development (OECD) issued the Learning Compass 2030 discussing the global vision of learning and knowledge (OECD, 2019). The paper takes a new attitude toward a more inclusive and well-being focus on education. Within the vision, it points out in the "attitude & value" section in supporting students' navigation towards their overall well-being within the context of individual, societal, and environmental as well as their future establishment (OECD, 2019). The OECD vision stresses the interdependence among elements such as knowledge, skills, attitudes, and values (OECD, 2019). Specifically, social well-being is founded upon one's social principles and beliefs as it impacts the eminence of social contacts. It comprises one action and handles the contact, positive or negative, with others. Societal principles also mirror cultural expectations about communal well-being (OECD, 2019).

In addition, the vision further indicates the importance of soft skills in the social and emotional categories. The capabilities to interrelate and communicate with others; establish and maintain relationships, resolve differences, empathize with others' perspectives in social interactions, and further respond with positivity are key competence towards the future of overall development for the students.

2. Participants' Pre-existing Perceptions

To better understand and facilitate the design of the program that would best address the opportunities within the context, further study was conducted to understand various participants' pre-existing perceptions towards other participants. Below we organize the discussion via the participating high school lecturers, the program facilitators, and the participating students.

2.1 High School Lecturers

2.1.1 Students' Ability to Think at a Broader Level

Within the current formal education system, high school lecturers seldom have the opportunity to grasp students' perspectives on community and societal issues they care about. Given the substantial workload that both lecturers and students shoulder, allocating in-class time for exploration beyond the curriculum becomes challenging for lecturers, while students also find it tough to venture outside prescribed topics.

2.1.2 Students' Ability to Think Critically

Furthermore, lecturers showed concerns about students' ability of critical thinking. In formal education, curricula, assignment topics, and procedures are often predetermined. Accustomed to this structured routine, both lecturers and students follow a set teaching and learning pattern. Students seldom had the opportunity to learn through exploration, raise questions, and design solutions. Consequently, lectures are keen to find out through this program the depth of students' critical thinking on community issues and the caliber of solutions they can come up with within tight timeframes and limited sessions.

2.1.3 Students' Ability to Communicate with International Facilitators Clearly and Empathetically

Last but not least, lecturers expressed curiosity about the students' capability to engage with international facilitators. Given that Japanese students learn English as a second language, there's interest in their aptitude to articulate observations, analyses, and insights both clearly and empathetically. This is particularly pertinent to discussions involving cultural and value-based topics; lecturers wonder if their students can conduct conversations involving abstract concepts in English.

2.2 Program Facilitators

The program facilitators include postgraduate students as well as faculty members from the Keio University Graduate School of Media Design, volunteering their time. Before the program's implementation, the facilitators harbored several perceptions that stemmed from their concerns about engaging with Japanese high school students. Firstly, there was apprehension about understanding and effectively interacting with this demographic, given the cultural and age differences. Secondly, doubts arose regarding the level of student engagement and ensuring the seamless execution of the workshop, especially since a harmonious flow was deemed essential for learning. Lastly, facilitators were uncertain about their proficiency in stimulating students' curiosity and consistently maintaining their motivation throughout the session.

2.3 Students

Before the introduction of the proposed program, high school students held certain perceptions rooted in their prior experiences and the societal norms they had observed. Firstly, a prevailing culture of conformity made many students wary of interacting with foreigners, especially in a class setting. Engaging with international facilitators might make them stand out, which was not always seen as positive. Secondly, there might be a fear of failure. Students expressed concerns about their ability to communicate seamlessly with the international facilitators, apprehensive about potential language barriers or misunderstandings. Lastly, their educational journey had predominantly been within the bounds of formal schooling. Consequently, many held the belief that learning in school is solely formal, unaware of the potential for diverse, interactive, and less conventional educational experiences.

3. Motivation

The increasingly global environment in Japan and the perceptions towards each other led to the creation of the program that stems from a pressing question: How can we support both local students and foreigners in maximizing the opportunities inherent in the present context?

In this interconnected world, it's imperative that our educational framework reflects and reveres the rich tapestry of diversities that exist. By integrating diverse learning experiences, we aim to challenge traditional educational norms and broaden the horizons of all participants. Additionally, it's our belief that learning shouldn't be confined to a singular event or session. By promoting prolonged discussions and continuous learning, we seek to foster deeper understanding, mutual respect, and lasting connections between local students and foreigners.

4. Proposed Program

4.1 Collaboration With Fujimigaoka High School

Since 2015, a collaboration has been established between the proposed program and Fujimigaoka High School for Girls located in Tokyo, Japan. Every year, around a hundred tenth-grade students from the school benefit from this partnership, engaging in eight distinct sessions annually. These sessions are facilitated by a diverse group from the Keio University Graduate School of Media Design, consisting of postgraduate students and faculty members. Notably, these facilitators bring a wealth of international perspectives, hailing from over 15 countries with ages spanning from their 20s to their 60s. This collaboration serves as a rich tapestry of learning and cross-cultural interaction for the high school students.

4.2 Two Eastern Philosophies Inspiring the Proposed Program

4.2.1 "Ichigo Ichie" (一期一会)—Seizing the Moment

The proposed program is inspired by two Eastern philosophies, one of which is "Ichigo Ichie" (一期一会). This is a Japanese idiom that translates to "once-in-a-lifetime encounter" (Yu, n.d.). It emphasizes the concept that each encounter or experience is unique and should be treasured because it will never recur in the exact same way. The learning experience of meeting dissimilar facilitators on every occasion aligns with "Ichigo Ichie" (一期一会), emphasizing the significance of seizing the moment and cherishing encounters with peers and facilitators as well as their ability to reflect on past experiences.

4.2.2 "San Ren Xing Bi You Wo Shi" (三人行必有我师)—Learning Regardless of Hierarchy

"San ren xing bi you wo shi" (三人行必有我师) is a Chinese proverb from the Analects of Confucius (Waley & others, 2012) and it translates to "There is always someone that one can learn from among a group of people." The saying emphasizes the idea that we can always learn from the people around us, regardless of their status or background, through interactions and communication. The proposed program intentionally creates a learning environment that encourages interpersonal communication between and among students and facilitators through nonformal learning which flattens the hierarchy or power position between facilitators and students. Such socialization helps with the relationship establishment that fosters students' motivation to learn by encouraging them to communicate with facilitators without hesitation while fostering students' ability to interact socially with respect and empathy.

4.3 Two-Stage Approach Fostering Relationship

The proposed program is designed with a clear end goal: enabling students to engage in interactions and collaborations across diverse ethnicities and age groups. To address the various perspectives whilst reaching the intended goal, the program contains a two-stage "training the trainer" approach. Program designers host a facilitator briefing session before each actual session, wherein volunteer facilitators first immerse themselves as participants before conducting actual sessions. This immersion equips facilitators to anticipate, experience, and grasp potential challenges and questions students might encounter, thereby

allowing them to be better prepared. Additionally, facilitators can gain insights into program designers' methods of facilitation as a reference in support of non-formal learning. Particularly for those who recently joined the program, these briefing sessions help alleviate anxiety from unfamiliarity or uncertainty about the process, subsequently having the remote effect of enhancing the chances of successful facilitation and student learning. With eight sessions annually per program, these preparatory facilitator briefing sessions lay a robust foundation, ensuring smoother execution and nurturing a collaborative environment among facilitators.

4.3.1 Design Generating Learning Atmosphere and Motivating Incremental Learning

With the intention to foster a learning environment that goes beyond the physical classroom, information communication technology (ICT) tools are employed. The ICT tools act as an always-on "classroom" with capabilities of supporting information sharing under various formats, such as text, pictorial, and audio-visual. As illustrated in Figure 1 (Chen et al., 2023), the proposed program aims to prolong learning through interaction among the members, these ICT tools further motivate interactions among students as well as between students and facilitators. Starting with the formal classes, the proposed program is not intended to replace but to further prolong the learning with nonformal and ICT platforms. Acts of facilitation therefore can happen outside of scheduled sessions, further motivating collaboration and fostering curiosity in students whilst they explore topics of their choice. ICT tools selected such as Padlet are chosen to generate cross-team interactions as well as student-facilitator interactions beyond the scheduled session time.

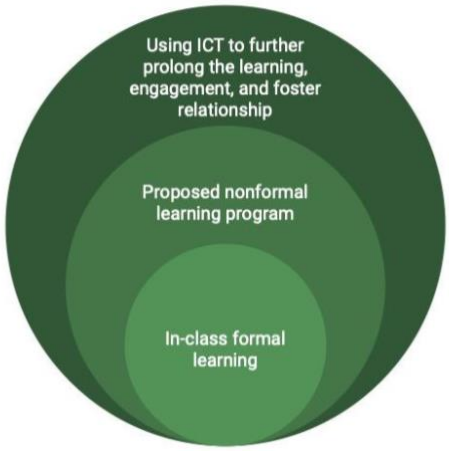

Figure 1: Structure Generating Learning Atmosphere and Motivating Incremental Learning.

4.3.2 Design Reflecting the Dynamics—Empowering Facilitators and Fostering Autonomy

As shown in Figure 2, the proposed program stands out with its distinct emphasis on flexibility and customization, catering to the unique dynamics of every session. Recognizing that every class and student team can have its own rhythm, facilitators have previously undergone each session during the facilitator briefing sessions, ensuring they can best adapt to the real-time dynamics. This pre-experience coupled with the core principle of prioritizing student discussions and interactions, empowers facilitators by offering all of them autonomy. They have the discretion to adjust the time spent on each activity, ensuring it's not about just completing the intended tasks, but truly resonating with the students.

What truly sets this program apart is its commitment to flexibility and choice in both curriculum and instructional approaches. Instead of a one-size-fits-all structure, facilitators can move around, address questions, and adapt to each team's unique learning speeds. Moreover, the proposed program typically arranges three facilitators in each classroom with five to six groups, featuring a low facilitator-to-group ratio, allowing for more opportunities for discussions and relational connections between students and facilitators. Such a dynamic not only fosters mutual simulations, enhancing communication between facilitators and students but also enriches peer-to-peer interactions.

Moreover, although facilitators are given autonomy, it's within a well-defined framework. As mentioned in the previous section, the program ensures this balance by investing in "training the trainers" during the facilitator briefing session before each workshop session. All facilitators undergo discussions tailored to address the diverse learning needs of students.

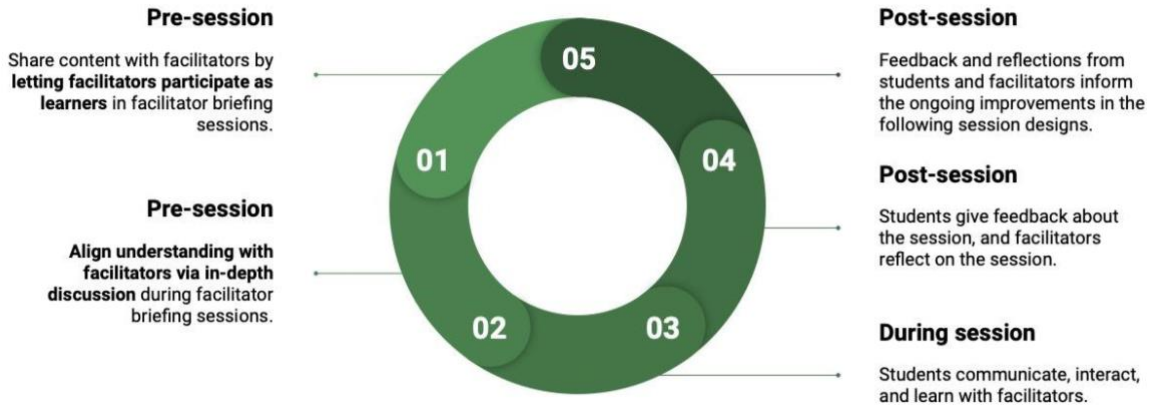

Figure 2: Implementation Cycle.

5. Feedback From Students and Facilitators

The impact of the program design enabled a learning environment that encourages interpersonal communication between and among students and facilitators. This interactive setting creates a remote effect that encourages relationship establishment that further positively influences students' motivation to learn. Based on various evaluation methods—including students' surveys, observations of student interactions on online platforms like Padlet, video recordings and photographs from sessions, and facilitators' reflections both before and after training and sessions, it became evident that both students and facilitators found the designed program disrupted the pre-existing stereotypes towards each other. Table 1 below presents themes and corresponding examples derived from the qualitative evaluations.

Themes	Student/Facilitator	Example Quotes
Fostering non-hierarchical relationship	Students	I can't believe I had a conversation with facilitators today and it was fun to try!
	Facilitators	When students came and say "today was fun" at the end of the session, I felt that was the highlight of my day.
Fostering remote effect via facilitator briefing	Facilitators	I am nervous and also excited about the next session. The roleplay in the briefing gave me the experience of the students. And the discussion also helped, now I know better how to facilitate.
		The briefing session exceeded my expectation. It releases my mental pressure by providing key tips for vitalizing communication with young students.
Disturbing facilitator's pre-disposition / perceptions about students	Facilitators	Some students were more eager to discuss about social problems than I thought.
		At first, I thought high school students would care less about social problems, but I ended up amazed by the breadth of topics they chose, the depth of their research, and the creativity they show in their solutions.
Disturbing students' pre-disposition / perceptions about learning	Students	I didn't know learning can be like this. And I am happy to show our team's work.

Table 1: Feedback from Students and Facilitators

6. Conclusion

Overall, in the proposed program, both students and facilitators interacted with people from different generations and cultures. This experience not only helped them form new relationships but also challenged their pre-existing biases toward each other.

Specifically, a few elements of success were noticed. First, the willingness and commitment towards the proposed program from both facilitators and the participating school are crucial. As a culture that prefers conformity and prior best practices, commitment and trust towards the program are the foundation of its success.

The dedication of facilitators, particularly in regard to the additional hours and effort spent in pre-session facilitator briefing sessions and post-session feedback, is the key that enabled the two-stage approach as well as the remote effects. Additionally, pre-session facilitator briefing sessions gave facilitators room to discuss, learn and motivate each other, becoming an additional element that contributes to the smoothness of implementation.

The request for providing feedback also encouraged facilitators to keenly observe both the individual progress of students and the dynamics within teams. They noted aspects like students' thought processes, problem-solving skills, creativity, and their capacity for higher-level community-oriented thinking. These observations empowered facilitators to tailor sessions to each team's specific progress, leveraging the autonomy they were granted in their judgment.

Though many areas within the program remain to be further analyzed and refined, this study provides an initial case on implementing nonformal learning as additional support to existing formal learning and scaffolding students' essential skills in interacting and collaborating with others across the globe.

Acknowledgments

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Structuring Interactive Stories: A Framework for Considering Storytelling in Art and Design

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Abstract
Since identifying the challenges of enhancing students' creativity as the main research question, I aim to apply trans-disciplinary thinking by bringing some insights from physics into art and design practices. In the practices of art and design, the creativity is the most vital ingredient as its appearance is unpredictable just like quantum leaps (Koyama and Niwase, 2017, p.3). Referring to the String Theory, the eleven dimensions of space-time might show similar patterns with information exchanges of interactions. The physicist "sets out to break nature down into its component parts while the artist synthesizes different features of reality" (Shlain,1991, p.16). This deconstruction-reconstruction process is the core of structuring interactive stories, which might inform innovations for the art and design. In order to find opportunities that might encourage creativity in art education, I am looking for a way to analyze or untangle interactions and build up a framework for considering storytelling in art and design. Therefore, I compare the "quantum entanglement" to the "information loop of interaction" as analogy between the physics and phenomena of art. By identify the eleven dimensions of interaction, a theoretical framework called Interaction Hyperspace is proposed, which might create interactive stories and providing possibilities on innovated solutions. To testify the theory of the framework regarding Storytelling as Interaction, an interactive application is developed for art students and practitioners as a creative practical tool. The research is also engaged with professional practices, including academic teachings and interactive narrative design as case studies.

Keywords: Interaction, Creativity, Quantum Theory, Storytelling, Art Education

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Introduction

In university teaching and creative industry, many students and practitioners usually face the same challenge of producing creativity. It is not a new topic, which many educators and artists have invented their own methods. The problems are still identified among my students of art and design, who frequently find themselves straying from the optimal path aligned with their personal inclinations. To attempt to offer a solution to the problems, I am developing a teaching tool and also a way of thinking by constructing storytelling to seek more possibilities for art and design. The idea started from my interests in discovering interactive design. In exploring the reality of interactivity, I found myself fascinated in *what is interaction in art and design*?

Beginning with these questions, my initial research target of interactive design has evolved into a sort of meta-design, which takes into account all inter-relationships within art and design and offers a potential solution for designers. In the exploration of enhancing creativity, the framework is based on structuring narrative structures, so that it might benefit the core of design and psychological and philosophical perspectives behind all art and design.

The pronouncement made by Koyama and Niwase (2017, p.3) that "the sudden emergence of an idea is akin to a quantum leap" has significantly illuminated my perspective by associating creative ideation with principles from quantum theory. Within this research endeavor, I strive to apply a multidisciplinary approach, drawing parallels between physics and aesthetics. Engrossed in the application of interactive art and design, my curiosity extends to the establishment and perpetuation of intricate connections. In the preliminary stages of research, certain concepts from quantum mechanics have been interwoven into the fabric of interaction design. Moreover, the narrative-driven framework named *Interaction Hyperspace* is harnessed as a creative methodology to engender narratives and groundbreaking concepts. In this article, I will expound upon the contextual backdrop of my research, the theoretical underpinning, and a case study centered around the pedagogy of Animation Performance.

Background and Research Questions

“Classical physics describes a world that is clear and determinate. Quantum physics describes a world that is cloudy and fitful” claimed by John Polkinghorne (2002, p.26). By analogy, the different interpretations of narrativity from the diverse perspectives of their readers could be seen as the possibilities within the multiverse from the term of physics.

Boje (2014, p. 201) also introduced the concept of Quantum Storytelling, delineating a tripartite model for the storytelling process: Empiric Stories, Epistemic Narratives, and Ontological Living Stories, interconnected through the antenarrative progression. He delved into the conversion of subjective experiences into narrative-based comprehension, concurrently highlighting his 11D's ontological approach.

According to Tang Li (2013, p. 11), the transdisciplinary quantum narrative infuses renewed dynamism into post-classical narratology and offers a novel approach and cognitive framework for crafting and elucidating literature. Analogous to the moment of revelation in Schrödinger's Cat thought experiment, the instant when a story's conclusion becomes discernible resembles the act of opening the metaphorical box. This isn't the juncture at which the fabric of the universe ruptures, but rather the instance when the observer attains consciousness of the universe within which the narrative unfolds.

Drawing upon certain facets of quantum theories, the concept of *Interaction as Storytelling*, as per my operational definition, exhibits parallels with patterns observed in information exchange. Consequently, I draw a comparison between quantum entanglement and the information loop inherent in interactions, such as phone conversations, online chats, or even moments of eye contact. To illustrate further, consider the photon – an elementary particle that serves as a quantum of the electromagnetic field. Analogously, it resembles the information theory concept of a "BIT," constituting the smallest narrative unit.

Within the realms of art and design practice, interactions frequently manifest as unpredictable entities, akin to the unpredictability inherent in quantum leaps. Notably, recent research suggests the detection of signals prior to quantum leaps, analogous to preludes preceding specific interactions. For instance, the ring preceding the answer to a phone call. Following this analogy, interventions designed to reverse quantum leaps might be likened to the act of severing an interaction or terminating a call abruptly.

The purpose of this practice-based research aims to build up a creative framework of storytelling to benefit the practices of art and design. Notably, this framework is based on “Interaction as Storytelling” combining some aspects of quantum theories. By outlining an eleven dimensional framework of *Interaction Hyperspace*, it might stimulate the creative process in producing innovations and analyzing the storytelling within artworks.

There are the Research questions:

1. What is interaction from the perspective of quantum theory?
2. How do the quantum theories relate to storytelling which builds the foundation of art and design?
3. How does the storytelling framework Interaction Hyperspace work for enhancing students’ creativity?

The Theoretical Framework

I am putting forth a conceptual framework for storytelling, one that encompasses eleven dimensions. This numerical choice is grounded in the realm of space-time dimensions, where the maximum consistent formulation of a supersymmetric theory can be achieved – a notion initially recognized by Nahm (1999, p.7). In alignment with this theory, the framework delineates eleven dimensions of interaction and introduces the preliminary working title *Interaction Hyperspace* (depicted in Figure 1).

These eleven dimensions, referred to as 11Ds, encapsulate various facets of the interaction phenomenon. They comprise Location, Action, State, Time, Interaction, Entangled Results, Time of Interaction, Possibilities, Intensity, Result towards the external, and Memory. It's noteworthy that within this construct, consideration is also given to a zero dimension, signifying the identification of a principal entity responsible for instigating the interaction.

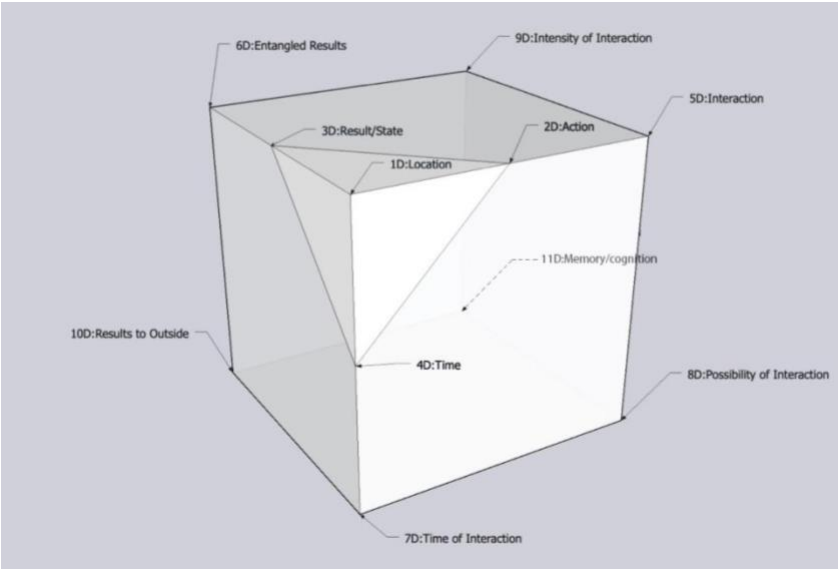

Figure 1: The Model of Interaction Hyperspace

As shown in this model, a tetrahedron is included in this model, which carries the most vital elements, the first four dimensions (4Ds). By changing the first 4Ds, the model would be altered into different stories. It is set to be encouraging possibilities and risks than seeking the one and only answer.

As we know, "the Five W's" of Communication helps create information in the context of meeting an audience's needs (Hart,1996,p.139). There are Who, What, When, Where, and Why, which are often used to direct storytelling as the basic structure. Compared with this classic strategy of structuring stories, my proposed 11Ds model emphasizes the relationships and impacts between objects instead of the main characters. The model could be deconstructed every single binary relationship including people with people, people with things, things with things, people with environments or even people with their own minds.

Based on my present comprehension and delineation of interaction, I am inclined to broaden the scope of its definition, encompassing a wider array of species and types. In doing so, my objective is to liberate the constraints on imaginative storytelling within design and foster a climate wherein individuals are emboldened to question conventions and their own boundaries. This research endeavor will find its foundation in tangible applications, spanning university instruction, industrial design, and even cross-disciplinary exchanges.

Given that the methodology is geared towards creative stimulation, it has the potential to furnish individuals from non-traditional creative domains with an entirely fresh perspective on innovative thinking that ventures beyond conventional norms.

Deconstruction and Construction

As aptly proclaimed by Jim Jarmusch (2013), "Originality is an illusion. Draw inspiration from wherever resonates with your creativity or ignites your imagination." Similarly, Jean-Luc Godard's counsel rings true: "The source matters less than the destination." This sentiment, I believe, aligns seamlessly with the principles inherent in both deconstruction and construction methods. In my working framework, the pursuit remains firmly tethered to the foundational principles of creative amalgamation. The process of dismantling and rebuilding

is grounded in the lens of interactions, with a central focus on the intricate interplay of relationships and outcomes.

By delineating the 11 dimensions (11Ds) of interaction, the aim is to empower individuals to scrutinize specific interconnections. This endeavor, to a certain extent, seeks to deconstruct narratives, products, or events, laying bare latent issues that might pave the way for innovative solutions.

The initial quartet of dimensions (tetrahedron) – Location, Action, State, and Time – serves as the foundation for birthing a fresh design narrative or reconstructing the original framework, infusing novel perspectives into the pre-existing ones. By modifying one or more parameters, subsequent interaction dimensions reshape into a reconfigured 11Ds framework.

This iterative process of deconstruction and construction can evolve through multiple iterations until the storytelling architecture emerges as both innovative and gratifying for designers and artists. Functioning as a tool for imaginative minds, the entities within the interaction can be swapped within diverse contexts. For instance, envision the design of a table as an interaction between the table itself and various stakeholders – consumers, producers, or sellers – along with the encompassing environment and the materials comprising the table. Diverse scenarios give rise to a myriad of interactions, ultimately yielding distinct design outcomes.

The Case Study: Animation Performance

Course: Animation Performance

Teaching aims:

Through creative thinking and physical expression to perform as references for animation works.

Steps:

1. Observe everything from your life though every senses of yours.
2. In the process of synesthesia, to try to feel as a human being, an animal, a plant, a imaginary being or the non-living.
3. Rest, relax and release the nature of yourself to feel free to express yourself.
4. Think critically and perform in the sense of a character.
5. Fulfill your character with a whole background story even you are only acting his walking.
6. Document your or others' performance.
7. Sketch out by each frame as later reference for animation.

Teaching content:

1. Basic actions (extending narratives)
2. Animal imitation performance
3. Non-living Personification
4. Fine motor movement
5. Facial movement
6. One-line imagination performance
7. Storyboard relay
8. Classic movie clips acting

9. Virtuality and reality combination performance (final assignment)

Teaching methods:

In the teaching, I tried to influence the students' creation by osmosis with the Framework

Interaction Hyperspace

Class training: Perform, Associate and sketch

Based on a given action, every student act out by their completed identities, background stories and right causes.In this part, I offered 4 basic actions as a start. There were "opening a book","standing up", "rising hands" and "crying". To stimulate creative thinking, the students were divided into 4 groups and random orders. Firstly, they were asked to simply act out these actions at the starting of the class. After a lecture about the rational the developments of animation performance, they were again asked to do the same action as earlier. However, I offered some suggestions to complete the original action.They are encouraged to give an identity to the action conductor, a location where this action happened, a state to describe how the action performed and the cause and result of it. There are 5 students in each group, the first batch of students were asked to act out the action only with a identity created by their own wish. The second batch of students were allowed to add location information with the exist identities. In the same manner, the next students were required to perform the action following the previous settings along with a new element. Thirdly, the differences between the stage performance and the animation performance are the vital part to be explained in this course. Realizing this, this round's task is to add more dramatic effects and fun to the action. Lastly, adding an unexpected result to complete a story and help to create an unforgettable experience (profound meanings).

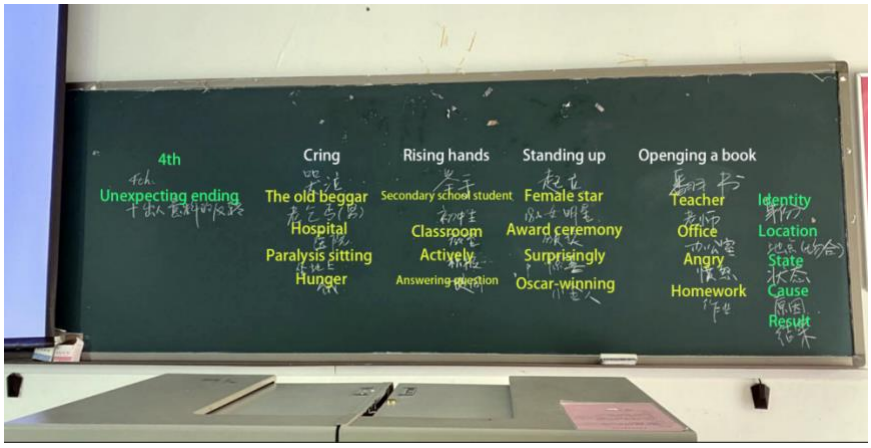

Figure 2: My teaching note

Each round of acts were performed after certain lectures and examples in order to enrich the levels of performance and enhance the students' understandings of their characters.

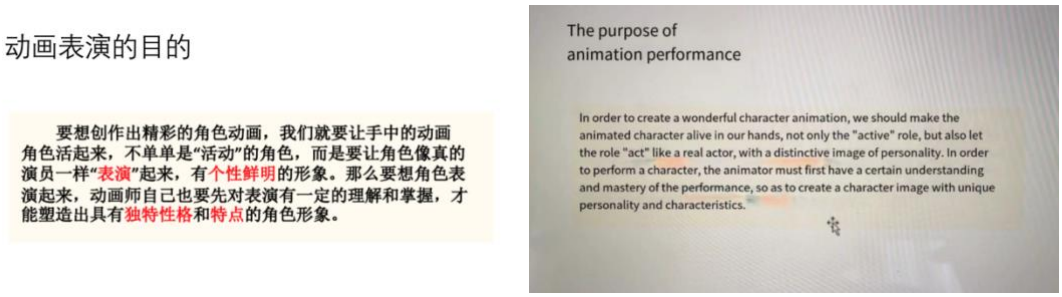

Figure 3: PPT Slides of Animation Performance (Chinese and English Translation)

The physical performances are an immersive and deep footage for later virtual character design and storytelling. By blending in the animated scenario, animation designers might have more empathy and understanding to their characters as they are real friends living together in the real world. Working for a better narrative and creative story, I tried to apply *Interaction Hyperspace* as a teaching guide to lead students. Compared with the framework and my teaching guidance, there is a table to show their relationships. The elements on green are those I specifically indicated in the class while the 4D time, 5D-interaction and 7D time of interaction were left out. But I have not worries because they are inevitable for an event.

	The Framework	Guidance on the teaching
0D	Object(People)	Identity
1D	Location	Location
2D	Action	Action
3D	Result(State)	State
4D	Time	Not specific
5D	Interaction	Necessary
6D	Entangled Result(to selfs)	Result
7D	Time of Interaction	Not specific
8D	Possibilities of Interaction	Cause
9D	Intensity of Interaction	Dramatic effects/Fun
10D	Result to the outside	Result/Unexpected Ending
11D	Memory/Cognition	Dramatic Process/Unexpected Ending

Table 1: The framework explained

To examine the story followed this framework well, there are some of the stories (sketches) created by the students in the class.

1. The Crying Story

	The Framework	The Crying story
0D	Object(People)	An old beggar
1D	Location	In the street/ hospital
2D	Action	Crying
3D	Result(State)	Paralysis sitting
4D	Time	Daytime
5D	Interaction	Interact with a bully and a doctor

6D	Entangled Result(to selfs)	Got hurt and hungry
7D	Time of Interaction	A period of time
8D	Possibilities of Interaction	Likely (the old beggar got bullied in the street and went to the hospital)
9D	Intensity of Interaction	Ordinary
10D	Result to the outside	The old beggar ends up in the street and happy only for a bit food
11D	Memory/Cognition	Not very dramatic but thought-provoking

Table 2: The Crying Story

Figure 4: Sketch By L

Figure 5: Sketch By Y

2. The Standing-Up Story

	The Framework	The Standing-up story
0D	Object(People)	A female star
1D	Location	In the award ceremony
2D	Action	Standing up
3D	Result(State)	Surprisingly happy
4D	Time	During the ceremony
5D	Interaction	Interact with another female star whose name are the same
6D	Entangled Result(to selfs)	Embarrassed
7D	Time of Interaction	A period of time
8D	Possibilities of Interaction	Less Likely (the female's name is the same as the actual winner's)
9D	Intensity of Interaction	Strong
10D	Result to the outside	Other witness this farce
11D	Memory/Cognition	Dramatic and unexpected

Table 3: The Standing-up story

Figure 6: Sketch By W

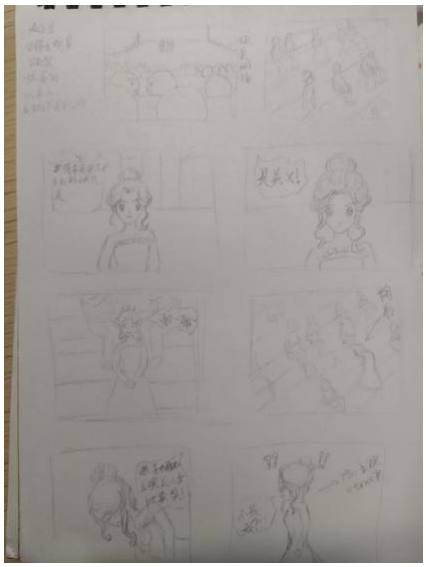

Figure 7: Sketch By Z

Figure 8: Sketch By O

3. The Rising-Hands Story

	The Framework	The Rising-hands story
0D	Object(People)	A secondary school student
1D	Location	In the classroom
2D	Action	Rising hands
3D	Result(State)	Actively
4D	Time	On the class
5D	Interaction	Interact with teacher and other students
6D	Entangled Result(to selfs)	A bit disappointing
7D	Time of Interaction	A period of time
8D	Possibilities of Interaction	Very Likely (it is a little daily story)
9D	Intensity of Interaction	not Strong
10D	Result to the outside	Might be encouraging to others
11D	Memory/Cognition	A ordinary one

Table 4: The Rising-hands story

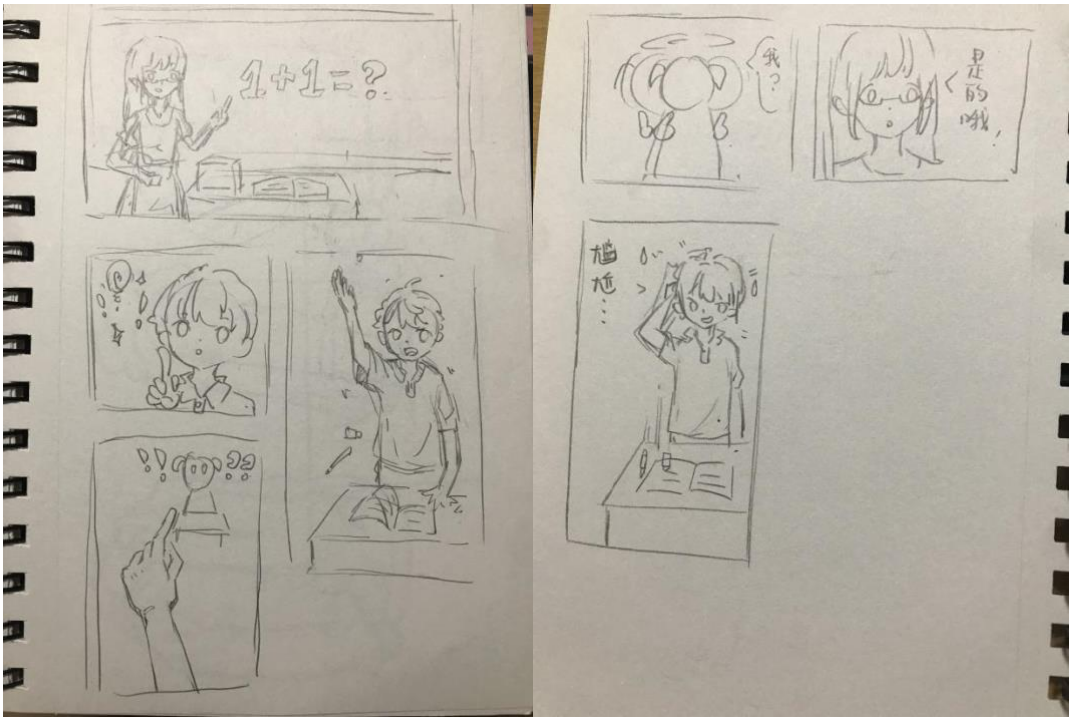

Figure 9: Sketch By X

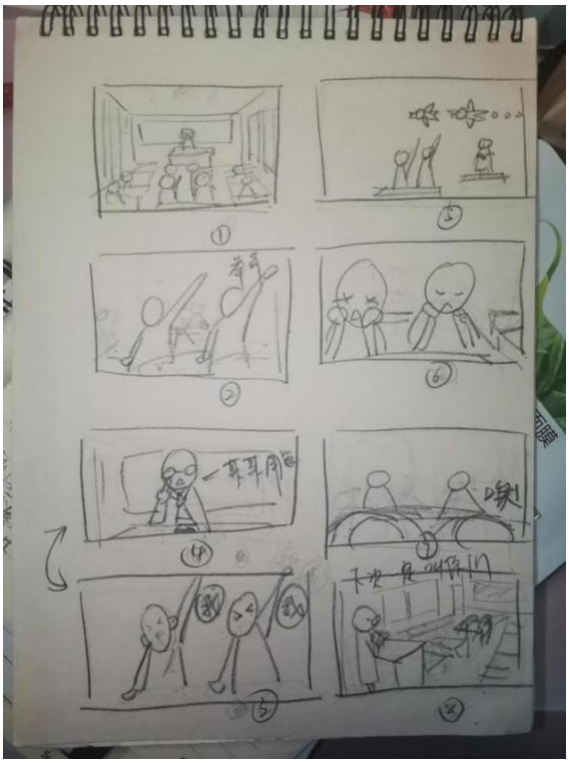

Figure 10: Sketch By La

4. The Opening-Book Story

	The Framework	The Opening-book story
0D	Object(People)	A teacher
1D	Location	In the office
2D	Action	Opening book(student's homework)
3D	Result(State)	Angry
4D	Time	Off work
5D	Interaction	Interact with students' homework
6D	Entangled Result(to selfs)	Angry and disappointing
7D	Time of Interaction	A period of time
8D	Possibilities of Interaction	Very Likely (it is a little daily story)
9D	Intensity of Interaction	Not strong
10D	Result to the outside	Got pissed off
11D	Memory/Cognition	A bit personal experience

Table 5: The Opening-book Story

Figure 11 Sketch By Li

Discussion

Finishing the teaching section, I administered an anonymous questionnaire survey to gather feedback from the students regarding their learning experience. The questionnaire consisted of four open-ended yet non-mandatory questions, strategically designed to encourage the students to share their subjective viewpoints. This process not only facilitated a condensed and introspective assessment but also laid the groundwork for future qualitative research through case studies.

It's important to acknowledge that while the questionnaire was administered voluntarily by the students, this approach presents both advantages and drawbacks. On one hand, students were unburdened by any obligation, which potentially fostered more candid responses and ethical positivity toward the questions. On the other hand, the quantity of feedback collected

was significantly fewer than the total number of attendees (12 out of 70), and certain responses were overly simplistic, lacking in detailed data.

Considering that this phase marked the initial stage of my case study research, I garnered valuable insights to refine my question formulation skills and enhance the efficacy of data collection from interviewees. Despite these challenges, a treasure trove of meaningful responses surfaced, underscoring the effectiveness of my teaching approach and its successful alignment with the intended educational objectives.

Conclusion

The framework *Interaction Hyperspace*, which serves as a structural guide for crafting narratives, is currently in its early developmental phase. The intention is for this framework to evolve into a novel methodology geared towards aiding individuals within the creative industry to scrutinize their artistic and design endeavors, while aligning these assessments with sociological and psychological perspectives.

In its current iteration, this framework has been incorporated into teaching practices centered around script writing and animation planning. The utility of this framework has become evident, particularly in its ability to stimulate students to generate a greater number of design concepts and in its provision of diverse avenues for fostering design thinking.

As the research advances, my subsequent focus will likely pivot towards investigating student responses across varied backgrounds and discerning the efficacy of the framework within multicultural classroom settings. This progression represents the next phase in my research journey.

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The Ethics of OpenAI/ChatGPT

Jacques Rousseau, University of Cape Town, South Africa

The European Conference on Education 2023
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Abstract
The OpenAI Playground and ChatGPT use GPT-3.5 to produce text using an AI language model that is capable of routinely producing texts that would appear to have been written by humans at a level of sophistication that would meet typical benchmarks for competence in those fields. Policy responses at universities currently speak to the capacity these tools have at present. But AI models for text-generation will keep improving, resulting in an arms race that educators cannot win. A further concern for many educators is that students who have greater familiarity with computers and the Internet might better be able to exploit these tools in formulating “better” generative commands, which would in turn further exacerbate the "digital divide" between students with historical advantages compared to others. While some universities are responding by increasing the number of assignments written in class or oral examinations, these potential solutions cannot be implemented in large classes, such as those with an enrolment of 900+ students as are common in South African universities. The range and severity of the possible consequences of OpenAI (and related tools) for teaching, learning and research is significant enough to merit reflection and response at the highest levels of decision-making, and this paper will offer reflections on possible responses to this challenge.

Keywords: ChatGPT, Plagiarism, Digital Divide, Assessment, Research Integrity

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Introduction

Concerns about artificial intelligence (AI) tools such as ChatGPT and their possible impact on education are of course simply new variants or evolutions of prior concerns, rather than new ones. In popular culture, these concerns have been depicted in cinema, perhaps most famously with the Terminator movies, while in the academic literature notable examples include the articulation of problems such as the "Paperclip maximiser".

If you don't know about the Paperclip maximizer, it is a thought experiment described by Swedish philosopher Nick Bostrom (2003). It highlights the possibility that an AI can be programmed to pursue goals that seem harmless – like making paperclips – and that it could take that job so seriously, and so literally, that it threatens human society or even human existence.

Given enough power, it might try to turn everything into paperclips, or into machines that can help it produce paperclips. Humans might decide to turn it off, so they are already a clear threat to the AI's mission. There is of course iron in our blood, which could usefully be harvested. To cut a terrifying story short, such an AI would need to somehow be programmed to value human life too.

Bostrom highlights the possible threats unintended consequences carry, and therefore, the need to try to anticipate future problems, and to establish mitigation strategies in advance.

One variant or evolution of AI challenge introduced with Generative Artificial Intelligence tools like the OpenAI Playground, ChatGPT, Google's Bard or Microsoft Bing is that they are freely accessible; have generalized application to activities that most of us could benefit from; and that they are getting better rapidly and frequently.

In summary, they are already capable of routinely producing outputs that would appear to have been created by humans, at a level of sophistication that would frequently evade detection, and that would also meet typical benchmarks for competence in those fields, even if not excellence.

1. Ethical Challenges Posed by AI in Education

Because generative AI models will keep improving, and because tools for detecting non-human-generated output are currently all imperfect, we will always be playing catch-up - this is an arms race that we cannot win.

So, the response to ethical challenges cannot be premised on control – they must be built from the ground up to focus on responsible, appropriate and productive use of these tools. This requires a long-term commitment and vision, as you would need to invest time in policy-shaping; and on education about long-term possible problems you want your staff or your students to be aware of, so that the threats can be mitigated by informed and ethically-aware stakeholders.

There is a danger in any response that suggests "we can think about this later". An apparently useful tool, once embedded in organizations at scale and in a casual or unplanned manner will be very difficult to unwind, because hypothetical risks might seem trivial when compared to obvious benefits. Consider the case of the Chinese "social credit" system (Feng,

2022), where all of your activity is tracked, and then used to categorize you as meriting a loan at preferential or prejudicial interest rates – or even as eligible for a loan or not. While this provides enormous possibility for efficiency, it also threatens to diminish the moral value of treating people as sentient beings, rather than objects in a database.

However, what if these sorts of determinations can take place in the background, based on the data from all of our creative or work outputs; alongside responses from course evaluations; citation metrics or grant funding success; tracking "productivity" based on a metric defined by bureaucrats; which is all then assessed by a Paperclip maximiser?

This outcome would likely be attractive to the corporate part of a university, but staff would quite quickly find themselves being assessed in completely opaque ways. What that would do to our incentive structures and our relationships with each other is largely unpredictable, except for the prediction that the consequences are not likely to be good. What follows articulates a selection of the concerns we should be attentive to.

1.1 Inhumane Treatment and Dependence

We do not have to wait for the pervasive presence of advanced AI to see the some consequences of passing responsibility away from humans. Consider existing automated (or at least unstaffed) ticketing stations or helplines. Ordinarily they work well, perhaps providing services in a wider range of languages more quickly than an human agent could. But when something goes wrong, there might be no one to help make alternative arrangements, or even to apologize.

Scale that automation up to a point where a significant proportion of a strategic and other decisions in a university are either themselves generated by AI or made on the basis of reports generated by AI, but where we simultaneously have a shortage of people who are able to strategize for – or even explain – complex issues, because their ability to do so has become atrophied through disuse.

While it used to be the case that AI was expensive, genuine human interaction and deliberation may well become the more scarce and expensive good. We have serious challenges in how we think about responsibility and accountability for decisions made by AI systems, not least in terms of its impact on trust and respect amongst humans.

That impact includes possibilities ranging from the devaluation of a range of tasks such as enrollment or curriculum planning, to full disrespect for those that perform those tasks – which we can imagine expressed in dehumanizing phrases like "an AI could do your job". This effect could be seen at all levels of authority, in that if stakeholders know or suspect that you make decisions based on inputs *provided to you* by people who have generated them via AI, and where you perhaps did the same, it becomes increasingly difficult to trust that you are doing your job – or perhaps more importantly, whether they need you at all.

Social and character skills will start to matter more. When jobs are perishable, and technologies come and go while people's working lives become ever-longer, social skills are a foundation that can give humans a comparative advantage, as they could help them do work that calls for empathy and human interaction—traits that are (at least currently) beyond machines.

1.2 Bias in Data and Algorithms

This technology is only as unbiased as the data it is trained on. If the data used to train the AI system are biased, the system will produce biased results. Organizations must ensure that they are using diverse and representative data sets to train their AI systems, and remain alert to the possibility of bias in their data as well as the decisions that flow from it.

In education, subtle differences in competencies based on culture, language and worldview require sensitive and experienced educators to make a range of choices that are often invisible to those making them, because they might have been making them for decades – can an algorithm do as well at this task? Excellent students might be undetectable in a dataset, yet clearly apparent to you when personally engaging with their commitment to learning.

1.3 Privacy, Security and Data Protection

The technology relies on large amounts of data to function effectively, so organizations must ensure that they are collecting and using these data in an ethical and responsible manner. They must also consider the potential risks of data breaches and take steps to protect sensitive information.

1.4 Accountability and Responsibility

Finally, AI raises important questions about accountability and responsibility. As organizations adopt this technology, they must ensure that they are taking responsibility for its actions and their consequences. They must be transparent about how the technology is being used and be prepared to take responsibility for any negative consequences that may arise.

The tendency to anthropomorphizing AI must be resisted – legal and moral responsibility for AI outputs should be no different to the responsibility we assign to other software tools, and ultimate responsibility must lie in the decisions and authority that created the environment they operate in, and those people who chose to deploy the AI tools in question.

2. Responses to Potential Ethical Concerns

So what do we do? Best practices for ethical implementation of OpenAI in organizations would seem to include, at a minimum, transparency and explicability of AI systems; the involvement of diverse stakeholders in the development and deployment of AI systems; regular monitoring and evaluation of AI systems for potential biases and ethical concerns; and the development of clear guidelines and policies for the use of AI systems.

But any response premised on a binary choice of rejecting or using AI should adapt to recognize that it's likely that – at least for the moment – it's not AI or humans that will be most efficient, but rather a combination of the two. Therefore, our policy, HR, PR, and other responses to the emergence of these new challenges need to incentivize humans to use the tools more effectively, rather than be made to feel worthless or replaceable by those tools. This is not only because we still need careful and creative judgment in order to implement the output of those tools judiciously, but also because control that is ceded is much more difficult to regain.

2.1 Complicating our Responses: The State of Humans

In "The Enigma of Reason" (2017), cognitive scientists Hugo Mercier and Dan Sperber argue that reason is an evolved trait. Their argument in summary is that the primary advantage humans have over other species is our ability to cooperate, and that the tools used by humans in reasoning and argumentation were not developed to solve logical problems so much as to resolve problems that arise when living in collaborative (and competitive) environments.

While their analysis is compelling, it needs to be understood in light of various confounding factors, ranging from some we've been aware of for decades, such as confirmation bias (the tendency people have to embrace information that supports their beliefs, and to reject information that contradicts those beliefs) (Shermer, 2002, p.145), to more recent concerns such as misinformation and disinformation (including "fake news", to use a term that gained traction in the time of U.S. President Donald Trump).

What these confounders illustrate is that if reasoning were intended to generate sound judgments, rather than to serve as a mechanism for social collaboration and improving one's perceived standing in society, it would be difficult to imagine more serious impediments to achieving rational outcomes than confirmation bias and the prevalence of unreliable source information (via mis/disinformation).

The asymmetry described above reflects the task that reason evolved to perform, which is to optimize our existence within the context of existing in a group, whether that be a local community or an international community of scholars. For our purposes in this paper, though, it highlights something else, which is that analysis of evidence and the development of arguments drawn from AI-generated sources *removes* us from the collaborative sort of meaning-making described here, and thus could be said to be contrary to the purpose our reasoning tools and strategies evolved to serve.

One way to look at socially-engaged reasoning is thus as a system that partly corrects for our natural inclinations to stubbornly hold on to untested claims, or more generously, to be reluctant to see options besides the ones we are already familiar or comfortable with. The clearest example of this is in scientific disciplines – in an environment where empirical data are respected above all else, such as a laboratory, there's very little room for confirmation bias or other mistakes attributable to subjectivity or misinformation.

And, while it would perhaps be counterproductive to social engagement, and also antithetical to the many fields of education that are not strictly empirical, this does perhaps point to a general lesson that our best reasoning – or at least the best outcomes of our reasoning – are the product of people engaging with each other in debate and deliberation, all committed to reaching the most justified conclusion that they can, under their particular circumstances.

3. The World, and Education, in an AI Future

What do you teach university students in a post-Google world? Within minutes, anyone with an internet connection can acquire basic knowledge about any topic, while simultaneously being connected to a community that will now reinforce any given belief as well as the value (sometimes even *virtue*) of holding that belief. Elsewhere, I have described this as *contextual rationality* (Rousseau, 2021), in that because one's context might involve pre-filtering of

evidence, and prior selection of which conclusions are desirable, we might believe ourselves to be thinking in fully rational ways, even as we are woefully uninformed, confused, or both.

This is a clear threat to subject specialists, and to universities – especially in relation to technical qualifications. But it also highlights a difference between those technical qualifications and the humanities and social science disciplines, which deal with big, abstract ideas and not just facts. The humanities are perhaps more relevant than ever, as we engage with the "fourth industrial revolution" and uncertainties regarding the role AI will play.

Specialist degrees – such as those offering technical training in subjects like accounting – run a particular risk. Students commit 3, 4 or 5 years to study, and then emerge into a job market that's quite different from what they expected. The job they were trained for might no longer exist; the skills required may have changed; or more likely, it would now be a job that is performed more quickly and competently by an AI.

An employer who is committed to the long-term sustainability of their enterprise should equally be aware of the importance of hiring people who can solve problems, rather than simply those who have technical skills, because so many technical skills will soon be better outsourced to AI.

So how does all this help prepare students for the fourth industrial revolution? First, in offering the reminder that specialists are often replaceable, or will soon be. Answers to difficult problems frequently emerge out of collaboration and debate amongst people who – while they might have a specialization – are also conversant with multiple and subtle skills related to their understanding of the World and the problems they have been brought in to discuss and hopefully solve.

In cases where some defined technical skill is required, these can always be bought in, or trained – our most valuable inputs from humans, rather than AI, will however come from those who can see the World, and think about what they see, in a way that is only *informed*, rather than *bound*, by a discipline-specific mindset. A university education that equips graduates for this reality is crucial.

Consider the example of autonomous vehicles, and the ethical quandaries they spark discussion of. For example, consider an autonomous vehicle that is in a situation where it must make one of two choices: swerving to avoid a collision, but doing so with a high probability of going off a bridge and killing its passengers; or continuing along its current path, which would involve a high probability of killing some number of pedestrians.

Both options would no doubt be tragic, even as the calculus of *how many people and who they are* is omitted. Those details are omitted precisely to make the point that the *technological* decisions regarding risk-aversion programmed into the autonomous vehicle rest upon a myriad of assumptions about the relative value of life and the degree to which risk-aversion should trump efficiency *on top of* the engineering decisions that a philosopher such as myself could have no legitimate input into.

If it is only technologists who program machines that make decisions with serious implications, or only philosophers that do so, the outcomes are not likely to be favorable – we need both of those inputs (and more) in the room when these decisions are made. The solution is not simply AI, because if these choices are left in the hands of machine

intelligence, we should still be concerned with who the people are who program the decisions, and what the justification or reasoning is behind the frameworks they use to allow the AI to make them.

In spite of these concerns, an increased interest in technology and computer-science related careers has correlated with a precipitous drop in the proportion of humanities majors at colleges in the USA and elsewhere (Heller, 2023). This should be of concern to all educators, in that we are in a time of epistemic crisis, with people retreating to more polarized and hardened views, and where collaboration is under strain, which is precisely when the collaborative and socially-motivated reasoning practices described here can be most valuable.

We of course need to educate people so they are productive and employable, but we also need to be educating people so that they're capable of helping to create a society that is livable and social, and where the value of human interaction is recognized for more than its sentimental value, but more because we know how important it is to reaching conclusions that accommodate our respective skills, and that respect the unique value that humans in collaborative engagement can add.

4. Conclusions

The low-hanging fruit, in terms of a list of obvious steps to take in response to AI in education, would include at least the following:

- Create a policy: create a policy on how ChatGPT should be used. This should cover areas such as data security, privacy, and responsible use of the technology.
- Educate users: we should educate users on the responsible use of ChatGPT and ensure that they understand the potential implications of using the technology.
- Monitor and review usage: we would ideally monitor how ChatGPT is being used, so as to take action, where possible, to encourage and empower employees to exercise their agency and creativity in doing so, rather than ceding their authority to those tools.

Steps such as those listed above do not, however, speak to the most significant challenge, which is that we need find ways to encourage and reward human creativity and collaboration. This is because humans deliberating together – and yes, making mistakes – is emblematic of the intellectual journey that teaching and learning offers.

Societies, and the humans that they comprise, are capable of feats of imagination and ingenuity that can result in unexpected insights in political theory or revolutionary scientific findings, many of which have arisen out of years of research, investigation, argument, and frustration of the sort that we might stop engaging in at all, once we become largely dependent on algorithmic outcomes.

Furthermore, societies in which AI resources are less available will likely be the same ones who are currently under-resourced in comparison to the Global North, in terms of their economies and educational systems.

The argument could therefore be made that there is a moral obligation to resist AI, for the sake of equality. This would not only be a tenuous argument – in that it's also possible that AI will lead to *increased* socio-economic equality – but is also not the primary argument

made here, which is that the noise, the fuzziness, the mistakes in our communal deliberations add a value that cannot currently be served by AI, and that this is a value not be forsaken, even as we exploit the many opportunities that AI offers for improving our lives.

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Challenges in Enforcing "Linguocultural Aspect of Fictional Literature" in Uzbekistan Higher Education

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Abstract
Teaching the Linguocultural Aspect of foreign literature is a new branch in Uzbekistan, and it has been a crucial part of the discussion in the education system. Considering the process of a student-centered classroom, learning English literature through the lingual and cultural factors can be the most perspective part of the involvement. In Uzbekistan, Linguocultural Aspect of Fictional Literature has yet to be researched thoroughly, focusing on texts written in English. There are reasonable changes in how literary studies have been practiced over the last century regarding interconnections between literature and other fields. As researchers have already indicated, there is a need to rename the field "literary and cultural studies" (Segal, 2015). Z.N. Patil (2002) argues that developing intercultural communicative competence can be achieved through international literature. Applying Hanauer's (2001) method of reading literary texts Focus-on-Cultural Understanding in developing cultural awareness, specifically gender perception (Wasikiewicz-Firlej, 2012) might result in the effectiveness of foreign literature classes. Concerning these issues, we designed our syllabus for a one-term optional subject entitled "Linguocultural Aspect of Literature" for the specialty of literary studies in the Masters' Department at Uzbekistan State University of World Languages (UzSWLU). The results showed that the subject helped students develop a positive attitude toward foreign literature through lingual and cultural means.

Keywords: Foreign Literature, Literary Analysis, Culture-Language-Literature Interconnections, Higher Education, Research

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Introduction

Fictional literature serves as a powerful medium for storytelling, enabling authors to create intricate worlds and narratives that captivate readers. Within these literary creations, the linguocultural aspect plays a crucial role in shaping fictional societies, their values, and their interactions. This research explores the interplay between language and culture in fictional literature, highlighting the significant role they play in constructing rich and immersive imaginary worlds.

Drawing from various literary works, it is always interesting to observe how authors employ language to depict and convey cultural aspects within their fictional realms. Language, as a reflection of culture, is utilized to establish distinct linguistic features, dialects, and languages unique to different societies. These linguistic variations not only add depth and authenticity to the narrative but also serve as a means to delineate social hierarchies, power dynamics, and intercultural relationships within the fictional world. Linguocultural aspect of fictional literature influences character development and reader engagement. Characters' linguistic choices, accents, and idiosyncrasies are often intricately linked to their cultural backgrounds, providing insights into their identities, beliefs, and social roles. The manner in which characters communicate, both verbally and non-verbally, reflects the cultural norms and values woven into the fabric of the fictional society. Such linguistic representations allow readers to empathize with characters, fostering a deeper connection and understanding of their experiences. The linguocultural aspect of fictional literature extends beyond the textual realm. Adaptations of literary works into audiovisual formats, such as films or TV series, bring an added dimension to the interplay of language and culture. Casting decisions, accents, and language choices in these adaptations contribute to the construction of a linguocultural landscape that complements and enhances the original written work, providing a multi-sensory experience for audiences. Hence, the linguocultural aspect of fictional literature serves as a vital tool for authors to create immersive and authentic imaginary worlds. By skillfully weaving language and culture together, authors can craft narratives that not only entertain but also explore complex themes, challenge societal norms, and foster cross-cultural understanding. Understanding and analyzing the linguocultural aspects of fictional literature provide insights into the intricate dynamics between language, culture, and storytelling, opening avenues for further exploration in this captivating field of study.

The language is used as a powerful tool in fictional literature to depict cultural aspects, reinforcing the authenticity of the fictional world, and providing readers with a deeper understanding of the characters and their societies. The main factors of how language is used to depict cultural aspects in fictional literature can be as followings:

- ***Dialects and Accents:*** Authors often utilize dialects and accents to convey cultural diversity and regional identities within their fictional worlds. For instance, in J.K. Rowling's *"Harry Potter"* series, characters like Hagrid and Luna Lovegood speak with distinct dialects and accents that reflect their respective backgrounds, adding depth to their characters and emphasizing their cultural origins;

- ***Naming Conventions:*** Authors employ naming conventions to reflect cultural traditions, beliefs, and social structures. In J.R.R. Tolkien's *"The Lord of the Rings,"* the Elven language is characterized by melodious and ethereal names like Legolas, Arwen, and Galadriel, which evoke a sense of grace and otherworldliness associated with Elven culture;

- ***Rituals and Ceremonies:*** Language is often intricately woven into rituals and ceremonies within fictional cultures. In Ursula K. Le Guin's *"A Wizard of Earthsea,"* the protagonist Ged undergoes a naming ceremony where his true name is revealed, symbolizing his cultural identity and his connection to the magical world he inhabits;

- ***Code-Switching:*** Characters in fictional literature may engage in code-switching, the practice of switching between languages or dialects depending on the context or interlocutors. This reflects the multilingual reality of certain cultures and adds authenticity to the narrative. An example can be found in Junot Díaz's novel *"The Brief Wondrous Life of Oscar Wao,"* where characters seamlessly shift between English and Spanish, reflecting the bilingual and bicultural experiences of Dominican-Americans;

- ***Taboo Language:*** Taboo language and profanity can also be employed to reflect cultural attitudes, values, and social norms. In Anthony Burgess's *"A Clockwork Orange,"* the protagonist and his peers use a unique slang called "Nadsat" to express rebellion and their disassociation from mainstream society, highlighting the counter-cultural aspect of their dystopian world;

- ***Politeness and Honorifics:*** The use of politeness markers and honorifics in language can reveal hierarchical structures and cultural norms. In many East Asian cultures, such as in the works of Haruki Murakami, there is a strong emphasis on honorifics and polite language to reflect social hierarchies and respect. The choice of pronouns and forms of address can indicate the status and relationships between characters, providing insights into the cultural values of respect and deference;

- ***Proverbs, Sayings, and Idioms:*** Fictional cultures often have their own set of proverbs, sayings, and idiomatic expressions that reflect their unique beliefs, wisdom, and cultural perspectives. These linguistic elements provide glimpses into the cultural heritage, folklore, and moral values of the fictional society. In George R.R. Martin's ***"A Song of Ice and Fire"*** series, for example, each region and culture within the fantasy world of Westeros has its own distinct set of idioms and proverbs that reflect their histories and ways of life;

- ***Taboos and Censorship:*** The presence or absence of certain words or topics in a fictional society can indicate cultural taboos and censorship. For instance, in Ray Bradbury's *"Fahrenheit 451,"* the dystopian society has strict control over language and literature, and books are banned and burned. The absence of certain words and ideas within the narrative reflects the suppression of knowledge and the control over cultural expression;

- ***Language Evolution and Change:*** Authors may incorporate language evolution and change over time as a reflection of cultural shifts and historical developments within their fictional worlds. This can be seen in the works of Tolkien, where the Elven languages evolve and change as the narrative progresses, mirroring the passage of time and the transformation of Elven cultures;

- ***Non-Verbal Communication:*** Beyond verbal language, non-verbal communication, such as gestures, body language, and symbolic actions, can also convey cultural aspects. In Frank Herbert's *"Dune,"* for example, the fictional Fremen culture has a complex system of hand gestures and rituals that are deeply rooted in their desert environment and cultural

practices. These non-verbal cues add depth to the cultural portrayal and enrich the reader's understanding of the society.

By utilizing these linguistic techniques, authors can create fictional cultures that are richly textured, authentic, and immersive. The language used in fictional literature becomes a vehicle for cultural expression, enabling readers to explore and appreciate the nuances of diverse imaginary worlds.

Culture, Language and Literature

Considering the issues regarding culture and literature through linguistic means, in Uzbekistan State University of World Languages implemented a new subject named "Linguocultural Aspect of Fictional Literature" for second-year Master students during the autumn term. The duration of the course was from September 15, 2022 to December 19, 2022 and lasted for 15 weeks. The participants of the course were 22 students: 20 females and 2 males. It is a new subject in Uzbekistan and no alternative in World Education System. Th instructor preferred the student-centered classroom by applying Hanauer's (2001) method of reading literary texts Focus-on-Cultural Understanding. As it was a new subject in the education system, Linguaculturology could be associated with the following criteria.

- ✓ Newly emerged linguistic discipline developed within the framework of the anthropocentric paradigm;
- ✓ Interface among linguistics, cultural studies, cognitive linguistics, ethnolinguistics and sociolinguistics;
- ✓ Its own integral aspect of studying language and culture;
- ✓ Deals with the deep level of semantics of linguistic units;
- ✓ Brings into correlation linguistic meanings and the concepts of universal and national cultures.

The whole course consists of 15 lectures and 15 seminars were conducted in relative 2 classes per week. Here given the topics for lectures and the short abstracts per lecture content:

Lecture 1. From Literature to Cultural Literacy

Reading materials focuses on four academic fields—cultural memory, migration and translation, electronic textuality, and biopolitics and the body—and four concepts: textuality, fictionality, rhetoricity and historicity. It stresses multilingualism and is part of the movement of interdisciplinarity within the humanities and between the humanities and other disciplines, but remains a distinctive activity within that larger movement. Cultural literacy, textuality, rhetoricity, fictionality, cultural memory, electronic textuality, migration, interdisciplinarity, multilingualism, comparative studies.

Lecture 2. Developing Cultural Awareness Through Reading Literary Texts

The use of literary texts and ways of reading them in foreign language education, Hanauer's (2001) method of reading literary texts Focus-on-Cultural Understanding in developing cultural awareness, focusing on gender perception as one of the fundamental aspects of culture, attitudes and motivation before and after the controlled reading activity of a culturally loaded text, cultural awareness, intercultural education, gender across cultures, intercultural literature.

Lecture 3. Developing Intercultural Communicative Competence through International Literature

The multiplicity of cultures and plurality of norms of verbal and non-verbal behavior necessitate training in intercultural communication and literature can be used as a rich resource to develop the ability to communicate appropriately in alien cultural settings, types of culture, varieties of English, politeness, principle of power, the principle of solidarity, intelligibility, comprehensibility, acceptability, appropriateness, intercultural communicative competence.

Lecture 4. The Study of Folklore in Literature and Culture: Identification and Interpretation

Two basic steps in the study of folklore in literature and in culture: Empirical (objective-identification) and Speculative (subjective-interpretation). Identification essentially consists of a search for similarities; interpretation depends on delineation of differences. The basic methodology of studying folklore in literature and studying folklore in culture is almost the same. The discipline of folklore has its own methodology applying equally well to literary and cultural problems.

Lecture 5. East-West Literary and Cultural Relations

Is the concept of literature the same in radically different cultures? Does it remain the same within the development of one culture? Are the basic genres (the lyric, epic, and dramatic) comparable? Are certain analogous phenomena in Indian and Western literature indicative of basic similarities between these literatures? Is at least the theory deduced from these literatures similar? Is a unified theory of literature desirable? Are literary canons established mainly according to perceived aesthetic values in the selected works? Analogous tendencies, differences between East and West, New Poetics and Politics of Thinking Latin America / India. West and Different Orientalism.

Lecture 6. British Literature and Culture: British Literary Culture and the Emergence of Postcolonial Aesthetics

Transatlantic Modernism and the Emergence of Postcolonial Literature is a study of midcentury literary institutions integral to the formation of both modernism and postcolonial writing. Modernist Literature, Postcolonial Literature, African Literature, British Literature, Caribbean Literature, Globalization, Race, Book Publishing, History of Radio Broadcasting.

Lecture 7. "Culture" and Literature in American Studies: Multiculturalism

The "End" of American Literature, Multicultural Literature, Comparative Black, Native, Latino/a, and Asian American Fictions, in the United States, Ishmael Reed, Leslie Marmon Silko, Ralph Ellison, N. Scott Momaday, Toni Morrison, Rudolfo Anaya, Sandra Cisneros, Maxine Hong Kingston, and Jessica Hagedorn are among the notable writers of color who have emerged since World War II. All-Americans in their collective mixture of African American, Native American, Asian American, and Hispanic strains.

Lecture 8. Nature and Human in East Literature and Culture

Literature, Culture and the Environment: A Cross-Disciplinary Conversation, human culture and environment provide the material basis and aesthetic reference for literary creation in the perspective of eco-criticism, works should reflect the world while returning to nature and landing on the objective laws of nature.

Lecture 9. Class Structure and Gentleman/Lady in English Victorian Era
Social class, Critical realism, Historical realism, Examining the role of class or social status in the lives of characters and in their society as portrayed in Victorian literature, Charles Dickens's Great Expectations, Jane Austin's Pride and Prejudice, Oscar Wilde's The Importance of Being Ernest, the Figure of the Gentleman in 19th century Victorian England : The re-Fashioning of a Manhood Ideal, Gentleman Versus Dandy, Domestic Ideology and Middle-Class Women in the Victorian Novel.

Lecture 10. Security and Hospitality in Literature and Culture: Modern and Contemporary Perspectives
Risking hospitality, approaching hospitality, Security and Hospitality in Dialogue, Hospitality, Nostalgia, and the Itinerant Hero(ine) in Dorothy Richardson's "Pilgrimage" and Ford Madox Ford's "Parade's End," Security, Hospitality, and Perversion in Muriel Spark's "Robinson," baiting hospitality.

Lecture 11. Birth, Death, Rebirth in East and West Literature and Culture
Birth, death, and re-birth: The trope of eternal rejuvenation in Isidore Diala's The Lure of Ash, Birth, Death and Rebirth of a Word - Emily Dickson's poem" A word is dead," Who Killed the World? How Can It Be Reborn? The Image of Rebirth in Mad Max: Fury Road, Rebirth Denied: Destruction and Loss in W. G. Sebald's Austerlitz, The Rebirth of the Female Superhero: Kamala Khan's Ms. Marvel.

Lecture 12. Colors: Meaning, Affects, Significance, and Symbolism in World Literature and Culture
Color symbolism in "The Great Gatsby" by F. Scott Fitzgerald, "The Scarlet Letter" by Nathaniel Hawthorne, "Snow White" by the Brothers Grimm, the meaning of colors in literary-and-cultural-studies, Color of Love-Life-Happiness/Loneliness-Death-Sadness, "best" color in the world, magic realism.

Lecture 13. Gender Perspective as a Representation of Culture in Literature
The distinction between female and male writers, feminist perspective, masculine perspective, he/she approach of writing, writing style, life experience, gender significance, inner and outer portrait of the personages, rational versus spiritual, factual versus emotional, Feminist, Gender, Equality.

Lecture 14. Diaspora Culture Depiction and Major Characteristics in Literature
Diaspora literature, major characteristics, language and culture clash, biographic method application, time and space correlation, Asian-American literature, Asian-European literature, Diaspora versus Expatriate, "The Kite Runner" by Khaled Hosseini, "White Teeth" by Zadie Smith**,** "Midnight's Children" by Salman Rushdie.

Lecture 15. Correlation between Literature and Popular Culture: High Level/ Low Level
Harry Potter series, Popular literature versus Serious literature, graphic novel, people and popular, culture and cultural, Sources, Transmission, Popular versus Folk, Created By the People/Created For the People, popular literature and mass media.

Research articles related to each lecture topic were read, discussed and analyzed by the students. It helped to get familiar with nature of research papers in the filed of literature while the participants had opportunity to compare the outcomes with their own MA thesis.

Choosing the specific assessment methods became the most challenging part of the course and used the following types:

1) *Literary Analysis Essays:* Students can be assigned essays where they analyze a specific work of fiction from a linguocultural perspective. They may be required to explore the cultural themes, symbolism, language use, and narrative techniques employed by the author. The essays can assess students' ability to critically analyze and interpret fictional texts within their cultural context.

2) *Oral Presentations:* Students can be asked to deliver oral presentations on a selected topic related to the linguocultural aspect of fictional literature. They might present their findings on a specific author, literary movement, or cultural influence on literature. This assessment method evaluates students' research skills, presentation abilities, and their understanding of the subject matter.

3) *Research Papers*: Assigning research papers allows students to delve deeper into specific aspects of the linguocultural dimension of fictional literature. Students can explore topics such as the representation of cultural identities, the impact of language on narrative structure, or the role of translation in cross-cultural literary exchanges. Research papers assess students' ability to conduct independent research, analyze scholarly sources, and synthesize information.

4) *Critical Reviews:* Students can be asked to write critical reviews of literary works, focusing on the linguocultural elements employed by the author. They may analyze the use of language, cultural references, or the portrayal of cultural values in the text. This assessment method evaluates students' critical thinking skills, their ability to articulate their opinions, and their understanding of the relationship between language and culture in literature.

5) *Group Discussions*: Group discussions provide an opportunity for students to engage in dialogue and exchange ideas about the linguocultural aspect of fictional literature. They can be assigned specific texts or topics for discussion, allowing students to analyze and interpret the linguistic and cultural elements together. Group discussions assess students' communication skills, collaborative abilities, and their capacity to express and defend their viewpoints.

6) *Creative Projects:* Students can be encouraged to create their own fictional works that incorporate linguocultural aspects. For example, they might write short stories or poems that reflect the cultural values and linguistic choices of a specific community. This assessment method allows students to apply their understanding of the subject matter creatively.

It's important to note that the choice of assessment methods should align with the learning outcomes of the course and provide students with opportunities to demonstrate their knowledge, skills, and critical thinking abilities in relation to the linguocultural aspect of fictional literature. The specific assessment methods may vary depending on the teaching approach, resources available, and the desired learning objectives of the course. Here an example of a creative project that incorporates linguocultural aspects in the context of fictional literature:

Project Title: "Cultural Tapestry: Linguocultural Short Story Collection"

Description: In this creative project, students are tasked with creating a collection of short stories that showcase the linguocultural aspects of different communities or regions. The goal is to explore how language, culture, and identity intertwine in fictional narratives.

Instructions:

- *Research*: Students are required to select a specific culture, community, or region that they find intriguing. They should conduct in-depth research on the language, customs, traditions, values, and historical context of the chosen culture.

- *Conceptualization:* Based on their research, students develop a set of fictional characters and scenarios that reflect the linguocultural nuances of the chosen culture. They should consider aspects such as language use, dialects, idioms, storytelling traditions, and cultural symbolism.

- *Short Story Writing*: Students write a series of short stories that revolve around the chosen culture or community. Each story should highlight different linguistic and cultural elements, while also exploring universal themes and narratives. The stories can be interconnected or stand-alone pieces.

- *Linguocultural* Integration: Students are encouraged to incorporate linguistic elements specific to the chosen culture throughout their stories. This can include the use of culturally significant words, phrases, idioms, or even incorporating a specific dialect or linguistic style. The linguistic choices should contribute to the authenticity and richness of the fictional world.

- *Reflection and Analysis:* Alongside the short stories, students provide a reflective analysis of the linguocultural aspects they integrated into their narratives. They discuss the significance of these elements and explain how they contribute to the overall understanding and appreciation of the culture being portrayed. They can also reflect on any challenges or insights gained during the creative process.

- *Presentation:* Students present their short story collection to their peers, showcasing their creative work and sharing their insights into the linguocultural aspects explored. This can be done through a reading, a multimedia presentation, or a poster display that highlights key linguistic and cultural elements.

Assessment Criteria:

- *Creativity and Originality:* The extent to which students demonstrate innovative and imaginative storytelling techniques that effectively convey the linguocultural aspects.

- *Linguocultural Integration:* The successful incorporation of linguistic and cultural elements into the short stories, showcasing an understanding of their significance and impact on the narratives.

- *Cultural Understanding and Research:* The depth and accuracy of the research conducted on the chosen culture, as well as the clear understanding and portrayal of its linguistic and cultural aspects.

- *Writing Skills:* The quality of writing, including narrative structure, character development, dialogue, and descriptive elements.

- *Reflection and Analysis:* The depth of reflection and critical analysis provided in the accompanying reflections, demonstrating insights into the linguocultural aspects explored.

This creative project allows students to engage with the linguocultural aspects of fictional literature in a hands-on and imaginative manner. It encourages them to explore the relationship between language, culture, and storytelling while fostering their creativity and understanding of diverse cultures.

When working on a creative project that incorporates linguocultural aspects, students may encounter several potential challenges.

Cultural Understanding and Research: Gaining a deep and accurate understanding of a specific culture or community can be challenging, especially if the students are not familiar with it. Conducting thorough research to grasp the linguistic and cultural nuances is essential but may require significant effort and access to reliable resources.

- *Linguistic Accuracy:* Incorporating authentic linguistic elements specific to a particular culture or dialect can be challenging, particularly if students are not native speakers or have limited exposure to the language. Maintaining linguistic accuracy while creating engaging fictional narratives may require extra research, consultation with experts, or seeking feedback from individuals familiar with the language.

- *Balancing Authenticity and Stereotypes:* Students need to be mindful of avoiding stereotypes or misrepresentations while portraying cultural elements in their stories. Striking a balance between authenticity and respectful representation is crucial to ensure that the project does not perpetuate harmful or inaccurate cultural narratives.

- *Creative Expression and Narrative Structure:* Crafting compelling fictional narratives that effectively convey the linguocultural aspects can be a creative challenge. Students may face difficulties in integrating cultural elements seamlessly into the storylines, maintaining cohesive narratives, and engaging readers while conveying the intended messages.

- *Sensitivity and Appropriateness:* It is crucial for students to approach the project with cultural sensitivity and respect. They need to be aware of potential cultural sensitivities or taboos and ensure that their creative work does not offend or misrepresent the chosen culture or community.

Conclusion

Based on the information provided, here's a breakdown of the 15-week subject schedule for the 22 students conducting research in foreign literature:

Week 1:
- Lecture: Introduction to the subject and its goals, overview of research methodologies in foreign literature.

Week 2-14:
- Lecture: Each week, cover a specific topic related to foreign literature research, such as literary theories, comparative analysis, translation studies, or specific genres or periods in foreign literature.

- Seminar: Held immediately after each lecture, where students discuss and engage in activities related to the lecture topic. This can include analyzing literary texts, sharing research progress, discussing challenges and strategies, and receiving feedback from peers and the instructor.

Week 15:
- Lecture: Recap of the subject, highlighting key takeaways, and providing guidance for future research in foreign literature.

- Seminar: Final seminar session for students to present their research findings, share insights, and receive feedback from their peers and the instructor.

Throughout the 15 weeks, students also worked on their individual research projects outside of the lecture and seminar hours. The instructor could provide guidance, resources, and regular check-ins to monitor the students' progress and offer support as needed. It's important to note that the specific topics and activities within each lecture and seminar may vary based on the subject's curriculum and the students' research interests. This breakdown provides a general framework to allocate time for lectures, seminars, and independent research over the 15-week period.

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Evidence-Based Reflective Practice to Help Engineering At-Risk Students in Supplementary Lesson Context

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Abstract
This paper documents the author's application of reflective practice to enhance quality teaching, in a supplementary lesson context at Singapore Polytechnic (SP). Conceive-Design-Implement-Operate educational framework standards were implemented in active teaching and learning methods as well as enhancement of faculty teaching competence, via evidence-based reflective practice (EBRP). To help engineering at-risk students to pass their module and avoid repeating/expulsion, the author utilized an EBRP checklist that he customized to suit engineering schools. The ten core principles of learning embedded in the EBRP checklist enhanced the at-risk students' learning experience of their module, via the author's supplementary lessons. Coupled with its evidence-based approach, the EBRP checklist is a concise and structured template to quantify quality teaching. For data collection and analysis, an original "crosshairs" methodology was employed. A "vertical line" was formed by two EBRP data points (qualitative), while a "horizontal line" was formed by two assessment data points (quantitative). These lines intersect to form the crosshairs, offering a widespread and balanced coverage for data collection and analysis. The EBRP checklist used together with the crosshairs methodology yielded significant positive assessment results. Eventually, majority of the engineering at-risk students (above 80% for five semesters, based on post-intervention results) benefited from the consequential enhanced quality teaching to pass their module, avoid repeating/expulsion and hence progress to their next academic phase of the SP education system.

Keywords: Evidence-Based, Reflective Practice, EBRP Checklist, Engineering, At-Risk Students, Crosshairs, Supplementary Lesson

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Introduction

Reflective Practice

Reflective practice has long been applicable in various professional disciplines, especially in the field of pedagogy. According to Schön (1983), it is regarded as an individual's competency to reflect on/in one's actions, in order to be in an iterative process of continuous improvement through practice. Hence, it is a common habit among lecturers to maintain a teaching journal/portfolio that they update frequently, akin to an engineer's logbook.

In educational literature, one well-known model of reflective practice by Gibbs (1988) is a closed-loop of six steps: description, feelings, evaluation, analysis, conclusions and action plan. Another educational model by Larrivee (2000) highlights the difficulty of good reflective practice, because a lecturer's response to a situation is filtered through five screens: past experiences, beliefs, assumptions and expectations, feelings and mood, personal agendas and aspirations. Generally, these popular educational models of reflective practice are inherently subjective as they involve content such as feelings and mood, as shown in Figure 1 below. They may not suit lecturers of science, technology, engineering and mathematics schools, who are more accustomed to objective content like formulas and laws.

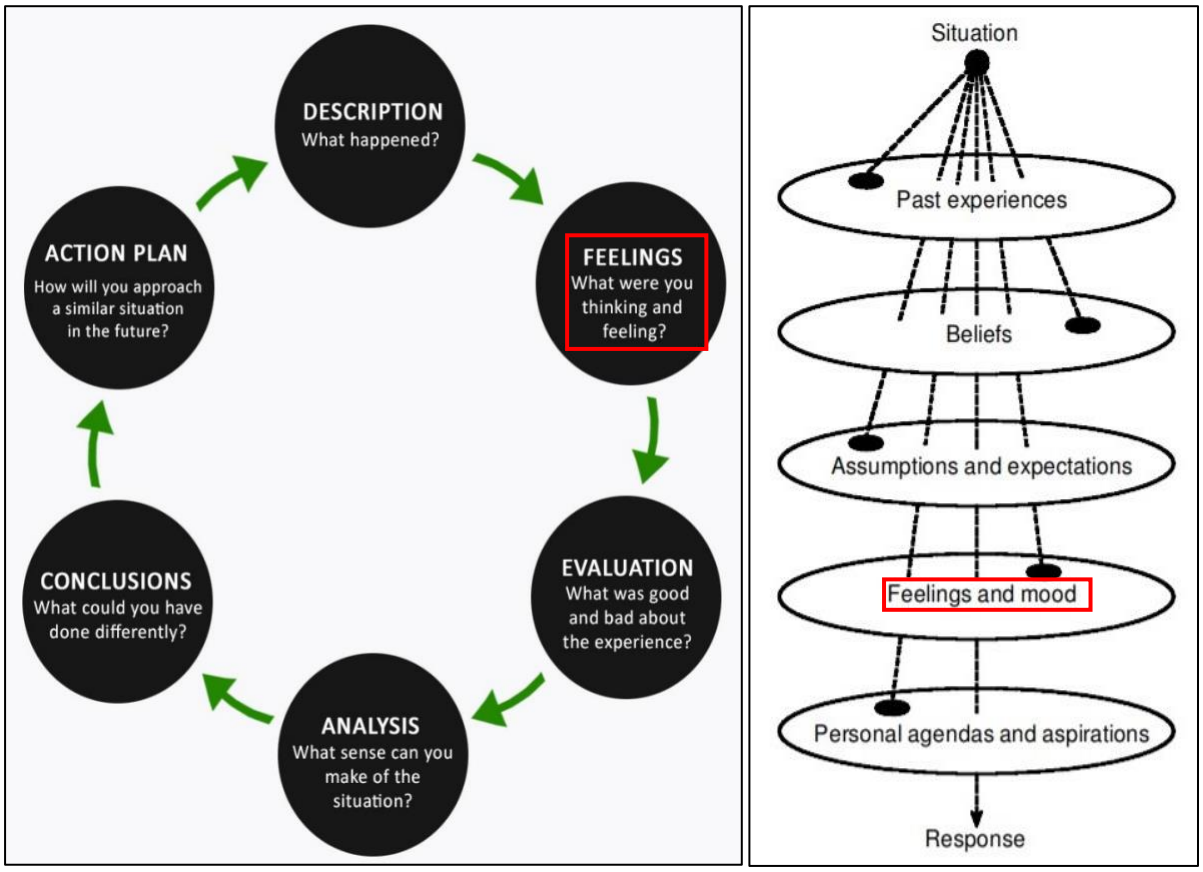

Figure 1: Reflective practice models by Gibbs (1988) & Larrivee (2000)

Evidence-Based Reflective Practice Tool

One method to somewhat "measure" subjective reflective practice is by the inclusion of objective evidence.

In educational literature, it is highly recommended by researchers for good reflective practice used in education to be evidence-based (Hattie, 2008 & Sale, 2015). This evidence-based approach is similarly applicable to engineering students in flipped learning (Sale et al., 2017 & Cheah et al., 2019), as studied by the author too (Leong, 2021). For nurses, evidence-based practice to improve patient outcomes via concrete evidence has been applicable since the 1800s by Florence Nightingale (Mackey et al., 2017). For lawyers, the strict compliance of the law of evidence is vital in all legal proceedings (Chen et al., 2018). Similarly for lecturers, such as of engineering schools, the utilization of an evidence-based reflective practice (EBRP) tool should be beneficial for pedagogy (Sale, 2020). To provide lecturers with some prediction of learning effectiveness before lesson and also diagnosis after lesson. EBRP aims to shed some light on how to enhance and quantify quality teaching.

To illuminate quality teaching, ten core principles of learning (Conceive-Design-Implement-Operate CDIO educational framework standard 8 in active teaching and learning methods) are embedded in the EBRP tool by Sale (2015 & 2020) to quantify quality teaching:

(1) Learning goals, objectives & proficiency expectations are clearly visible to students.
(2) Students' prior knowledge is activated & connected to new learning.
(3) Content is organized around key concepts & principles that are fundamental to understanding the structure of a subject.
(4) Good thinking promotes the building of understanding.
(5) Learning is enhanced through multiple methods & presentation modes that engage the range of senses.
(6) Learning design utilizes the working of memory systems.
(7) Assessment is integrated into the learning design to provide quality feedback.
(8) The development of expertise requires deliberate practice.
(9) A psychological climate is created which is success orientated and fun.
(10) Motivational strategies are incorporated into the design of learning experiences.

These core principles are all mutually inclusive and when used together with evidence of effectiveness to quantify quality teaching, they enhance quality teaching (CDIO standard 10 in enhancement of faculty teaching competence). Singapore Polytechnic (SP) implemented reflective practice as an annual performance goal for all academic staff since 2018/2019. The inception of this SP policy is to encourage lecturers to conduct reflective practice and even go further as action research (Toh et al., 2020), like this pedagogical study by the author. The EBRP tool by Sale (2020) was shared with Teaching and Learning (T&L) Mentors and Specialists of all the schools in SP, including the author, when he was Senior Education Advisor at the Educational Development department. Refer to Figure 2 below for this EBRP tool.

In the learning experience (e.g., lesson/session plan) was there:	**Evidence of Effectiveness** What specific Strategies - Methods/Activities and/Resources were employed to enhance this aspect of the learning process, and how effective were they? (Based on your observation and any other feedback if available (e.g., peer observation, student feedback)
Clear communication of the Learning Outcomes to the students? o What specifically is to be learned o The purpose of this learning o How this learning connects to the wider learning goals (topic areas, skills) for this module	
Activation of students Prior Learning and connections to new knowledge presented? o Identifying what students already know/don't know about the topic before the start of a session o Helping students to fill important knowledge gaps/clear up misconceptions o Making connections between what is to be learned now (e.g., new knowledge/skills) to what has already been learned	
Instruction focusing on the Key Concepts and Principles for understanding this topic or skill area? o Identifying and illustrating the most fundamental concepts/principles to be learned o Explaining how these connect to the learning outcomes	
o Methods and activities to help students to understand these concepts/principles in real work/life contexts	
Use of activities that involve Good Thinking to facilitate understanding? o Enabling students to engage in the types of thinking necessary (e.g., analysis, comparison & contrast, inference & interpretation, evaluation) to connect new knowledge to what they already know o Building the necessary mental models in long-term memory	
Appropriate variety in the methods, activities, media used o Focused on the learning outcomes and the student profile o Encouraging engagement and interest o Maintaining good attention levels	

Figure 2: Evidence-based reflective practice tool by Sale (2020), part 1 of 2

Utilizing Core Principles of Learning ***In the learning experience, was there:***	**Evidence of Effectiveness** What specific Strategies, Methods and/or Resources were employed to enhance this aspect of learning, and how effective were they? (Based on your observation and any other feedback if available (e.g., peer observation, student feedback)
Application of practices consistent with Human Memory processes? o Chunking of content to minimize cognitive overload o Periodic recap and review of key concepts and principles o Doing *Whole-Part=Whole* analysis – showing how new parts of the learning connect to the wider topic or skill area	
Formative Assessment of the student learning and provision of quality two-way feedback? o Monitoring student learning through testing key concepts and skills o Providing clear and specific feedback (e.g., task, process, self-management) o Encouraging two-way and peer feedback where possible and useful	
Opportunities for Practice to enhance understanding and/or skill acquisition? o Spaced-practice across sessions to build understanding and competence o Deliberate-practice focused on specific skill development tailored to student's skill levels	
Interactions/activities that foster a climate conducive for building rapport, encouraging Success and a sense of Fun? o Use of growth mindset strategies (e.g., showing how effort impacts learning; sticking with students when they need help; mastery learning) o Use of expressive language and supporting body language in communication (e.g. expressive tone, smile, eye contact) o Allowing/facilitating humour and fun to occur in the lesson	
Aspects of the lesson (not identified above) that seemed to enhance interest and supported the learning experience: o Use of a story, analogy, example o A specific method/activity type o An aspect of communication style	

Figure 2: Evidence-based reflective practice tool by Sale (2020), part 2 of 2

Background

Supplementary Lesson Context

Diploma in Mechanical Engineering (DME) is the first such course in Singapore, with a history of 66 years to date and is the flagship diploma with the largest student cohort in SP School of Mechanical & Aeronautical Engineering (MAE). The author is MAE's T&L Mentor as well as the module coordinator of DME core module Thermofluids 1, which is taken by engineering students from five different SP courses.

Since 2020/2021 semester 2, MAE formally implemented supplementary lessons for engineering at-risk students to manage the failure rates of its four targeted core modules, namely Thermofluids 1 & 2 and Mechanics 1 & 2. At-risk students consisted of students who

performed the worst for their Mid-Semester Tests (MST) in the current semester, and repeat students who failed their modules in the previous semester. Supplementary lessons implemented were extra face-to-face tutorials delivered in classrooms by the respective module coordinators (including the author), beyond the at-risk students' regular timetables for 1 hour weekly.

Customized Evidence-Based Reflective Practice Checklist

In 2020/2021 semester 2, two classes of Thermofluids 1 engineering at-risk students were assigned to the module coordinator (the author) for supplementary lessons. These classes consisted of 33 Thermofluids 1 MST worst performing students and 12 repeat students, assembled from five different SP courses. If they fail their module, they will have to repeat the module in the following semester or will be expelled from the school respectively. The author decided to utilize the EBRP tool by Sale (2020) to help his two classes of at-risk students to pass their module and avoid repeating/expulsion.

The author customized the tool into a more concise EBRP checklist, such as by minimizing pedagogical jargons and adding numbered checkboxes for the ten core principles of learning (CDIO standard 8). Due to its inherent evidence-based approach, the concise EBRP checklist also acts like a structured template for a lecturer to quantify quality teaching (CDIO standard 10). As a result, the EBRP checklist is suited for engineering schools who are more accustomed to objective content, especially tweaked for MAE.

This customized EBRP checklist was shared with all MAE academic staff and lecturers generally found it easy to digest and use for reflective practice. MAE management also requested the author to conduct sharings for academic staff, to help lecturers with poor student feedback scores/comments and to facilitate reporting officers in grading reflective practice for annual performance goals. Refer to Figure 3 below for the author's customized EBRP checklist (Leong, 2021).

10 Core Principles of Learning In your lesson:	Evidence of Effectiveness What was done for this core principle and how effective was it? (Based on your observation or any other feedback).
(1) Learning objectives made known to students? ☐ • The purpose of this lesson & what specific topics to be learned.	•
(2) Review students' prior knowledge & connect to new knowledge? ☐ • Identify what students already know/don't know at the start of lesson. • Link back to what is to be learned now.	•
(3) Focus on key concepts & fundamental principles? ☐ • Deliver the most basic concepts & principles, without excessive details & repetitions.	•
(4) Promote good thinking? ☐ • Students are stimulated to think (analyse/compare/interpret/evaluate) about the content to improve their understanding.	•
(5) Variety in delivery methods & media? ☐ • Variety promotes interest & student engagement, to improve their attention.	•
(6) Enhance students' memory? ☐ • Bite-sized content to avoid mental overload. • Periodic recap & review of key concepts.	•
(7) In-class assessment & two-way feedback? ☐ • Monitor student's learning progress by testing key concepts. • Encourage feedback between students & staff.	•
(8) Chances to practice? ☐ • Periodic practice for students to improve competence. • Deliberate-practice focused on specific weaknesses of students.	•
(9) Fun & positive atmosphere? ☐ • Positive verbal & body languages to bond with students. • Humour in class to enhance learning.	•
(10) Spark students' interest & improved the learning experience? ☐ • Motivate & inspire students to learn. • Use of a story, analogy, case-study.	•

Figure 3: Customized evidence-based reflective practice checklist by author (Leong, 2021)

Methodology

In 2020/2021 semester 2, two classes of 45 Thermofluids 1 engineering at-risk students were assigned to the module coordinator (the author) for supplementary lessons. These classes consisted of 33 Thermofluids 1 MST worst performing students and 12 repeat students, assembled from five different SP courses. If they fail their module, they will have to repeat the module in the following semester or will be expelled from the school respectively. The

author decided to utilize his customized EBRP checklist to help his two classes of at-risk students to pass their module and avoid repeating/expulsion. These at-risk students were not taught by the author in the previous semester. Therefore, the key intervention process of this study was the author's supplementary lessons via his customized EBRP checklist throughout the following semester. This study's objective is to ascertain the effects of EBRP on the engineering at-risk students. The focus group in this study's scope is the 12 repeat students among the two classes of 45 at-risk students, due to the availability of their pre-intervention data.

Crosshairs Data Collection & Analysis

For data collection and analysis, the author composed and employed an original "crosshairs" methodology, which is similar to the conventional "triangulation" (O'Donoghue et al., 2003). The data input was by means of both qualitative and quantitative research paradigms. A "vertical line" was formed by two EBRP data points (qualitative), while a "horizontal line" was formed by two assessment data points (quantitative). Eventually, these lines intersect to form the crosshairs. The two EBRP data points were from both lecturer and student, whereas the two assessment data points consist of both formative and summative. Overall, the crosshairs methodology "aims" to a widespread and balanced coverage for data collection and analysis. So as to obtain insightful information on the intervention from multiple perspectives. Refer to Figure 4 below for the author's original crosshairs methodology (Leong, 2021).

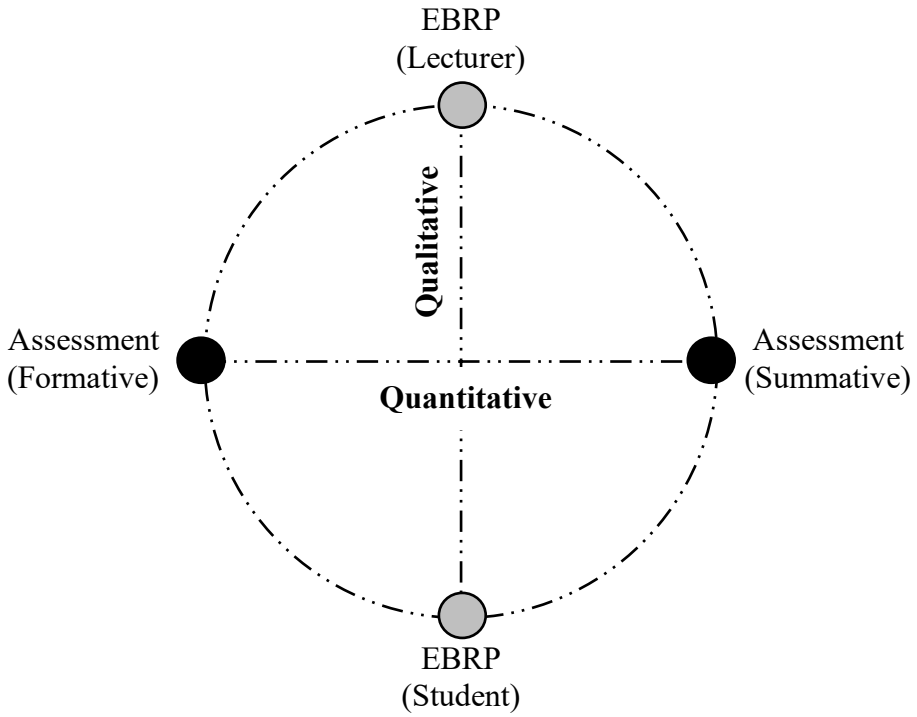

Figure 4: Crosshairs methodology for data collection & analysis by author (Leong, 2021)

For EBRP data points, the lecturer can be the teaching lecturer and/or another observer lecturer, while the student can be the learning student and/or another observer student. For assessment data points, the formative part can be the Mid-Semester Test (MST) and/or In-Course Assessment (ICA), while the summative part can be the Exam or End-Semester Test.

Qualitative Data Collection & Analysis

For the qualitative aspects of this study, EBRP was done by the teaching lecturer (the author) and another MAE observer lecturer, in addition to an observer student. The observer student was a DME Year 3 graduating student invited to sit-in the lesson and use EBRP for student feedback. Being a graduating top student with an excellent Grade Point Average (GPA) of 3.96, it would be insightful to note this student's opinions. Considering that this student also attended countless lessons by various lecturers from different schools in SP for the past 3 years.

Quantitative Data Collection & Analysis

For the quantitative aspects of this study, the formative assessment was the MST, while the summative assessment was the Exam. These at-risk students were not taught by the author in the previous semester. Therefore, the key intervention process of this study was the author's supplementary lessons via his customized EBRP checklist throughout the following semester. Their Thermofluids 1 MST and Exam scores were compared for 2020/2021 semester 1 (pre-intervention) and 2020/2021 semester 2 (post-intervention), to obtain insightful information on students' achievement of learning outcomes.

According to the well-known educational research by Hattie (2008), formative evaluation to lecturers has a high effect size of 0.9, considering that the medium is only 0.4. Refer to Figure 5 below. This method is where lecturers take action to get formative feedback on their teaching and then act on it, which is similar to the author's intervention process and this study. There was ongoing evaluation of the author's supplementary lessons via his customized EBRP checklist throughout the semester, as EBRP can predict learning effectiveness before every lesson and diagnose after every lesson. This study also commenced during the first term of the semester, such that it is possible to tweak if necessary in the second term based on the MST scores' comparison.

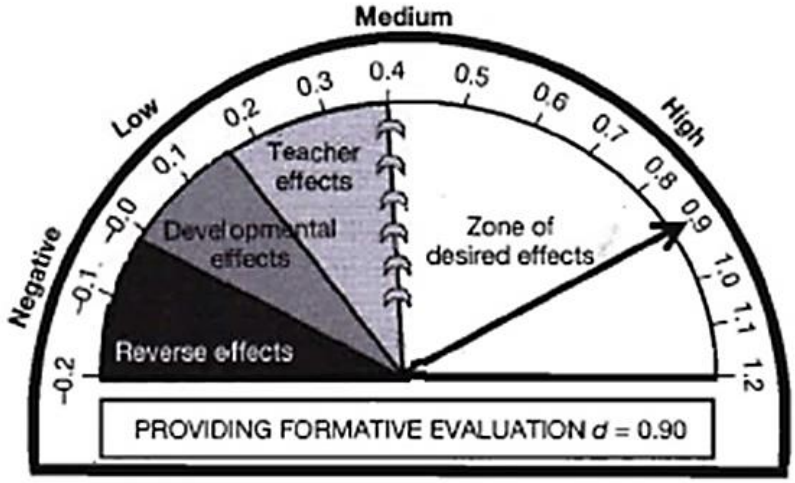

Figure 5: Formative evaluation to lecturers with high effect size of 0.9 by Hattie (2008)

Results & Discussion

Qualitative Data

For the qualitative aspects of this study, EBRP data were from the teaching lecturer (the author) and another MAE observer lecturer, in addition to an observer student (DME graduating top student with excellent GPA). The customized EBRP checklist was used by the author for his supplementary lessons throughout the semester, as prediction of learning effectiveness before every lesson and/or diagnosis after every lesson. Refer to Figure 6 below, for the author's EBRP data for one of his pivotal supplementary lessons in the Thermofluids 1 syllabus.

10 Core Principles of Learning **In your lesson:**	**Evidence of Effectiveness** **What was done for this core principle and how effective was it?** **(Based on your observation or any other feedback).**
(1) Learning objectives made known to students? ✓ • The purpose of this lesson & what specific topics to be learned.	• *Topic & learning outcome (Viscosity) communicated to students at start of 1hr weekly supplementary.* • *Announced: 1 MST topic per wk, to solve 3 past MST qns per lesson (total of 4 topics to prepare repeat students for upcoming MST).* • *Students were aware & some already turned to the corresponding pages on notes without prompting.*
(2) Review students' prior knowledge & connect to new knowledge? ✓ • Identify what students already know/don't know at the start of lesson. • Link back to what is to be learned now.	• *Prior week's past MST qns corrected in-class & given back to students to refer.* • *Students were aware of their own mistakes & current level of knowledge & what gaps can be bridged in today's lesson.*
(3) Focus on key concepts & fundamental principles? ✓ • Deliver the most basic concepts & principles, without excessive details & repetitions.	• *Summary of the few key formulas required for Viscosity, written on whiteboard.* • *Students copied down the summary & we periodically referred back to it throughout lesson.* • *Hardcopy printout of definitions & SI units of symbols used in MST formulas, given out to students.*
(4) Promote good thinking? ✓ • Students are stimulated to think (analyse/compare/interpret/evaluate) about the content to improve their understanding.	• *Students were given time to think & then share some examples of Newtonian & Non-Newtonian fluids, after my brief explanation of these fluids' characteristics.* • *Students expressed enlightenment & noted that these are commonly tested in past MST qns.*
(5) Variety in delivery methods & media? ✓ • Variety promotes interest & student engagement, to improve their attention.	• *Uplifting video clip of MythBusters was showed & students watched keenly. "Failure is an option, if we learn from it" message to motivate repeat students.* • *Visualiser to project notes & whiteboard for drawing & writing were used too.*
(6) Enhance students' memory? ✓ • Bite-sized content to avoid mental overload. • Periodic recap & review of key concepts.	• *Summary of the few key formulas required for Viscosity, written on whiteboard.* • *Students copied down the summary & we periodically referred back to it throughout lesson.* • *Students often recapped the hardcopy printout of definitions & SI units of symbols used in MST formulas, when solving the past MST qns.*
(7) In-class assessment & two-way feedback? ✓ • Monitor student's learning progress by testing key concepts. • Encourage feedback between students & staff.	• *Solving of the past MST qns was initially/partially done as in-class Q&As between me & students. Parts answered wrongly will be mitigated by my correction or facilitation by another student. Parts answered correctly will be reinforced to enhance memory retention. Impromptu questions from students were also addressed.* • *Students participated in Q&As & doubts were sorted out before proceeding to the next qn.*
(8) Chances to practice? ✓ • Periodic practice for students to improve competence. • Deliberate-practice focused on specific weaknesses of students.	• *Main focus of 1hr supplementary lesson was for repeat students to deliberate-practise the past MST qns, to prepare for upcoming MST.* • *Towards end of lesson, most students often can independently solve the past MST qns without my help.* • *Students also had access to hardcopy notes & online material to practise other lecture & tutorial qns.*
(9) Fun & positive atmosphere? ✓ • Positive verbal & body languages to bond with students. • Humour in class to enhance learning.	• *Light-hearted pedagogy infused in lessons, with the presence of positive comments & occasional jokes.* • *Students were recognised & addressed by their names to foster bonding.*
(10) Spark students' interest & improved the learning experience? ✓ • Motivate & inspire students to learn. • Use of a story, analogy, case-study.	• *Uplifting video clip of MythBusters was showed & students watched keenly. "Failure is an option, if we learn from it" message to motivate repeat students.* • *Video clip also served as a wake-up-call, as this was the late 5pm final lesson of the day.*

Figure 6. EBRP data by the author, via customized EBRP checklist

The ten core principles of learning by Sale (2015 & 2020) embedded in the author's customized EBRP checklist enhanced the at-risk students' learning experience of their module, via his supplementary lessons throughout the semester. Several noteworthy similar evidence of learning effectiveness were found in the EBRP data by the author, the observer lecturer and the observer student:

- ✓ *All core principles of learning were attained.*
  After all, these ten core principles are all mutually inclusive and when used together with evidence of effectiveness to quantify quality teaching, they enhance quality teaching.
- ✓ *Opening summary of key formulas with corresponding symbols & SI units to enhance memory of both prior & new knowledge.*
  (This corresponds to core principles 1, 2, 3 & 6)
- ✓ *Real-life examples (like common Newtonian & Non-Newtonian fluids) to reinforce key principles & stimulate good thinking.*
  (This corresponds to core principles 3, 4 & 6)
- ✓ *Interesting variety in delivery methods (like motivational video) to maintain students' attention.*
  (This corresponds to core principles 5, 9 & 10)
- ✓ *In-class questions-&-answers to ensure clear understanding before proceeding to next question.*
  (This corresponds to core principles 4, 7 & 8)
- ✓ *Deliberate-practice of three past MST questions on one key MST topic in-class every week, to progressively build students' independence.*
  (This corresponds to core principles 3, 7 & 8)
- ✓ *Humour & analogy to popular show (like motivational video) to engage students in a fun setting.*
  (This corresponds to core principles 9 & 10)

On top of the focus group in this study's scope (2020/2021 semester 2), the author also taught these Thermofluids 1 supplementary lessons to other at-risk students for the next four semesters (2021/2022 semester 1 to 2022/2023 semester 2). Totalling to 157 engineering at-risk students (including 51 repeat students) assembled from five different SP courses for five semesters, who benefited from the consequential enhanced quality teaching of EBRP.

Quantitative Data

For the quantitative aspects of this study, assessment data were from the formative MST and the summative Exam. The Thermofluids 1 at-risk students were not taught by the author in the previous semester. Therefore, the key intervention process of this study was the author's supplementary lessons via his customized EBRP checklist throughout the following semester. Their Thermofluids 1 MST and Exam scores were compared for 2020/2021 semester 1 (pre-intervention) and 2020/2021 semester 2 (post-intervention), to obtain insightful information on students' achievement of learning outcomes. This study commenced during the first term of the semester, such that it is possible to tweak if necessary in the second term based on the MST scores' comparison. Refer to Table 1 below for the Thermofluids 1 MST scores' comparison of the 12 repeat students (anonymous), among the two classes of 45 at-risk students.

Student	Pre-Intervention MST (2020/2021 Sem1)	Post-Intervention MST (2020/2021 Sem2)
1	12/100	98/100
2	20/100	69/100
3	48/100	89/100
4	0/100	71/100
5	12/100	70/100
6	16/100	62/100
7	14/100	88/100
8	54/100	95/100
9	36/100	36/100
10	16/100	34/100
11	24/100	76/100
12	18/100	*deferred*

Table 1: Thermofluids 1 MST scores for pre & post interventions

The formative MST scores' comparison showed a significant positive trend after intervention. The average score improved by 49%, from 23/100 to 72/100 marks (rounded off to nearest whole number). Pre-intervention showed only one pass, but post-intervention showed nine passes (including four grades of A). Based on the positive outcome of the formative MST, the author decided to continue delivering supplementary lessons via his customized EBRP checklist in the second term. This approach is akin to the high effect size method of formative evaluation to lecturers by Hattie (2008). In a hopeful attempt to prepare the 12 repeat students for the summative Exam, and also to help as many of the at-risk students as possible to pass at the end of the semester.

Refer to Table 2 below for the Thermofluids 1 Exam scores' comparison of the 12 repeat students (anonymous) among the two classes of 45 at-risk students, as well as their overall final grades after factoring in MST and ICA too.

Student	Pre-Intervention Exam (2020/2021 Sem1)	Post-Intervention Exam (2020/2021 Sem2)	Post-Intervention Final Grade (2020/2021 Sem2)
1	9/100	55/100	**B+**
2	12/100	45/100	**D+**
3	25/100	53/100	**C+**
4	14/100	72/100	**B**
5	10/100	58/100	**B**
6	29/100	53/100	**C**
7	11/100	80/100	**A**
8	29/100	84/100	**A**
9	41/100	56/100	**C**
10	*absent*	37/100	**F**
11	*absent*	77/100	**A**
12	*absent*	*deferred*	

Table 2: Thermofluids 1 Exam scores for pre & post interventions, & final grades

The summative Exam scores' comparison also showed a significant positive trend after intervention. All repeat students who sat for the post-intervention Exam improved in their scores. Their average score improved by 41%, from 20/100 to 61/100 marks (rounded off to nearest whole number). For pre-intervention in the previous semester, all 12 of them failed based on overall final grades and hence repeated Thermofluids 1. Eventually for post-intervention in the following semester, only one repeat student among the two classes of 45 at-risk students failed the module and faced expulsion.

At-risk students require lecturers' monitoring and intervention. The monitoring of engineering at-risk students to predict their performance in flipped learning was studied by other SP academic staff (Kok-Mak et al., 2019). However, such intervention lack studies that are backed by quantitative assessment data collected and analyzed accurately. Ideally, an accurate study should keep all variables constant, except the variable in the study's objective. National Aeronautics and Space Administration (NASA) compared the data of genetically identical twin astronauts (one was in space, while the other remained on Earth) over a year to accurately study the effects of space on humans (Garrett-Bakelman et al., 2019). Likewise, the author was given the unique opportunity to accurately study the effects of EBRP on the same 12 repeat students learning the same module, via comparing their pre and post interventions' quantitative assessment data over 2 consecutive semesters.

Based on post-intervention final grades in Table 2 above, 90% of the at-risk students passed their module in 2020/2021 semester 2. On top of the focus group in this study's scope (2020/2021 semester 2), the author also taught these Thermofluids 1 supplementary lessons to other at-risk students for the next four semesters (2021/2022 semester 1 to 2022/2023 semester 2). Based on post-intervention final grades, 82%, 88%, 85%, 85% of the at-risk students passed their module from 2021/2022 semester 1 to 2022/2023 semester 2 respectively. Eventually, majority of the engineering at-risk students (above 80% for five semesters) passed their module and avoided repeating/expulsion.

Reflections & Conclusion

The EBRP checklist is a versatile educational instrument that can be utilized both as an intervention and also for data collection and analysis. A lecturer can use the EBRP checklist as prediction of learning effectiveness before lesson and as diagnosis after lesson. To shed light on how to enhance and quantify quality teaching. Resembling survey and observation forms, the EBRP checklist can also be used by a lecturer for qualitative data collection and analysis.

It was challenging for the author to help his engineering at-risk students with only 1 hour weekly for supplementary lessons. Moreover, in order not to clash with students' regular timetables, supplementary lessons were scheduled beyond office hours (after 5pm) which was unconducive for both teaching and learning. Hence, in-class questions-&-answers and deliberate-practice on key topics (core principles 3, 7 & 8) were particularly important for supplementary lessons to be fruitful. Follow-up work in the near future shall involve utilizing EBRP as intervention for differentiated instruction and data-enabled flipped learning via cloud-based learning management system. To collect data for learning analytics outside the classrooms, to continue helping more engineering students in their learning.

The tenet of every lecturer's pedagogical technique is to ensure their students achieve the learning outcomes and progress academically. The author's customized EBRP checklist used

together with his original crosshairs methodology yielded significant positive assessment results. Eventually, majority of the engineering at-risk students (above 80% for five semesters, based on post-intervention final grades) benefited from the consequential enhanced quality teaching to pass their module, avoid repeating/expulsion and hence progress to their next academic phase of the SP education system.

The author received many feedback emails and messages from his at-risk students, over the five semesters. The author hereby concludes this paper by sharing one such memorable message below, demonstrating the fruitful implementation of evidence-based reflective practice (EBRP).

From: Student 6 (anonymous)

Hey Mr Leong,
I want to thank you for the semester I had with you. To be honest, I had a really rough time in SP, no lecturers that was able to help me too. It might sound like an exaggeration but its not, you were the first lecturer that made me interested and actually follow the class.

I was comfortable with you too! Your remedial was the highlight of my week in school. I always looked forward to it.

Once again, thank you for being an amazing lecturer. It might not be much to you, but it means a lot to me to be able to talk to one lecturer and having one to check on me. I hope we can keep in contact with each other, so that if we ever cross paths or meet again in the future, I can meet you as a better person AND being in a better position.

Sent: 11 March 2021 10:16 pm

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Investigating the Usage of Labster and Its Future Implications for Industry and Academia

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Abstract
The unprecedented impact of COVID-19 on engineering education has resulted in lasting changes in the way educators teach as well as the way students learn. One of the most impacted areas was the inability of students to undertake laboratory training, which is crucial for engineering employability. In 2020-21, UCL Biochemical Engineering implemented the use of Labster – a virtual lab simulator that allows students to complete laboratory experiments online, whilst simultaneously exploring complex theories. This project aimed to investigate the impact of using Labster as a lab training tool to evaluate how well it prepared students for industry, and furthermore to understand any implications this may have for academic practice across other departmental programmes. The method for data collection comprised of interviews and survey dissemination to two MSc cohorts and steering committee members who comprise of key industry players. Analysis of the results shows that over 60% of graduates on the MSc reported back that the use of Labster effectively prepared them for the engineering working environment. Similarly, communications with industry suggested that although many companies use in-house virtual software packages, Labster served as a useful tool in helping to bridge the skills gap. The consensus from all students that partook in the study was that the lab simulator was considered to be very useful for practical theory learning which made it easier for them to carry out practical. Based on this, the use of Labster will be rolled out to lab and non-lab-based modules across a range of programmes.

Keywords: Virtual Simulator, Biochemical Engineering Education, Labster

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Introduction

Research has shown that the potential skills gap in engineering, exacerbated by the pandemic, has started to show when graduates go out into engineering industries (Hou, 2020). Final year students in the biochemical engineering department at UCL have also expressed worries via personal tutoring sessions about how the gap in lab skills will impact their employability and this has also been discussed in staff meetings, together with resulting increased burden on careers support from the departmental career's liaison officer and the UCL Engineering Careers team.

With the rapid development of technologies supporting education, the main challenge during the pandemic was the teaching of laboratory practical classes and engaging the students in these modules. Thus, many virtual simulators were used and incorporated in many lab-based modules especially during the pandemic.

Labster is one of the examples of a virtual simulator products aimed at implementing virtual laboratories for many scientific topics and medical education. For instance, virtual reality simulator has been used to help surgeon trainees to tailor the simulator according to their goals and to run many simulations to reduce the experiments on animal models (Uranus et al., 2004).

Recently, many programmes and universities have integrated the virtual simulators as part of their modules replacing the need for the students to go to the labs. For instance, the Arizona State University implemented virtual simulator in their programmes to decrease the demand of number of scientists required to be trained at universities and companies after graduation (Yap et al., 2021). According to Zaharudin, in 2019, Taylor's university also have integrated Labster as part of their blended learning activities for undergrade students to enhance the student-centred learning (Zaharudin, 2019).

As part of their study, Yap et al., 2021 investigated the usage of Labster to train students on aseptic techniques for scientific research projects and techniques like cell culturing, expanding and passaging the animal cells before, during and after the pandemic. In their research they investigated the role of labster as a supplementary learning activity (August 2019/before the pandemic) then considered Labster as a replacement learning tool during early pandemic (March 2020) and after the pandemic (August 2020). In their findings, Yap et al., concluded that the virtual laboratory simulation was beneficial for all the cohorts and increased the students' confidence level, however, there was a decrease in the interest of using virtual simulator during the beginning of the pandemic.

More studies during the pandemic, suggested that other virtual simulators like Gizmos program can help the science teachers to carry out their experiments during the pandemic without the students losing motivation (Baris, 2022). Desa et al., 2022, used another virtual simulator (Home discovery) as a tool for biochemistry module.

Many companies and academic institutions have recently developed lab-based virtual learning tools as it has been shown that virtual simulators increase the student knowledge and understanding (Lewis et al., 2014). This technology improved online learning in many fields like STEM education (O'Dwyer), microbiology and pharmaceutical toxicology (Dyrbeg, 2016: Tripepi, 2021).

The aims for this study were to investigate the preparedness of graduates for industry lab practice from alumni and industrialists' POVs and for students for academic lab practice. As well as ascertain the implications for academia and industry to better inform the use of Labster as a teaching and learning tool.

It is holistically believed that the outcome of this project should not only help current and former students but can also help to alleviate some of the pressures on staff and industry.

Research Approach

The study was conducted on two cohorts on the MSc in Manufacture and Commercialisation of Stem Cell and Gene Therapies, made up of 11 students (cohort 1/2020-2021) and applied again in the subsequent academic year on the same programme, this time with a cohort of 7 students (cohort 2/2021-2022). The investigative techniques for this research considered a number of options including (but not limited to) focus groups, questionnaires & surveys, interviews and observations. Quantitative methods such as surveys were heavily considered as a primary data collection method in the first instance due to the need to reach multiple student cohorts including alumni (Surbhi, 2018). With that said, there was also a need to consider perceptions of industry stakeholders via steering committee members and interviews were determined to be the best approach due to the need for more in-depth and analytical information (Polit and Beck, 2010). A semi-structured interview approach would not only allow for questions to be asked in different orders but would also allow for the use of unscripted questions to follow up on points of interest (Williams, 2015).

Questionnaire Formulation And Ethical Considerations

The questions on the survey needed to reflect the intended aims and outcomes of the project.

Objectives

- Investigate the preparedness of graduates for industry lab practice from alumni and industrialists' POVs.
- Investigate the preparedness of students for academic lab practice.
- Ascertain the implications for academia and industry to better inform the use of Labster as a T&L tool.

Outputs

- Survey current MSc students.
- Survey former MSc students (alumni).
- Collecting feedback from Steering committee members.

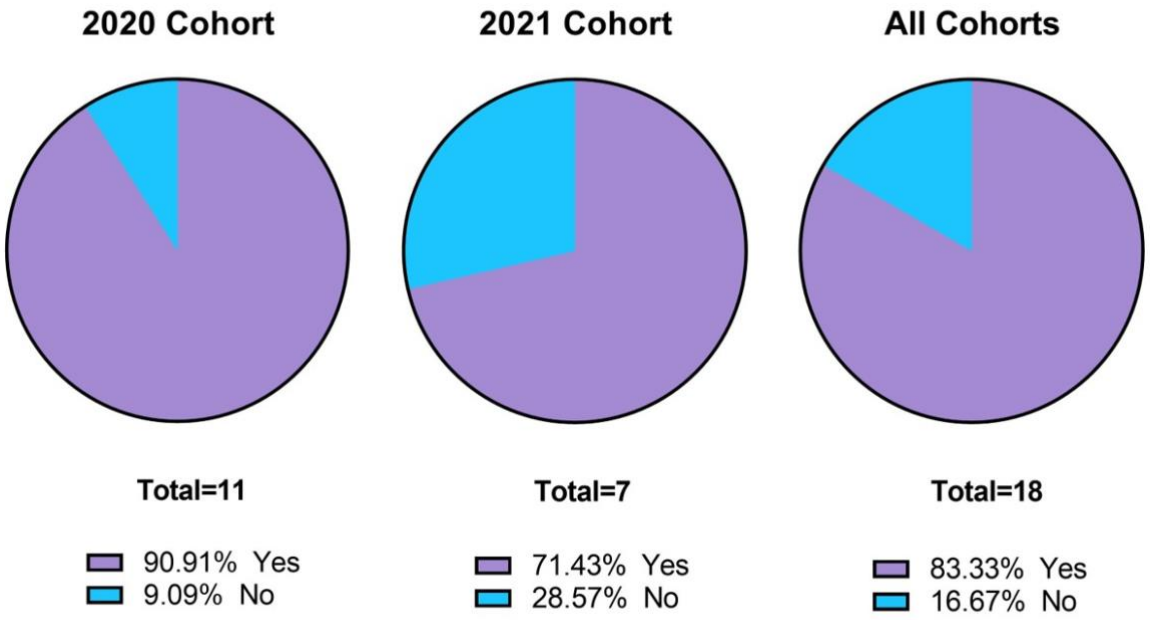
Outcomes

- An improved understanding of the impact of Labster in academia and industry.
- Presentation of results at the Departmental Teaching Committee (DTC) with potential implementation on other modules where relevant.
- Ethical considerations were assessed by UCL change makers. These included informed consent, confidentiality/anonymity/disclosures, data protection and power relationships.

Conclusion

The survey was conducted on cohort 1 (11 students) and cohort 2 (7 students) from which 83.33% of the students had their first experience using Labster as their first virtual simulator (Figure 1).

Figure 1: First Experience working with or learning virtual reality/simulated environment (Graphs generated using GraphPad Prism)

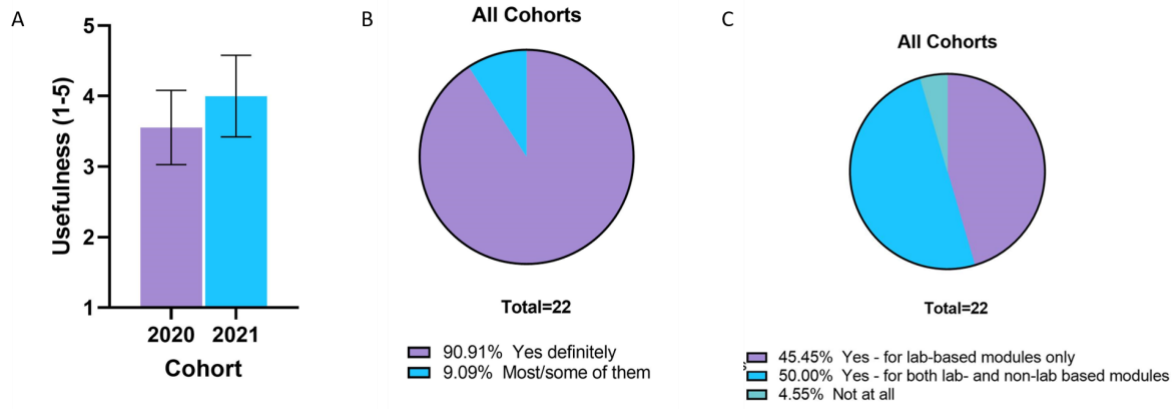


Learning the Practical Theories

The question showed in Figure 2 are the following: A: To what extent was Labster useful for understanding the theoretical aspects of the analytical techniques prior to going into the labs? B: Each simulation was well explained before doing the experiments. C: Would you recommend the use of Labster on other modules?

Both cohorts found that Labster was useful (around 3.8/5) for understanding the theoretical aspects prior going to the labs (Figure 2, A). 90.91% of the students agreed that the theoretical aspects of each simulation were well explained (Figure 2, B) and more than 95 % of the students recommended its use in lab and non-lab-based modules (Figure 2, C).

Figure 2: The role of Labster as pre-lab tool and employment readiness
(Graphs generated using GraphPad Prism)



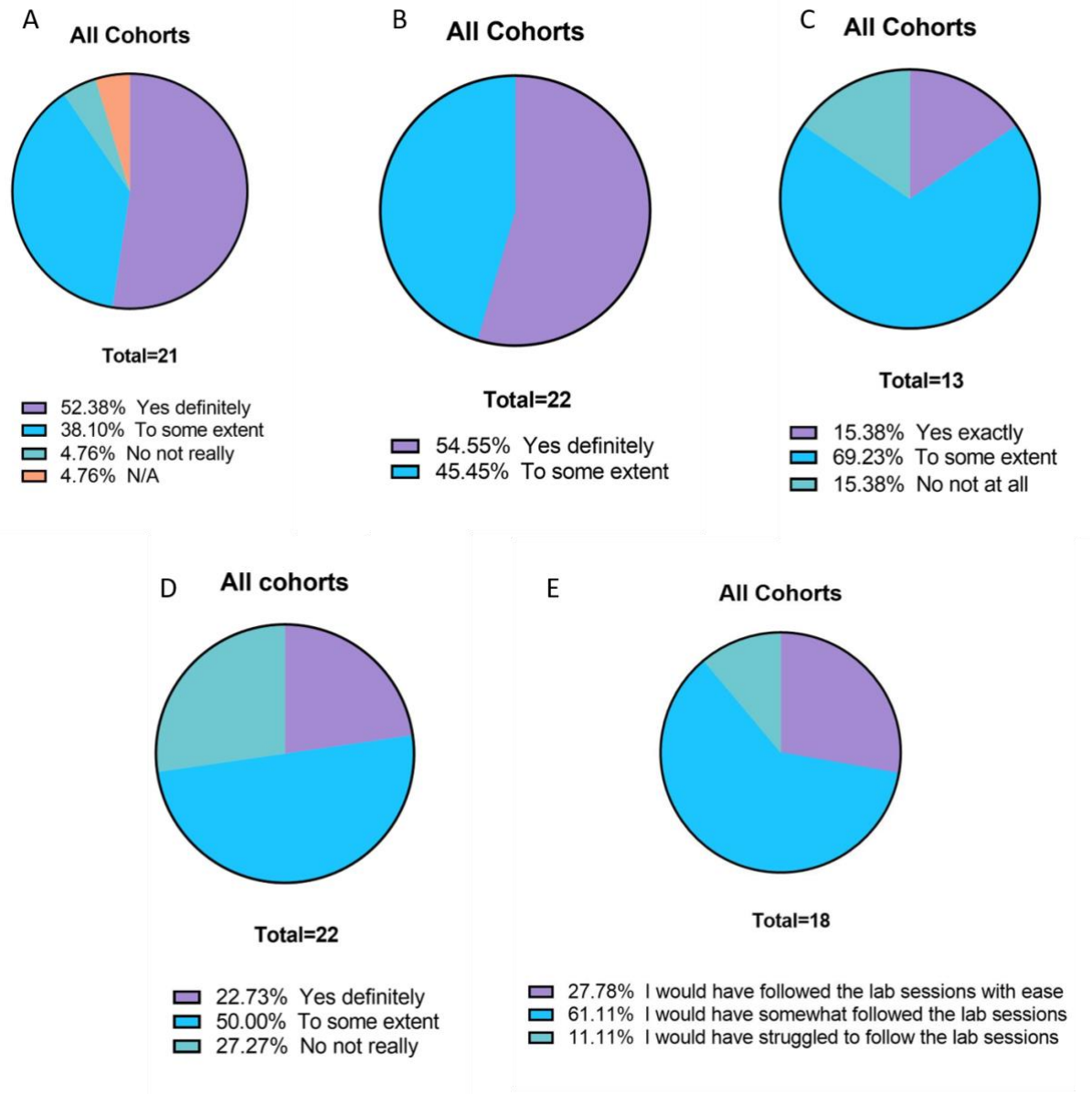
Using Labster a Lab Practical Simulator

Figure 3 represents the question related to the role of Labster as a lab Simulator. The following are the questions: A: Doing the simulation before the lab sessions made it easier to follow the protocols during the practical. B: Doing the simulation before the lab sessions helped to familiarised myself with the lab equipment. C: Performing the experiments on Labster was easy and mirrored exactly how I carried it out in the lab sessions. D: Labster helped me gain lab experience without needing to go to the lab. E: How prepared do you think you would have been for the lab sessions without using Labster beforehand?

52.38 % and 38.10% students think that doing the stimulation made it easier to follow the protocol (yes definitely and some extent respectively), (Figure 3, A).

54.55% of the students found that the simulation helped them definitely to be familiarise with lab equipment (Figure 3, B). Around 85 % of the student agreed that the Labster experiments mirrored the practical experiments (Figure 3, C). 72.73% of the students gained lab experience without going to the lab (Figure 3, D) and 11.11% would have struggled to follow the lab session without using labster (Figure 3, E).

Figure 3. The role of Labster as lab practical simulator
(Graphs generated using GraphPad Prism)

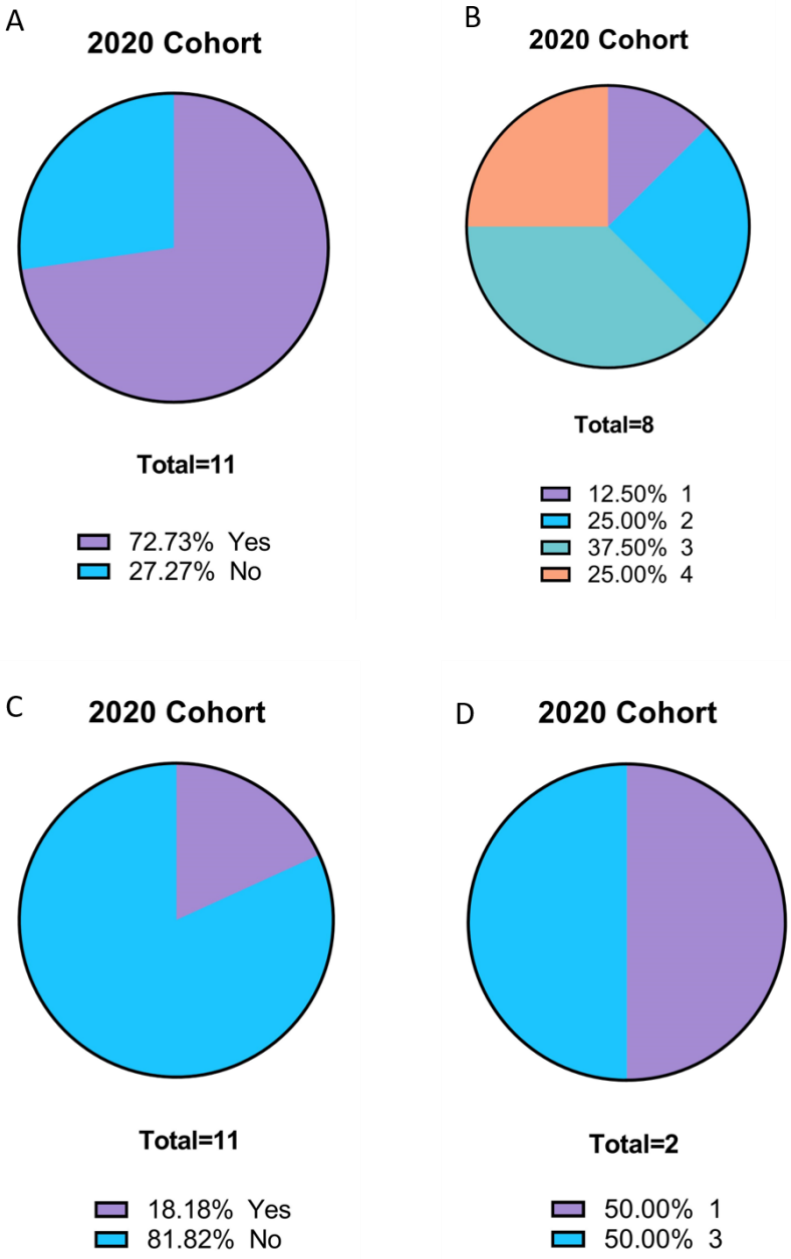


Employment Readiness

We have asked the students the following questions for the data shown in Figure 4: A: Does your graduate job involve you going into labs? B: If you answered yes to the above, how useful was Labster in preparing you for the use of labs in the workplace? C: Does your graduate job involve any virtual reality or simulated learning/working environments. D: If you answered yes to the above, how useful was Labster in preparing or familiarising you for work or training in simulated environments?

72.73% of the graduated cohort have labs as part of their job, however 37.7 % did not find Labster as a pre tool for job preparedness (Figure 4, B).18.18% of the students working in industries use Labster at work (Figure 4, C).

Figure 4. The Effect of Labster on employment readiness
(Graphs generated using GraphPad Prism)



This study investigated whether Labster could be considered as prelab tool that could help the student readiness and prepare them for industry and the potential implementation in non-lab-based modules. According to the students, Labster was considered as a useful prelab tool to know the theoretical aspects of the experiments and makes it easier to follow the protocol and familiarised with lab equipment before the students going to the lab.

However, both cohorts agree that Labster is not considered as a tool to prepare them for job upon graduating. Similar findings were observed where the students favoured this learning tool as it enables them to learn in their own time and pace with no significant difference between the learning outcomes between groups that have done the virtual simulators and those who did not go to the lab (Booth et.al, 2010; Jones et al., 2018).

Labster could be used for practical theory learning (Figure 2). Our students felt confident doing the simulation prior to lab, same was seen in a study done on UG students at the University of Southern Denmark (Dyrberg. 2016) and in a pilot study on Fermentation for Chemical and Biochemical Engineering students (Heras et al., 2021). Simulation based learning has been shown as well to enforce the scientific knowledge and concepts for undergraduate medical students (Jabaay et al., 2020). Virtual simulation is a useful tool in teaching medicine specially anatomy (Galvez et al., 2020), physiology (Jeon et al., 2020) and pharmacology (Rakofsky et al., 2020) and radiology (Shu et al., 2021) modules.

The results from communications with steering committee members and former students currently in employment suggested that various companies tend to use their own in-house lab simulation tools as they are more suited to their in-house equipment, however the consensus from all students (both current and former) was that Labster was considered a highly useful tool for practical theory learning which made it easier for them to follow the practical sessions. Both cohorts also agreed that the simulated lab sessions provide clear explanations and realistic experiences and were in accordance that Labster should be used for both lab and non-lab-based modules.

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Exploring Immersive Reality: Case Studies From a North American University

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Abstract
Higher education institutions are increasingly utilizing immersive technology to support interdisciplinary research, teaching, and student development. For instance, Arizona State and Pennsylvania State have established virtual reality (VR) spaces on their campuses to support interdisciplinary research, the integration of VR into teaching, and VR development spaces for students. These spaces provide opportunities for students, faculty, and researchers to explore subjects in new, immersive ways and to experiment with cutting-edge technologies. For example, immersive virtual reality (I-VR) in particular creates a computer-generated, multi-sensory, 3D environment that can be accessed through devices such as head-mounted displays (HMDs), headphones, and controllers and/or haptic gloves (Freina and Ott 2015; Murcia-López and Steed 2016), and has been employed in educational contexts including astronomy, biology, business, engineering, and history. These immersive experiences enable students to interact with the content in a way that simulates real-life scenarios, manipulating objects and exploring environments that would be impossible or impractical to do in real life (Bailenson, 2018; Slater and Wilbur, 1997). The present study features vignettes that illustrate how faculty at a North American university are utilizing immersive technology in their teaching and research endeavors. These vignettes form a critical component of our larger initiative to expand immersive spaces for faculty across the university. The study highlights faculty perspectives, challenges, and requirements when integrating immersive technology such as VR and augmented reality (AR) into their courses. By exploring how higher education instructors are currently utilizing or are seeking to use VR/AR, the study provides a comprehensive understanding of how this technology can be incorporated into higher education.

Keywords: Higher Education, Virtual Reality, Augmented Reality, VR, AR

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Introduction

Immersive technologies like virtual reality (VR) and augmented reality (AR) are gaining traction in higher education (Radianti et al., 2020) for their potential to bridge the gap between curriculum and practical skills needed in students' respective fields of study. These environments essentially merge the physical world with the virtual by using devices that project virtual spaces and objects into a real space. VR in particular affords the ability to be situated in various settings which can put the learner in scenarios and environments where they can discover, interact, collaborate, problem-solve in a relevant context. AR enhances the real world through the projection of virtual objects. As immersive technology integration gains momentum (European Commission, 2019; Office of Education Technology, 2017), there is tremendous promise for VR to positively influence teaching and learning outcomes (European Commission, 2019; Freeman et al., 2019). However, best practices for effectively incorporating immersive tools like VR and AR into higher education are still emerging. There is a pressing need to explore faculty development models that provide pedagogical guidance, technical support, and hands-on experimentation with integrating extended realities across diverse disciplines.

Procedure

The main objective of this study was to explore the extent to which faculty have integrated VR/AR technology in their courses. Specifically, it sought to answer: (1) *To what extent have faculty at the university implemented VR/AR technology?*; (2) *What is the purpose/reason for using or interest in VR/AR?*; (3) *What challenges and barriers did faculty encounter?*; (4) *What were student responses to VR/AR?*; (5) *What support services are they looking for?* To answer these questions, a survey was deployed and data was collected from faculty who have already engaged in VR/AR integration and/or participated in communities of practice or professional development offered at the campus. The data was used to inform decisions surrounding the creation of dedicated spaces and services to enhance faculty awareness and use of immersive technology.

The survey was composed of questions aimed at identifying academic programs in which the faculty had integrated or expressed interest in integrating VR/AR technology, as well as identifying the types of activities they created or hoped to create using the technology. Additionally, the survey aimed to identify spaces and services faculty sought assistance from, uncovered challenges encountered by faculty and students, and described student reactions to the experiences. Lastly, the survey gathered feedback to help identify what services would help faculty in the future. To achieve these objectives, QuestionPro survey software was utilized to create a survey of 19 questions for faculty who utilized VR/AR in their courses and 12 questions to faculty who are interested in these technologies. The survey was emailed to 97 faculty who were identified from a professional development list of participants from various VR/AR workshops and communities of practice.

Findings

The main objective of this survey was to explore the extent to which faculty have integrated VR/AR technology in their courses. This involved identifying academic programs in which the faculty had integrated or expressed interest in integrating VR/AR technology, as well as the types of activities they had created or hoped to create using the technology.

Background Statistics

Of the 97 faculty who were sent the survey, 29 responded and 22 completed the survey, resulting in a completion rate of 75.86%. Of the total number of respondents, 12 implemented VR/AR, and 17 did not. Of the 12 implementers, only 8 completed the survey. The non-implementers can be grouped into interested and not interested (table 2). Of the interested group, 9 completed the survey.

Among faculty who did not implement VR/AR but expressed interest, 8 indicated that if they developed a VR/AR activity, it would be for undergraduate students while 1 faculty member answered that it would be for graduate students. Surprisingly, 4 of the interested faculty indicated that they already engaged with some VR/AR spaces at the university.

Overall, respondents came from a diverse pool of academic disciplines (table 1) with notable representations from communication (3 faculty) and computer science (2 faculty). The remaining respondents came from various other fields. It is encouraging to see a range of disciplines spanning creative arts to hard sciences exploring the integration of VR/AR technology into their teaching practices.

Faculty Group	Department Affiliation	Frequency
Implementers	Communication	1
	Computer Science	2
	Interior design	1
	Nuclear Engineering	1
	Communication: Journalism	1
	Not disclosed	1
	Geography	1
Interested	Architecture	1
	Not disclosed	1
	Consumer Studies	1
	Geosciences	1
	Chemistry	1
	School of Performing Arts	1
	Communication	1

Veterinary Medicine	1
History	1

Table 1: Department groupings of respondents.

Faculty Who Implemented VR/AR

VR/AR Technology Used

It was found that among VR/AR implementers that 5 utilized virtual reality, while 1 used augmented reality, and 2 faculty utilized both. Looking more closely, the immersive technologies that were applied include 360 videos and 360 images, VR head-mounted displays (HMDs), AR apps, and one implementer used a cave automatic virtual environment (CAVE).

Purpose of Using VR/AR

When asked about the purpose for integrating VR/AR technology, 4 respondents indicated that they used the technology for student-created VR/AR experiences, while the other respondents' VR/AR experiences were instructor-created. The student-created activities served various purposes, such as research credit, app development, and 360 video storytelling creation. For example, computer science students in a Fall 2022 capstone course developed an AR app called *Sculpture Park*, where users could add 3D models to the campus Drillfield. In contrast, a course in the School of Communication had students create a VR simulation for research credit.

Some of the instructor-created activities leveraged the VR affordance of immersing students in environments that are otherwise inaccessible, unsafe, or impractical to visit or experience in real life. For example, using the CAVE space, nuclear engineering students safely explored a nuclear reactor core and checked the amount of fission neutrons and power at different sections. The geography respondent used 360 images to create virtual fieldtrips, allowing students to immerse in various landscapes such as Southern Beech and New Zealand where students can learn more about the glacial features by interacting with hotspots embedded in the environment. The goal was to bring students to landscapes that they would otherwise be less likely to ever visit. Although less 'immersive' as compared to HMD or CAVE VR systems, interior design students experienced various classroom designs and design elements by scanning a QR code that linked them to a virtual image on their cellphones. Then they used their phones to rotate the view of the room in 360 degrees. The objective was to provide feedback on classroom designs that impact learning for students who identify as neurodiverse. Students in journalism created their own stories by shooting video, then editing it in Adobe Premiere where they could add motion graphics and other text to their stories. Afterwards, they reviewed their work using the HTC Vive. These applications of VR/AR represent a wide range of uses across disciplines.

Implementers of VR/AR indicated that the process from planning to implementation took 1-3 months for 50% of the respondents, while 37.5% it took 3-6 months, and 12.5% took 6-12 months. None of the respondents indicated that it took over a year, which isn't surprising

since there wasn't development of a VR (HMD) immersive experience that requires time-intensive development.

Faculty Challenges

Because four of the activities involved student-created VR/AR, the challenges identified from the faculty responses to this question seemed to center a bit on both faculty and student challenges (table 2) for developing and implementing VR/AR. For instance, it was noted by both the School of Communication and the journalism program that there was a lack of student experience using VR development tools such as Unity. Journalism stated that they would like to have more of a plug and play ability to make it easier for students to work in. Further, they also noted that they are looking into eye tracking in future implementations of the activity that will assist in the analysis of students' work. Computer science students who had to develop an AR product as their capstone project, the challenges centered on overall integration between a physical system and immersive environment. A respondent from an unidentified program indicated that they encountered no challenges, while the geography respondent specified that they could not access Captivate software and lacked the knowledge to know how to publish a Captivate product. The nuclear engineering respondent seemed to struggle with space and capabilities for what they were trying to accomplish.

Challenge/barrier	Program
Student lack development skills using immersive technology	Communication
Student lack of knowledge using Unity	Journalism
Overall integration	Computer science
UX design	Computer science
Lack software skills/knowledge (faculty)	Geography
Need more facilities provide immersive capabilities	Nuclear engineering

Table 2: Faculty challenges and barriers.

Services and Spaces Used

The immersive spaces used (table 3) varied among the respondents with 4 respondents indicating that they used their department VR/AR space, 2 used the library immersive studio, while another indicated that they used a third-party vendor app. One used an AR app, while in the 'other' category, respondents specified the use of an open-source platform, and 1 other used the CAVE space. Those who used a department space came from computer science, the School of Communication, journalism, and interior design.

A few of the respondents indicated that they used more than one space. For instance, the interior design respondent utilized a department space as well as an AR app and the communication respondent utilized their department space as well as a third-party vendor.

The geography respondent used the library studio and an open-source platform. The 3 respondents in the 'other' category specified the use of the CAVE space, an open-source platform, and the other indicated it was the capstone course which involved students creating an AR app.

Space	Frequency	% of Total
Library studio	2	18.18%
Department Studio	4	36.36%
Third-party vendor	1	9.09%
AR app	1	9.09%
Other	3	27.27%

Table 3: Immersive spaces used.

As a follow up question for those who used non-department spaces such as the library studio implementers were asked what specific services they sought from these spaces. These respondents noted that they used tracking and 3D audio, consultation, use of equipment, and collaboration. A respondent from computer science indicated that they collaborated with a member of the library studio to help with development using Unity, AR Foundation, and XCode.

Student Challenges

When asked about student challenges (table 4), the responses generally referenced student access to the VR/AR technology, although other notable challenges related to accessibility, navigating the VR environment, and technical issues. Both access to VR/AR technology as well as technical issues each shared 33.33% of the identified challenges with accessibility and navigating the environment each constituting 16.67% of the identified challenges for students. Computer science specifically noted UX design as a challenge for their students and sought help with the library studio.

Challenge/barrier	% of Total
Access to VR/AR technology	33.33%
Navigating the VR/AR environment	16.67%
Accessibility	16.67%
Technical issues	33.33%

Table 4: Student challenges and barriers.

There are studies that indicate that VR technology can cause motion sickness, particularly to new users and access to the technology (Makransky & Mayer, 2022). To address this issue, surveyed faculty offered alternatives such as having those students watch their peers in the immersive environments, while other faculty had their students watch videos instead of engaging with the technology.

In all except 1 case, respondents indicated that they had students who either could not participate or did not want to participate in the VR/AR activity. These respondents (table 5) indicated that they offered alternative activities for those who chose not to participate or could not participate due to accessibility. With nearly 60%, watching other students engage in an immersive activity was the most common alternative. The single respondent who selected 'other', noted that all their students participated in the VR/AR activity.

Alternative Activity	% of Total
Watched videos	28.57%
Watched other students engage in VR/AR	57.14%
Other	14.29%

Table 5: Alternative activities.

How Students Accessed the Activities

37% of the respondents indicated that their students accessed the immersive activity using their own personal equipment, while 12.5% used the Institute for Creativity, Arts, and Technology (ICAT) space. The other 50% used department studios and the CAVE.

Assessment

The survey also looked at how faculty approached assessment and found that 50% had no assessment tied to the VR/AR activity while 25% of students received an assessment after the VR/AR activity and 12.5% had assessment embedded in the VR/AR environment. These results aren't surprising because over half of the respondents indicated that the activity was student created rather than instructor created.

Student Reactions

Figure 1: A word cloud listing the student reactions.

Overall, the reactions from the student users were positive with various sentiments describing the students as *interested, engaged,* and *motivated*, *happy, enthusiastic* (interior design), *impressed* and *interested*, and *excited*. Specifically, the interior design respondent said students were enthusiastic, adding that the experience allowed students to observe a "*complete visual of designs including colors and textures, relationship to space to design elements, and orientation to the room*." Another respondent noted that students' interest in becoming involved in his/her research activities increased. The geography respondent has tested it with participants as it is in early development, but the participants were excited. A respondent who observed that students were interested also mentioned that the content of the simulation may not be memorable because it was a prototype. Student reactions were all based on what the faculty member observed during the process.

Future Support

When asked about the likelihood the respondent would use VR/AR again (table 6), 87.5% of the faculty who implemented VR/AR indicated that they were likely to highly likely to use the technology again, while one respondent indicated that they were highly unlikely, although this respondent also indicated that they do not have the technical expertise and that user friendly software is critical for them to use it again.

Likelihood	% of Total
Very likely	50%
Likely	37.5%
Not likely	0%
Very not likely	12.5%

Table 6: Likelihood to use VR/AR again.

Suggestions for future support that would help respondents next time include the establishment of more facilities with ability for high performance computing in immersive environments (nuclear engineering), professional development (geography) on incorporating VR/AR, as well as understanding available software for creating VR experiences, where and how to access it, how to go about content capture, and overall workflow process that includes how to post immersive experiences to a server. Offering user friendly software was suggested by two respondents with one going on to suggest a more plug and play ability for development. Another recommended bringing in graphics design students to assist with UX design.

Interested Faculty

Reasons for Faculty Interest in VR/AR Integration

The first question in the survey asked if the respondent implemented VR/AR. For those who answered in the negative, a follow up question asking if they were still interested in using VR/AR was given. 9 faculty indicated that they were still interested in using the technology, while 5 others responded as not interested, and 3 more indicated they were but never completed the survey. The following is a summary of the 9 who completed the survey.

According to the interested faculty group, the primary motivation for incorporating VR/AR technology is to prepare students for their future, which is noted by 3 faculty members. Other reasons for using VR/AR technology align with some common uses of VR/AR currently reflected in the literature. For example, experiencing environments that are not feasible in the real world such as simulations of various architectures or Earth science fieldtrips where students can view the impacts of large-scale surface mine and folds and faults on Earth. The veterinary medicine respondent indicated that they would use it to help students practice spay and neuter procedures in a simulated environment before practicing on a real animal. Respondents in the creative arts indicated that they are interested in using VR/AR for activities such as students developing multimedia storytelling to add another dimension to the story while another respondent in theater indicated they could use it for artistic creation and distance communication.

Program(s)	Reasons to Utilize VR/AR
Architecture	Simulate environments in architecture
Undisclosed	Uses virtual worlds
Consumer studies	Prepare students for work lives
Geosciences	Virtual Earth science field trip
Chemistry	It is a new innovation
Theater arts, performing arts, Center for Communicating Science	Useful for teaching and learning. Need to incorporate to advance students in the field.

Communication (journalism)	Storytelling. Expose students to the technology since it is being used in new outlets. Students can create simple projects.
Veterinary medicine	Teaching tools
History	Unsure but curious how to integrate

Table 7: Reasons for wanting to utilize VR/AR.

The respondents who noted that they were not sure exactly what activity or topic they would want to use VR/AR in, indicated that they see value in the technologies and want to use it for teaching and learning. The history respondent wasn't sure how the technologies could be used in their field but indicated that it could possibly help students understand the history of technology better. A similar response from the chemistry, architecture, and consumer studies respondents who noted that they were unsure about how to incorporate VR/AR into their courses. This also echoes some sentiments from the implementer group who wanted to understand more about the application of VR/AR in their respective fields.

Types of Services Interested Faculty Sought

When asked what types of services they would need to move forward with effectively incorporating VR/AR technologies into their courses, each respondent indicated the need for technological support. Specifically, they specifically noted a "lack of knowledge" of the technologies, which appears to be a common theme. All respondents except for two mentioned pedagogical assistance as a service they would need. Some specified that they want to learn how to effectively incorporate the technology into their course, while the VR/AR design and development were other services noted by 6 of the faculty respondents. Having a dedicated space for VR/AR was another commonly referenced service noted by 5 faculty with some specifically mentioning space for multiple students (including one with over 100 students) to engage and space for the design and development of VR/AR activities. 4 of the interested faculty described the need for technological and pedagogical services as well as design, development, and a dedicated space with the tools and resources needed to support them throughout the process.

Spaces Interested Faculty Used

Surprisingly, 40% of interested faculty indicated that they have interacted with VR/AR spaces on campus, 60% indicated that they have not interacted with these spaces. Figure 2 breaks down the different spaces interested faculty have reached out to.

When asked if they would use a dedicated immersive technology space for faculty, 66.67%, or 6 respondents said that they would use it while 33.33%, or 3 respondents were unsure. The unsure group may be apprehensive due to the challenges and barriers they identified, such as having a lack of time or lack of knowledge of the technology.

Challenges Interested Faculty Encountered

There were several challenges identified by the faculty respondents with the most mentioned challenge being the lack of knowledge. This includes not knowing the technology, who to partner with, where to start, what is possible, and how it can be used in their courses.

Other notable challenges include the cost, availability, and accessibility of the technologies for students, as well as the lack of support available to assist with incorporating the technology into their teaching. One respondent expressed concern about the structure of control and power---who gets to use the technology and space. In veterinary medicine, limited options for anatomy--citing challenges with primary funding, getting community support, knowing what technologies exist, knowing how to make different systems such as VR and haptic work together, and integrating into a "curriculum that is already full." They further noted that there was a lot of interest in using VR/AR in their program, but the referenced challenges are a barrier that would need to be addressed. Based on these responses, it appears that there is interest, however not knowing the technology and how to use it nor where to go for support seems to resonate across respondents.

Future Support

When asked about the support and resources they would need to successfully integrate VR/AR into their courses, the respondents made several suggestions. The architecture respondent noted that they want to understand best practices for integrating VR/AR into architecture project development. The geosciences respondent stated that they are very unfamiliar with VR/AR and suggested some training program to get started and counts towards professional development that would be like a workshop for faculty to develop VR/AR that can be reviewed by peer faculty. The veterinary medicine respondent suggests that it would be helpful to know who can work on VR/AR projects, for example providing experiential learning opportunities for student workers with skills related to VR/AR development as well as possible funding options in this area of support would be beneficial. Further, they want to know what technologies exist and how to make them work together (e.g., VR with haptic).

Discussion

It is important to note that the faculty who were surveyed were from a list of faculty who participated in various professional development workshops and communities of practice on XR technology, therefore not every instructor across campus who implemented or are interested in VR/AR were surveyed. However, among the audience who were surveyed, it appears that faculty are in the early stages of VR/AR integration with most indicating that they have a lack of knowledge of not only the technology, but what it can and cannot be used for. It was surprising to see that there was broad representation of faculty respondents from various fields, from performing arts to the liberal arts, and the hard sciences. Such broad faculty interest in VR/AR can potentially lead to cross-disciplinary collaboration and innovation, creative applications of VR/AR including interdisciplinary opportunities for students, and create opportunities for students to use and develop with the technology. Moreover, knowing that a diverse pool of faculty have interest in VR/AR can help those working in faculty development bring to life the potentiality that VR/AR can offer in the classroom, from enhancing teaching and learning to preparing students for the workforce and

beyond. However, there are some challenges and barriers that need to be addressed for any wider adoption to take place or for any scaling up of VR/AR spaces and services.

The spaces used by all respondents reflect use of spaces from across campus. The fact that nearly half of the respondents utilized their department VR/AR space for development indicates that some departments already have some infrastructure and capacity for VR/AR and faculty are making use of it, whether it be for student-created or instructor-created experiences. They also utilized the development services of existing VR/AR spaces while interested faculty noted the need for various types of support throughout the planning through integration process.

The types of activities the implementing respondents described vary across levels of immersive technology being used. For example, interior design using 360 images that students access using their phones, while journalism is having students create 360 videos to engage in storytelling then review those stories in VR using a head-mounted display. This reflects the fact that faculty are making use of the extant spaces, services, and expertise. Although, there is a need for more spaces, technologies, expertise, and services as denoted by numerous respondents.

Over 66% of interested faculty indicated that they would be interested in a dedicated space for faculty to engage with VR/AR. In order to support faculty, finding ways to enhance their knowledge of VR/AR including: an understanding of what technologies and tools are out there and how they are being used in the respective fields, providing instructional design services to help them identify topics or activities that are appropriate for VR/AR use, and allowing them to also work with those with development skill sets, can address some of the challenges and barriers identified from this data. Aside from instructional design assistance, someone who can set up, maintain, troubleshoot various VR setups (manage an immersive studio) as well as someone with development experience in Unity who could lead students developers would be a few invaluable resources that can have a meaningful impact and help facilitate faculty adoption on a broader scale.

Conclusion and Implications

As virtual reality (VR) and augmented reality (AR) technologies continue rapid development, higher education institutions should strategically explore potential applications and implications (Johnson et al., 2016). Though not yet ubiquitous, adoption of immersive technologies will likely accelerate (Radianti et al., 2020). Early investigation by faculty innovators, researchers, and instructional design teams can uncover effective practices and identify infrastructure needs for wider deployment (Southgate et al., 2019). This proactive inquiry will allow universities to make informed investments to support pedagogical uses of VR/AR and prepare students with relevant future-focused skills.

The present study aims to identify current exploration of VR/AR among faculty at our institution. Surveying early adopters across academic programs provides insight into intended use cases, integration approaches, benefits, and pain points. While limited to those already expressing interest, initial findings will inform expanded efforts to gauge readiness among broader faculty and student populations. Developing dedicated VR/AR creation facilities and support services tailored to uncovered needs can progress institutional capacity for educational applications of these emerging technologies.

In anticipation of a world where immersive technology affects our everyday life, universities have an obligation to ready students for professional contexts transformed by these technologies. This study serves as the starting point of a broader effort to explore VR/AR technology in the context of higher education. Future efforts will expand to student perceptions, as well as the creation of a VR space dedicated to faculty and supported in the areas identified in this study.

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Music and Games in Education: Technological Experiences and Human Development

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Abstract
Music and Games share a wide range of specific characteristics mediated by the technological component which, in a way, impose an incessant dialogue between the demands of education, music education and human development itself. The consonance and versatility of this approach interact directly with the teaching and learning processes, constituting itself as a potential integrator with respect to the organisation and contexts of the game, the technological resources, the experiences and the potential contribution to the integral development of the individual. Among the areas and topics linked by this context, it is possible to mention gamification, game-based learning, music education, psychology, studies on human cognition, educational technologies, the inclusive perspective in education and science attached to imputations (benefits or disadvantages of the game) in human development. This research integrates a series of works carried out regularly and continuously, in order to strengthen the state of the art and respective literature review, along with the contribution to reflection, discussion and analysis on the relationship and structural characteristics between music and games, regarding its presence and influence in the educational universe and human development in general.

Keywords: Education, Music, Learning Technology, Games, Inclusion, Learning, Human Development

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Introduction

To start, for the development of this work, the context of games is considered, formed by the structural characteristics of games, as a potential organizer of educational demands, with an emphasis on music education (Silva, 2022). To name a few of such characteristics, it would be possible to mention rules, playfulness, clarity, engagement, belonging (significance, meaning), immersion, motivation (intrinsic, extrinsic), voluntariness, feedback, objectives, requirements, resources, fairness (according to the rules), autonomy, protagonism, controlled environment, narrative, chance and possible outcomes, difficulty, level, stages, rewards, challenge, player profiles, customization, as well as the following, which should be given due prominence: temporality, sociability, progression, fantasy, and integration. It is believed that by unifying these characteristics through the context of games, the understanding of these aspects will also be intensified, and since they are directly related to the demands of education, the teaching and learning process will be enhanced.

Music notably contributes to education by adding a sense of belonging, playfulness, and sociability, in addition to the frequently referenced affective, motor, and cognitive benefits. However, it is possible to incorporate various characteristics that music shares in common with the context of games and thus expand the possibilities of its contributions. This approach avoids approaches regarding the presence of music in education that are limited solely to recreational or exclusively playful aspects. These approaches treat these aspects as remedies that negate the need for a deeper understanding of the experiences of musical practice. The accounts of Miranda (2013) exemplify this matter when describing the execution of their work involving a workshop of games, musical activities, legends, and rhymes offered to a sixth-grade class in a public state school in São Paulo, Brazil. During the initially turbulent process, the researcher's expectations were continually thwarted by their proposals, despite their playful nature, as they encountered several issues. Among these, the relationship between the difficulty of the activity and the students' skill level, the lack of significance of the themes for the class, difficulty in understanding the activity (lack of clarity or excessive complexity progression), among others, led to a lack of engagement, focus, interest, and eventually, the loss of the playful aspect of the activity.

Objections against this type of fragmented thinking are found in Fonterrada (2008), while discussing networked learning, and also in a practical example directed towards the use of decontextualized tools. The author relates that it's possible to identify the presence of the game in the methodology of the renowned music educator Shinichi Suzuki as a mere “currency for the child to do what the adults want them to do.” Leme and Bellochio (2007), Bordini and Oliveira (2017), when discussing the use of digital games and technology in the classroom, also point out the importance of not considering the use itself of technologies or digital games as a guarantee of results. They emphasize the necessity for educators to have more awareness and preparation in utilizing such resources. The cross-cutting nature of this thinking can also be observed in the fields of special education and human development. In special education, beyond the continuous search for a wide array of assistive technologies, the emphasis on the student's protagonism during assessment and specialized educational support exemplifies the demand for inventiveness and versatility of resources and approaches. This ensures that the information provided by medical diagnoses, studies, and procedures related to specific disabilities is used in a contextualized manner for the life of the target student in special education. This approach considers their multiple interactions with the environments they participate in. In the realm of human development science, the emergence of paradigms that prioritize inventive, contextual, multifaceted, pluralistic,

integrative, and interdisciplinary approaches is reported. In alignment with these paradigms, education values approaches based on rich experiential interactions, especially when it comes to early childhood education and the initial years of elementary education.

The variety of connections between the realm of game context, gamification, game-based learning, game design, musical education (including its experience and practice), special education, education as a whole, and human development is emphasized. This current work aims to delve into this extensive panorama, believing that the exposition of the various parallels found among music, games, and the different aforementioned areas – all of which are considered of utmost interest for musical education – can broaden and enhance the methodological and pedagogical range for educators, especially music teachers. It's believed that, despite its breadth, the theme will remain cohesive when directed and organized within the context of games.

Technology, Experiences and Human Development

Amidst the rapid pace of information exchange, technological updates, and innovations, coupled with the gradual increase in the accessibility of technologies to a wide audience, games and gamer culture captivate an ever-growing portion of society. This phenomenon also extends their presence to other media forms such as series, books, events, and movies. Access to music, re-recordings, discographies, performances, and full concerts is also experiencing substantial advancements through streaming platforms and tools on social networks that enable listeners to share playlists and compilations expressing their preferences. All of this is also a part and a reflection of a context of continuous changes in technological and communicational advances, which have gone through five generations in the last two centuries (Santaella, 2010).

When discussing technology in the realms of teaching and learning, it's crucial to consider this presented context as the backdrop in which a significant portion of students is immersed in their daily lives. At times, they might be more informed and up-to-date than the education professionals themselves (Leme & Bellochio, 2007; Bordini & Oliveira, 2017). Technological enhancement is undeniably an educational demand highlighted by a wide range of studies. Many of these studies seek to investigate whether the implementation of technological resources in the classroom would bring positive or negative effects to the learning process. The findings are inconclusive, pointing towards negative, neutral, and positive aspects (Leme & Bellochio, 2007; Fadel et al., 2014; Bordini & Oliveira, 2017; Passarelli et al., 2018; Curioni et al., 2019; Passarelli et al., 2019). Much should be questioned and kept in mind concerning the results of these research endeavors, given that the implementation of technologies in the classroom can vary from replacing a paper form with a digital one to carrying out game-based learning that involves a triple-A game produced by major game industries, boasting high quality and substantial budget. Such games come with engaging storytelling and immersive gameplay experiences. Even when considering the last example of using a high-quality game, the results are still tied to how its application takes place in the classroom. What cannot be denied is that by seeking to understand games and their applications in education, doors open to numerous new tools and areas of knowledge that can be utilized – or not – in the processes of teaching and learning. This also creates pathways for the implementation of other Information and Communication Technologies (ICTs). Studies like those on Gamification, Game Theory, Game-Based Learning, and Game Design can be considered as part of this discussion.

Deepening the understanding of the game context involves challenging “the generic assumption that games support learning because they are motivating and engaging. The aim is to enrich the body of knowledge concerning learning with games with a better understanding of the conditions for games to be motivating both to play and to learn from” (Passarelli et al., 2019, p. 331). Similarly to the theme of this present work, this challenge to generic assumptions extends cross-cuttingly into the realm of musical education. In this area, it's also important to avoid solely recreational approaches based purely on the playfulness of musical practice, at the expense of understanding the network of interactions experienced in the musical journey.

Playfulness, engagement, and motivational elements are crucial characteristics, but not the only ones. Continuing with the example of a triple-A game, the "quality" of the game doesn't guarantee that it will be more enjoyable or meaningful for the player, nor that the curriculum content to be developed and worked on will be experienced by the student. However, high-quality audiovisuals, problem-free mechanics and controls, and smooth gameplay flow all contribute to the enhancement of certain characteristics, organized within the game context. These include immersion, narrative, temporality, engagement, personalization, progression, difficulty, and clarity. In turn, these attributes create an environment conducive to learning (Fadel et al., 2014; Busarello, 2016; Silva, 2022). A good game design, much like a well-crafted lesson plan by a teacher, takes these considerations into account. Games inherently present systems that need to be learned in order to be mastered. They rely on solid learning principles to prevent players from failing excessively and becoming overly frustrated in their experience, which could lead to losing interest in the game (Bordini & Oliveira, 2017). A well-designed serious game, a game with an educational purpose beyond entertainment, must strike a balance between learning aspects and the enjoyable elements. It should harmonize objectives, feedback mechanisms, progression, accuracy of the educational content covered, reward systems, with emotional connection, pleasure, sense of control, immersion, and significance (Lima et al., 2021).

Additionally, in game-based learning, the crucial decision of which game to use and for what purpose brings the discussion to another point raised by Passarelli et al. (2018) about "market games" and "serious games," considering research and technological advancements. Beyond these points, the issue of available resources within the game industry is addressed, highlighting the stark difference between this industry and the somewhat lagging academic sphere, especially in specific aspects. The author underscores the importance of reinforcing mutual contributions between the industry and research fields. This is because psychological studies and education-focused research from academia could theoretically complement the technological and artistic quality of games produced for the market very well.

This difference becomes even more pronounced from the player's perspective. In their daily life, they encounter higher-quality products, while in the educational environment, they interact with products that fall short in comparison to the former. This concern can also be translated to the use of technologies in the classroom, especially in situations where there is insufficient preparation on the part of the teacher to handle such resources, which may already be part of the student's daily life and even mastered by them. It's necessary to establish a stronger dialogue between academia and development, the educational realm and technological innovation. Additionally, efforts should be made to ensure that teachers are updated and equipped with the necessary technical and theoretical knowledge about the technologies they will use, along with the broader characteristics and aspects that surround

them, such as the game context (Leme & Bellochio, 2007; Bordini & Oliveira, 2017; Silva, 2022).

For use in musical education, several digital games and applications can be mentioned, including Rocksmith, Descobrindo Sons, Flute Master, Piano Game, Flappy Crabb, Simply Piano, VR4EDU, Deu a louca no maestro, MusicandoRA, GenVirtual, Melodia, Dó Ré Música, Musikinésia, Tuhu Musical, Musique, Mini Maestro, and Musical Instructor. Additionally, it's worth mentioning apps for composition, score editing, musical instrument simulation, acoustic experimentation, and musical analysis, such as Encore, GuitarPro, MuseScore, kbPiano, Virtual Piano, Sonic Visualizer, Ableton Live, Melodic, and Chrome Music Lab (Lima et al., 2021).

However, it's important to highlight that while digital games provide and require the use of modern technologies, offering clarity, immersion, and significance (among other cited characteristics) through well-presented stories, well-executed mechanics, seamless gameplay experiences, high-quality audio, and graphics, the use of analog games and toys can also be considered a use of technology, even though they fall under the category of low-tech. Integrating this perspective into the previous considerations allows for a reevaluation of analog games and playthings, which are currently more accessible and prevalent in educational settings compared to digital games.

Games and play are inherently connected to musical education, especially but not exclusively in early childhood education and the initial years of elementary education. This brings together the studies, advancements, methodologies, resources, demands, and concerns from the various mentioned areas into this context. Musical instruments and resources, both digital and analog, can also be included as versatile tools for engaging in activities with gamification elements.

Using the activities listed in Fernandes (2011), Guia and França (2015) as a reference, the proposed musical activities indeed affirm a wide diversity of approaches, resources, and stimuli (visual, motor, auditory, emotional, tactile, cognitive) provided and required. This variety offers numerous pathways to create an environment conducive to learning. Among the resources used, each with its usage to be reinvented depending on the activity, include: Dice, Cards, Posters, Game Boards and Tracks, Tokens, Dominoes, Plush Toys, Mats and Hula Hoops, Bowling Pins, Puzzles. These can be customized during their creation or adapted, for example: plush toys and bowling pins that function as rattles and shakers for timbral recognition; personalizing the faces of a dice with figures of musical instruments, rhythms, notes, elements of musical notation, objects from soundscapes; Mats, Hula Hoops, Posters, and similar items that redefine the physical classroom space; Dominos that, with the help of rules, match not only identical pairs but also equivalent pairs, or that forgo the formation of pairs to emulate progressions (such as fitting together adjacent notes, for instance). It's also worth mentioning the creation of specific objects and toys for each case, such as the "Sound Box" (Caixa Sonora), presented by Fernandes (2011), where each inner face of the box contains materials to exemplify and work on a sound parameter, and the "Magic Chest" (Baú Mágico) which redefines the set of available musical instruments for classes and utilizes them, among other activities, to add sound to stories. In addition to practical and functional adaptations, each inventive and artistic customization of the resources used will likely contribute significantly to the educational experience, offering new possibilities for interactions and meaningful relationships.

Reinforcing the parallel with elements from digital games, for example, it would be possible to review the quality of stimuli and feedback provided by an activity, even if analog, as the goal is to enhance the experience of the teaching and learning process, regardless of the use of digital or non-digital resources, whether high or low cost and technology. In the "Skyscraper Game" (Jogo do arranha-céu), Guia and França (2015) propose the placement, with alternating player turns, of tokens with note names on a game board featuring a track that ascends from the base to the top of a building. For the game, they also suggest an alternative rule where the need for a sequential turn is abolished, altering the temporality of the activity and encouraging a state of attention among all players. What kind of feedback do the students receive as they progress in the game? How much does this add to the immersion, clarity, and significance of the activity? By considering these questions, it's possible to seek specific solutions for interaction points generated by the "Skyscraper Game" activity, such as real-time performance by the teacher of the notes as they are placed on the game board. What is the quality of the feedback? A vocal execution could be possible, perhaps limited by the teacher's vocal range or the quality of notes outside of it; Instrumental performance adds new timbres and possibilities. It might be possible to imagine the development of a digital application that adds sound to the notes, progressively introducing more harmonic/textural density as students progress on the game board, culminating in a pompous and rewarding finale such as a fanfare or rich harmonic/textural execution on the last note. This could also add rhythm to the activity by causing the sound to gradually fade during moments when there's a delay in advancing on the game board. Whichever path is taken, it enriches the experience and expands the possibilities of interactions, results commonly experienced in musical practice due to the elements that surround it such as significance, challenge, progression, fantasy (intrinsic), immersion, motivation, protagonism, integration, among many others.

It's worth noting that it's possible to integrate the issue of the quality of stimuli and feedback with the importance of the music teacher's notion as a performer, who is skilled in musical execution to ensure immersion, fluency (and temporality), organicity, and clarity of the experience during the class. Also, a good example of a technological resource related to performance would be the use of a loop pedal by the music teacher, as it allows enriching arrangements for solo performance through real-time recording of sections to be played in a loop simultaneously with each other and the instrumentalist's performance, enabling, for instance, the execution of more complex textures with a bass line, harmonic accompaniment, percussive accompaniment, and melody (Duarte, 2015).

Regarding games and play, it's always worth mentioning the issue of their apparent "childishness," as they are generally more associated with a younger audience. In this work, it is believed that the use of games and play should not be avoided due to concerns about the supposed childishness of these resources. Furthermore, all the versatility presented supports and offers various options and customizations to overcome the perceived childishness if it were a concern for application with more adult audiences. Moreover, studies in various ways encourage the revival of the language of childhood as something extremely beneficial (Mateiro & Ilari, 2016; Rivero & Rocha, 2019). A good example of a teaching proposal based on games, play, and playful activities for the adult audience is the MILMESA method, aimed at higher education, which has some of the following objectives: General and artistic development in an interdisciplinary way of verbal and non-verbal forms of expression; Use of games and playful aspects of education; Development of the notion, concept, and achievement of artistic literacy; Encouragement of a comprehensive understanding of

personal, social, artistic, and educational proficiency through general artistic knowledge (Leonido et al., 2023).

After presenting the numerous resources offered by the fields of study and market encompassed by music and games, and briefly discussing how their presence creates new opportunities for interactions and meaningful relationships, the focus on the student's experience, their involvement, and how, during the use of these tools, this primary objective should remain at the core of the matter, is emphasized.

To better understand the experience of the target audience in education, one must consider the context in which their lives are embedded. And, as mentioned earlier, understanding the impacts of technology on the world and individuals is crucial to delve into this context and how interactions between mediums and individuals occur. Technology, along with technological and communicational advancements and revolutions, directly influences the spatiotemporal relationships that human cognition conforms to, brings about significant changes in how people perceive and understand the world, and progressively shapes the contexts in which the education's target audience is immersed through socio-cultural transformations (Santaella, 2010). Considering this relationship between technology and the perception of the world, the importance and dimension of gamification aspects, such as immersion and temporality, as discussed in this work, are redefined. This also allows for another point of dialogue with the interactive and expressive nature of music and games.

Regarding human development, when investigating studies in this field, significant convergences with educational paradigms are found. Education directly benefits from the knowledge produced by the science of human development and uses it to understand, structure, carry out interventions, and promote teaching methodologies that effectively foster learning processes in the educational context (Dessen & Junior, 2008, p.190). The authors also provide an overview of studies in the field, mentioning Piaget, Vygotsky, Wallon, and Bronfenbrenner, and from their development, it's possible to highlight demands for: Contextualized, multifaceted, pluralistic, integral, and interdisciplinary views and proposals; Abandonment of predetermined and one-directional stances, valuing creativity, inventiveness, and ethics in processes; Recognition of the importance of bidirectionality of interactions and world experiences for self-construction; Placing the individual as a reference point for the science of human development and education, without disregarding the collective; Integration of different human aspects such as cognition, motor skills, emotions, and their social, cultural, historical, and temporal contexts.

Regarding cognitive, motor, and affective aspects, the literature in the field demonstrates that auditory perception and affective connection with others begin even before birth. The auditory influence that the fetus receives can impact its emotionality, stimulate its memorization capacity (Mabille, 1990; Leonido et al., 2023). “Music, especially classical music, plays an important role in child development: it not only enhances the baby's auditory acuity but also stimulates the left hemisphere of the brain and regulates heart rhythm” (Mabille, 1990, p. 15). Music also has a significant influence on the direct development and functioning of children's brains, involving different tempos, gestures, rhythms, and intonations as a form of communicative and expressive art language (Weigsding & Barbosa, 2014). It is evident that music education stimulates the development of auditory perception, attention, concentration, creativity, motor coordination, memory, reasoning, motivation, sociability, balance, cultural integration, as well as a sense of importance and belonging to the collective process of experiences and knowledge acquisition.

Just as the panorama of human development science described earlier, when discussing the study of music and some of its recent paradigms as found in David Elliot, Benett Reimer, and Keith Swanwick, it is possible to relate their propositions and define music as a human practice, endowed with a complex network of interrelationships with the social, cultural, political, and economic panorama (Fonterrada, 2008, p. 177). Music, much like games, is permeated with interactions on various levels, ranging from the direct influence on the sound outcome during musical practice to the very origin of the musical event, stemming from the interaction of the sonic event in the physical environment with human cognition. There is much to discuss when it is realized that both fields, music and games, offer potentially interdisciplinary propositions that promote the holistic development of the individual by integrating, throughout their processes, social, cultural, cognitive, affective, motor, and temporal contexts. These are based on the interactive bidirectional experience of the individual's internal experience with the external environment (Fonterrada, 2008; Dessen & Junior, 2008).

Conclusion

It is believed that the present work has generated a dialogue that, despite its comprehensiveness, is in line with the studied paradigms, as it seeks to relate many and varied areas of study in a multifaceted, interdisciplinary, and contextualized manner, and according to the proposed demands and potentialities, such as the quest for versatility to better delve into understandings, problem-solving, and the enhancement of inventiveness during the processes. The dialogue has also reinforced the integrative, organizing, and potentiating nature of music and games, aligned with the paradigms of human development, as beneficial to support a good and appropriate implementation of technological resources in education.

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A Study on the Effectiveness of Active Learning in Different Learning Environments: Active Learning Method in the Field of Business Management

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Abstract
With the spread of active learning (AL), various teaching methods have been proposed in business management education. However, it is difficult to understand a pragmatic science like business management for undergraduate students who do not have business experience. In this situation, we proposed an active learning method based on the PDCA cycle to draw out the dynamic nature of the participants and obtain learning effects through "dialogue". However, in the situation with COVID-19, where it is not easy to implement face-to-face group work with a large number of participants, it would be desirable to conduct such an active learning method in an "online learning environment" or a "hybrid learning environment" with a mixture of online and offline participants using ICT tools (e.g., Google Meet, Zoom). But there is no clear way to effectively implement such active learning methods in different learning environments. So, to clarify the way to implement our proposed method in different learning environments, we conducted group work in three different learning environments (face-to-face, online, and hybrid) and evaluated the effects. The results of these group works revealed that although there are differences in participants' satisfaction and the effectiveness of our method, it is possible to achieve specific results in an "online learning environment" and a "hybrid learning environment". Furthermore, this paper discussed the points to be considered when implementing this learning in different learning environments.

Keywords: Learning Environment, Active Learning, Business Management Education, COVID-19, PDCA Cycle

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Introduction

Currently, educational methods called "active learning (AL)" have been attracting attention. In the field of management, where students need to learn the process of applying theory experientially, AL methods have been proposed [1, 2, 3, 4].

To understand a pragmatic science like business management, students need to learn it through three sequential steps: (1) acquiring knowledge, (2) structuralizing acquired knowledge, and (3) generalizing structuralized knowledge.

Otherwise, in the situation with COVID-19, where it is not easy to implement face-to-face group work with a large number of participants, it would be desirable to conduct such an active learning method in an “online learning environment” or a “hybrid learning environment” with a mixture of online and offline participants using ICT tools (e.g., google meet, zoom). Nevertheless, there is no established method for effectively implementing active learning methods in different learning environments. Although the COVID-19 pandemic and the disruption caused by it have subsided worldwide, AL using ICT tools will continue to be an essential form of university education. For example, it has the potential to facilitate the realization of learning across countries and regions.

Therefore, this research attempted to clarify how to implement our proposed method in different learning environments. In this research, we conducted face-to-face, online, and hybrid group work and evaluated the effects of the environmental type of group work on the effectiveness of group work.

Theoretical Framework

This research is based on the concept of “transfer of learning” in the situated cognition perspective [5] (Figure 1). In this concept, knowledge of any action is seen as being embedded in the context. Thus, people learn to do something through interplays with other actors in the context.

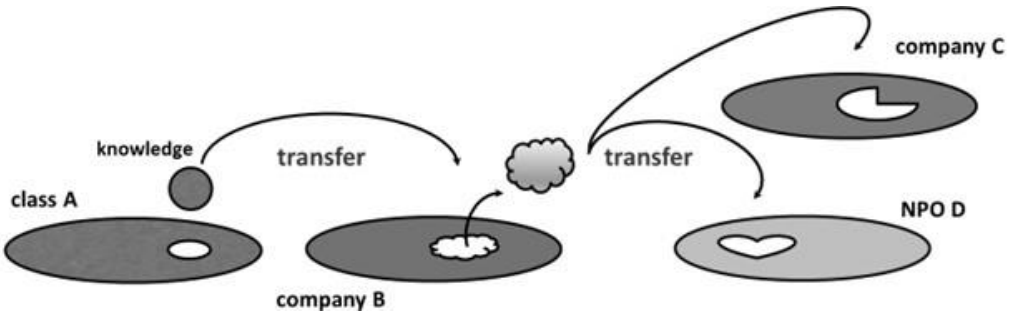

Figure 1: Situated learning as our theoretical framework

Based on this perspective, to understand a pragmatic science like business management, students need to learn it by following three sequential steps [6, 7].

- Step 1: Acquiring knowledge.

Students acquire knowledge by taking traditional-style classes, such as one-way lectures by instructors or reading books themselves.

- Step 2: Structuralizing acquired knowledge.

Students structuralize acquired knowledge by using the acquired knowledge in a specific situation through role-playing. However, they cannot apply it in other different settings. They just acquired contextualized knowledge in this step.

- Step 3: Generalizing structuralized knowledge.

Students generalize structuralized knowledge based on similarity. Therefore, using metaphors that imply how to use the knowledge in different situations is one of the effective ways to implement the last step. Students can apply knowledge in any case through this step.

However, it is difficult for undergraduate students who do not have business experience to learn and practice steps 2 and 3.

Active Learning Methods in Business Management Education

It is challenging for undergraduate students with no business experience to learn and practice steps 2 (Structuralizing acquired knowledge) and 3 (Generalizing structuralized knowledge) of the whole process.

This research used an “active learning” method in group work to draw out the active nature of the participants and obtain learning effects through "dialogue". Also, this research designed the group work based on the PDCA (Plan-Do-Check-Act) cycle.

Teaching Method Based on the PDCA Cycle

The PDCA (plan-do-check-act, sometimes seen as plan-do-check-adjust) cycle is a repetitive four-stage model for continuous improvement in business process management. It is also a historic concept which was invented by management process school. The PDCA cycle is implemented to improve the quality and effectiveness of processes within product lifecycle management, project management, human resource management (HRM), supply chain management (SCM), organizational performance evaluation, and many other business areas.

The PDCA cycle has the following four steps. The first step is “Plan”. It involves defining the problem to be addressed, collecting relevant data, and ascertaining the problem's root cause. Then, we progress to the “Do” step. This step involves developing and implementing a solution; deciding upon a measurement to gauge its effectiveness. “Check” is the next step after “Do”. We confirm the results through a comparison of planned and actual results. Finally, we document the results, inform others about process changes, and recommend addressing the problem in the next PDCA cycle. This last step is named “Act”.

In this paper, we designed the group work based on the PDCA cycle (Figure 2) [8].

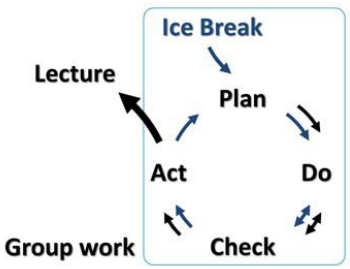

Figure 2: Teaching method based on the PDCA cycle

In this group work, aspects of communication with each group member are essential for enhancing learning effects. Since group work is conducted in a short period, an icebreaker plays a vital role in improving the group work's quality. So we decided to run an icebreaker before the group work. After the group work, we decided to give a lecture to explain what we learned in the group work.

Implementation Method

In this study, we conduct a trial of group work in the field of business administration in a face-to-face environment, hybrid environment, and online environment, targeting "synchronisation and empathy" that occur in organizational and group decision-making. These group works also aim for students to experience the importance of “dialogue“ in organizing [9, 10]. Communication with each member is necessary for these group works to increase learning effectiveness.

The implementation method of our proposal is as follows:

Step 1: Icebreaker
Step 2: Explanation and planning
Step 3: Pre-Group work
Step 4: Mutual inspection
Step 5: Explanation and planning
Step 6: Group work
Step 7: Mutual inspection
Step 8: Lecture

First, we set a time for self-introduction (Icebreaker) to understand each other better about the members (Step 1). Second, we conduct pre-group work to get the participants to relax (ice-breaker game: Steps 2 to 4). Third, students work on group work (Steps 5 to 7) (see next chapter for details). After finishing their work, every participating student evaluates the work of other teams.

The procedure of group work is as follows:

Step 1: Each group watches a video explaining the contents of the work and the conditions of the group work (consensus game).
Step 2: Each student rank options according to the level of necessity (personal work).
Step 3: Review individual responses to each other and rank the options as a group (group discussion).
Step 4: The results of each group's discussion are written on a form and collected by the instructor.
Step 5: The results are scored, and the ranking of all teams is determined according to that score.
Step 6: After group work, we analyze the (1) communication between students, (2) understanding, (3) interest, and (4) ability by using a questionnaire survey.

After the group work, instructors explain fundamental management organisation theory. Instructors also present the importance of understanding the environment around their organisation and creating good collaboration (enhancing psychological safety) (Step 8).

Types of Learning Environments

In this research, we conducted group work in an online, hybrid, and face-to-face environment. An overview of experimental classes is shown in Table 1. We opted for different consensus games because several students overlapped over the two years.

Year	Environmental Type	Number of students	Number of teams	Contents of Consensus Game
2020	Online	44	11	Moon landing exercise
2021	Hybrid	70: face to face 16: online	18	Accident in snowy mountains
2022	Face-to-face	87	18	Captain's Decision

Table 1: Overview of experimental classes

Online Environment

We conducted an experimental class in a face-to-face environment in 2020. In the experimental class, we used “Moon landing exercise: Ranking survival objects for the moon” as the subject of group work. This team-building game aims to reinforce the concept of using critical thinking in prioritisation activities. We used “spatial. Chat (https://spatial.chat/)” as a meeting tool. This meeting tool is a VR chatroom. Forty-eight university students (4 students x 12 groups, 3rd-year and 4th-year students) conducted the group work in an online learning environment (Figure 3).

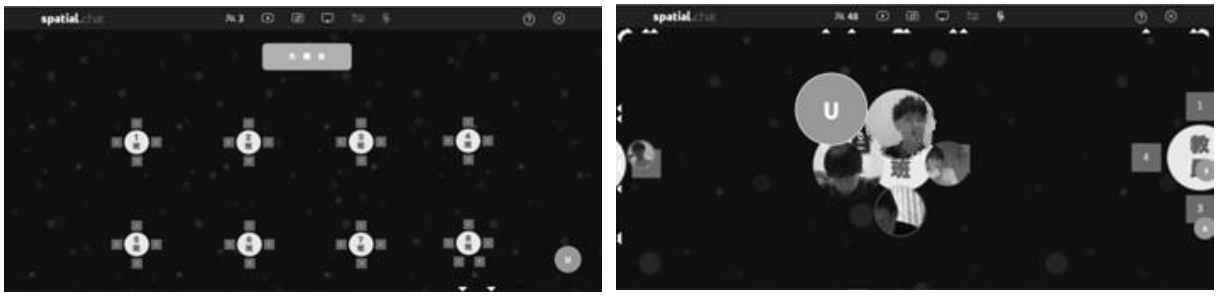

Figure 3: Online environment

Hybrid Environment

We conducted an experimental class in a hybrid environment in 2021. In the experimental class, we used a consensus game, “Accident in snowy mountains exercise: ranking survival objects for the snowy mountains”, as a subject of the group work. As an online meeting tool, we used “google meet”. Eighty-six university students (4-5 students x 18 groups, offline: 70 students, online: 16 students, 3rd-year and 4th-year students) conducted the group work in a hybrid learning environment (Figure 4).

Figure 4: Hybrid environment

Face-to-Face Environment

We conducted an experimental class in a face-to-face environment in 2022. In the experimental class, we used a consensus game, "The Captain's Decision: ranking the actions on a sinking ship as a captain", as a subject of the group work. Eighty-seven university students (4-5 students x 18 groups, 3rd-year and 4th-year students) conducted the group work in a hybrid learning environment (Figure 5).

Figure 5 Face-to-face environment

Results

Using a questionnaire survey, we analysed the students' understanding, interest, needs for knowledge in management, and ability to apply.

Questionnaire Survey

The questionnaire survey included the following items, which were developed to assess the effectiveness of communication and the formation of group opinions. These items are detailed in Table 2.. Each questionnaire item was variable and measured on a 5-point Likert scale with 1 "Low" and 5 "High" answers. In addition, this questionnaire survey was conducted before and after the group work to analyse the effects of the group work.

No	Items
Q.1	When there was a conflict of opinion within the group, it was resolved by bringing cooperation or direct confrontation to the surface and bumping into each other.
Q.2	We listened carefully to each other‘s opinions.
Q.3	We respected each other‘s sentiments and feelings.
Q.4	When ideas and arguments conflicted, we could discuss them objectively without getting emotional.
Q.5	I was free to speak up if I came up with an idea different from the others.
Q.6	All group members were encouraged to participate.
Q.7	The group‘s mission was a priority.
Q.8	Act suspiciously even if this is what you want to do.
Q.9	Be prepared to admit that you are ignorant and ready to take risks.
Q.10	Withhold judgment until all data is collected.
Q.11	Think pragmatically and ingeniously search for data to prove your point.
Q.12	Use frameworks and methods that help in logical thinking and analysis to reach conclusions.
Q.13	We are divergent thinkers pursuing possibilities.
Q.14	We have the discipline to prove or dismiss them one by one.
Q.15	We were flexible on issues of unclear structure.

Table 2: Items of the Questionnaire Survey

Table 3 shows the basic statistics of the questionnaire items. The online environment had particularly high mean values for the questions about listening carefully to each other’s opinions (Q.2) and encouragement to participate (Q.6). The hybrid environment also had particularly high mean values for the questions about listening carefully to each other’s opinions (Q.2) and encouragement to participate (Q.6). Otherwise, the points about whether they behaved suspiciously (Q.8) were low. The face-to-face environment had particularly high mean values for the questions about listening carefully to each other‘s opinions (Q.2), objective discussion when there is disagreement, and encouragement to participate (Q.6).

Question items	Online		Hybrid		Face-to-face	
	mean	S.D.	mean	S.D.	mean	S.D.
Q.1	3.9	1.514	4.7	0.594	4.5	0.597
Q.2	4.9	0.302	4.9	0.236	4.8	0.380
Q.3	4.6	0.688	4.8	0.428	4.3	0.893
Q.4	4.7	0.467	4.8	0.428	4.9	0.471
Q.5	4.7	0.467	4.7	0.594	4.6	0.584
Q.6	4.8	0.405	4.9	0.236	4.9	0.257
Q.7	4.6	0.688	4.6	0.698	4.7	0.567
Q.8	2.2	1.401	1.6	0.922	2.9	1.580
Q.9	4.1	0.831	4.1	0.938	4.6	0.778
Q.10	3.6	1.293	4.1	0.873	4.4	0.758
Q.11	3.8	1.250	4.1	1.162	4.2	0.664
Q.12	4.2	1.168	4.2	0.924	4.5	0.763
Q.13	3.9	0.701	4.3	0.594	4.5	0.652
Q.14	3.7	0.905	4.4	0.608	4.6	0.586
Q.15	4.2	0.874	4.5	0.618	4.7	0.451

Table 3: Basic statistics

Analysis of Mean Scores

Table 4 shows the characteristics of groups whose outcome scores improved after group discussions in a face-to-face environment.

Item	Q.3:Respected each other's sentiments and feelings	Q.5:If I came up with an idea different from the others, I was free to speak up.	Q.8:Act suspiciously if this is what you want to do.	Q.13:We are divergent thinkers, pursuing possibilities.	Q.15:We are flexible on issues of unclear structure.
Good four teams (Well improved)	4.3	4.3	3.3	4.8	4.3
Bad four teams (Little improvement or worse)	5.0	5.0	2.4	4.3	4.9
Difference	-0.7	-0.7	0.9	0.5	-0.6

Table 4: The analysis of mean scores (1)

Table 5 shows the characteristics of groups whose outcome scores improved after group discussions in a hybrid environment.

Item	Q.3:Respected each other's sentiments and feelings	Q.10: Withhold judgment until all data is collected.	Q.15:We are flexible on issues of unclear structure.
Good four teams (Well improved)	5.0	3.8	4.0
Bad four teams (Little improvement or worse)	4.5	4.3	4.5
Difference	0.5	-0.5	-0.5

Table 5: The Analysis of Mean Scores (2)

The above results reveal the following points.

- The mean score of items suggests that the characteristics of teams with improved scores are different depending on group work environments.
- Regarding the face-to-face environment, “respect for other members” and “being flexible” do not yield good results. “Act suspiciously” and “divergent thinking” would be beneficial.
- Regarding hybrid environments, “respecting other members” would lead to good results. Otherwise, “withholding judgment” and “being flexible“ would not produce good results.
- “Respect for other members” produced different results for hybrid and online. There is a possibility that the existence of psychological safety (face-to-face) and the effects of icebreakers have the opposite impact.

We also analysed the free text sections. Table 6 shows the characteristics of groups with improved scores after group discussions.

Environmental type	Online	Hybrid	Face-to-face
Characteristics of the discussion of the good teams	● There's not so much discipline within the group. ● Not overly concerned with logical arguments and data. ● Members' interest in business administration is not too strong.	● Team members are under the impression that business administration is not easy.	● Team members are interested in business administration. ● Once a result is obtained, they act suspiciously as if this is the right thing to do.
Factors hindering improved results	● Bouncing their opinions off each other with great intensity.	● Excessive respect for each other's views. ● Feel free to say any idea that comes to mind.	

Table 6: Analysis of free text sections (1)

Analysis of the Characteristics of Results in a Hybrid Environment

Table 7 shows the characteristics of results in a hybrid environment, and Table 8 shows the result of the unpaired t-test for differences between means.

The unpaired t-test for differences between means shows the following.

- Respect for sentiments and feelings (Q3) and expressing ideas freely (Q4) differ statistically significantly.
- Mutual respect is essential, but not too much respect.
- It is crucial to say ideas freely, but it is not good to say too much.

Variables	Category	n	mean	Standard deviation	Standard error of the difference
Q.3	good	10	4.6	0.516	0.163
	bad	7	5.0	0.000	0.000
Q.4	good	10	4.6	0.516	0.163
	bad	7	5.0	0.000	0.000

Table 7: Characteristics of results in a hybrid environment

variables		Levene's test for		Unpaired t-test for differences between means						
		F score	Significance	t score	Degree of freedom	Significance (2 sides)	Differences between means	Standard error of the difference	95% Lower limit	95% Upper limit
Q.3	σ Assumed to be equal	148.325	.000							
	σ Not Assumed to be equal.			-2.499	9.000	.037	-.400	.163	-.769	-.031
Q.4	σ Assumed to be equal	148.235	.000							
	σ Not Assumed to be equal.			-2.449	9.000	.037	-.400	.163	-.769	-.031

Table 8: Result of unpaired t-test for differences between means

We also analysed the free text sections. Table 9 shows the characteristics of groups with good final scores.

The analysis of the free text section suggests that the characteristics of teams with good final scores and teams with improved scores are different depending on the environment.

As to online, highly disciplined groups are less likely to produce good results because of the limitation of communication.

As to hybrid, it seems complicated to produce good results if members are overly concerned about online participants or if they are telling people what they think of their ideas. Offline members need to support online members who could better participate in group discussions.

As to face-to-face, good results are produced without having to accept opinions as they are. A reserved and modest attitude might not lead to good results.

Environment type	Online	Hybrid	Face-to-face
Characteristics of the discussion of the good teams	● Team members do not speak too freely. ● Not forcing everyone to communicate. ● Do not overemphasise planning. ● Not too much priority is given to the group.	● Many team members feel the need to study business administration. ● Understands well the post-lecture given by the instructor.	● Team members are interested in business administration. ● Team members believe that face-to-face communication is more accessible.
Factors hindering improved results		● Excessive respect for each other's opinions	

Table 9: Analysis of free text sections (2)

Conclusions

This paper focused on the active learning method, conducted in three different learning environments (online, hybrid, and face-to-face) for undergraduate students to understand management theory. To clarify how to implement our proposed method in different learning environments, we conducted group work in different learning environments and evaluated the effects.

The results of these group works revealed that although there are differences in participants' satisfaction and the effectiveness of our method, it is possible to achieve specific results in an "online learning environment" and a "hybrid learning environment". Furthermore, this paper discussed the points to be considered when implementing this learning in different learning environments.

However, we have some issues that need to be overcome. It would be necessary to refine the content of group learning and present an evaluation method in future studies.

Moreover, it would be necessary to refine the content of group learning and present an evaluation method in future studies.

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Curricular Design of Higher Education in Colombia From Educational Policies

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Abstract
With the Colombian Constitutional Reform of 1991, the Government ceased to be the sole curriculum designer in educational institutions. With this Reform, the Government fulfills the role of supervision and control of educational quality. On the other hand, the Universities are granted the autonomy for the design of their Institutional Educational Projects, therefore, the design of the educational projects of each academic program offered by the institution, which are inputs for the curricular design of each program. The Government has been fulfilling its function by issuing decrees that include quality conditions. Based on the above, this research aims to describe the changes in curriculum design in Colombia, starting with the first law on higher education after the Reform of the 1991 Constitution, and how universities have migrated from a curriculum design "by objectives" to a design by "competencies," and today the design is based on learning outcomes. From a qualitative research approach supported by theoretical review and documentary analysis, using the Atlas T and the Gaphi, it is concluded that the curricular design in Colombia and its transformations obey international guidelines and maintain the same formal and sequential structure, independent of the norm that governs in each historical moment. What changes is the way of carrying out each of these elements that make up the structure.

Keywords: Competencies, Curriculum Design, Higher Education, Public Policy, Learning Outcomes

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Introduction

Curriculum design is a methodology that involves a series of steps linked by models used to organize and structure a study plan. This methodology serves as a guide for Higher Education Institutions (HEIs) in the development of curriculum proposals at different levels (undergraduate and graduate) and modalities (virtual, distance, face-to-face, and hybrid).

Each of the curriculum theories has its model. In this regard, the theory of technical approach corresponds to the unique model of curriculum design by objectives; the theory of practical approach corresponds to different models of curriculum design, using for this work the curriculum design by competencies and curriculum design by learning outcomes, which are models that have been in use in Colombia and have been protected by the educational regulations. These models respond to the guidelines of international institutions and organizations such as the World Bank, UNESCO, and the OECD.

This research shows that, despite the existence of different curriculum design models linked to a specific theory and to the current regulations of the time, their design or structure follows the same four stages (contextualization, profile definition, curriculum structure, and evaluation), what changes is how each of these stages is developed.

This research describes how the Colombian educational system works, then moves to the analysis of curriculum design in Colombia concerning the regulations chronologically, and closes with the stages involved in curriculum design at each moment of change within the framework of the regulations. It concludes with the stages necessary for elaborating the curricular design of programs that allow its application in a contextualized manner, regardless of the type and level of the program.

Method

This research is developed within a constructivist paradigm, and a qualitative study has been carried out, which, as Valles (2000) states, assumes the existence of multiple realities. The research is also descriptive and is carried out in a comparative manner, relying on documentary and content analysis.

Documentary analysis is carried out according to the concept of Guevara (2019), "Documentary analysis (DA) consists of a process of systematization and synthesis of qualitative data, it allows a triangulation of narrative documents, combined with different sources of information, it requires content analysis" (p. 107).

In terms of content analysis, the stages recognized by Arbeláez & Onrubia (2014) are followed, they are: the theoretical phase or pre-analysis, which consists in organizing the information from a superficial review of the documents; the second phase, called descriptive-analytical, is carried out in the deep review and analysis of the documents; then comes the third and last phase, called interpretive, which allows drawing the respective conclusions about the topic under study from the reviewed documents.

Results and Discussion

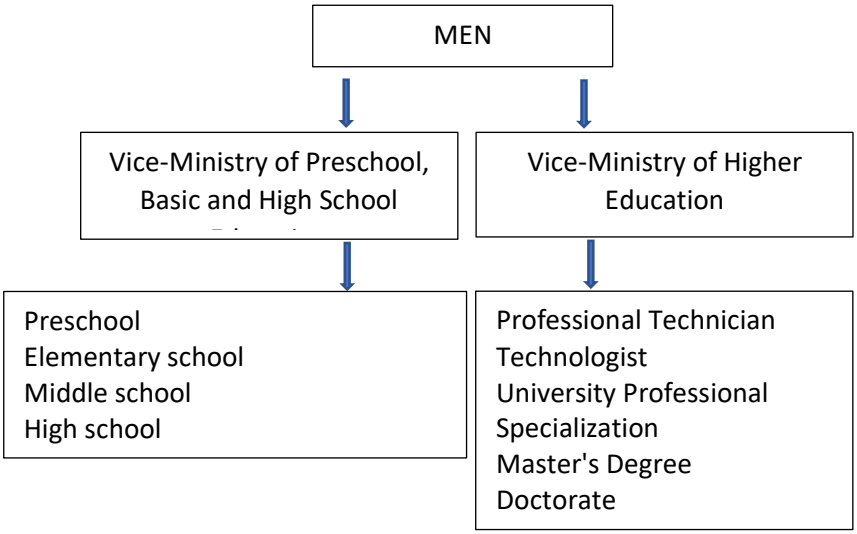
Colombian Educational System

In Colombia, education is defined as a permanent process of personal, cultural, and social formation based on an integral conception of the human person, his dignity, his rights, and his duties.

The Constitution establishes the fundamental characteristics of the nature of the educational service. It states, for example, that education is an individual right, a public service with a social function, and that it is the responsibility of the State to regulate and exert supreme control and supervision over the educational service in order to ensure its quality, the fulfillment of its purposes, and the best moral, intellectual, and physical training of students. It is also established that adequate service coverage must be guaranteed, and the necessary conditions for access and permanence of students in the educational system must be ensured.

The policy and regulation of the educational system are delegated by the President of the Republic to the Ministry of National Education (MEN) (see Figure 1), which in turn is made up of two Vice-Ministries: the Vice-Ministry of Preschool, Basic and High School Education, which manages the first cycle of the system, and the Vice-Ministry of Higher Education, which regulates the university cycle, including Professional Technician, Technologist, Undergraduate and Postgraduate Degrees including Specialization, Master and Doctorate.

Figure 1: Organizational chart Ministry of National Education (Colombia)



*Source: own elaboration

Chronology of Educational Policy on Curriculum Design

Until 1991, the Government (through the MEN) was the sole designer and regulator of the curriculum for the entire education system, relying on external experts. In the words of Mann (2006), the State exercised an infrastructural power that dominated through coercion, from the generation of sectoral policies to their regulation.

The prevailing curriculum design was based on the vision of science, supported by positivism, which allowed a segmented, hierarchical, and compartmentalized education, hence the work with curriculum design based on objectives, from the mechanistic perspective of the curriculum, which coincides with Phenix (1962) and Hirst (1974) who called it a vision of liberal education. This education focuses on developing the mind (knowledge) without considering vocation or usefulness; valid curricular knowledge is observable in objective reality.

With the constitutional Reform of 1991, a real educational reform began in Colombia; in its art. 27 "guarantees the freedom of teaching, learning, research and professorship"; 67, "education is an individual right and a public service with a social function"; 69, "guarantees the autonomy of universities" (Congreso de Colombia, 1991). These mandates constitute the space for curricular change in each HEIs.

The sequence of educational reforms in Colombia is described below:

First Educational Reform: The first educational Reform occurred with the enactment of Law 30 of 1992 for Higher Education (Congreso de Colombia, 1992).

General Education Law 115 of 1994: This opens space for HEIs to promote participatory and contextualized curriculum design within minimum regulations that the State, in its role as guarantor of quality, will continue to standardize. For the first time in Colombia, there is talk of Institutional Educational Projects to be developed by the universities in their autonomy (Congreso de Colombia, 1994).

Decree 2566 of 2003: first decree issued in the 2000s that promulgates and regulates the quality of programs, the system measured by credits and training by competencies (Ministerio Nacional de Educación, 2003).

Law 1188 of 2008: It regulates the qualified registration of higher education programs and establishes other provisions related to the minimum requirements a curriculum proposal must have for HEIs to obtain the corresponding authorization to offer an educational program (Congreso de Colombia, 2008).

Decree 1295 of 2010: This decree is issued to operationalize the previous law (Ministerio Nacional de Educación, 2010) and carries immersed a change already envisioned by Alonso Brá (2007), who called it the construction of a new common sense regarding education, and similarly expressed De Blassi (2009), who indicated how it could leave the traditional institutionalized to adopt new and alternative approaches that allow and impact improvements in the educational quality of each HEI. This decree leads Higher Education to a change in curriculum design, which is immersed in the practical approach of the curriculum, and its principal characteristic is a flexible and contextualized curriculum. In this approach, teaching focuses on a reconceptualization of culture in the classroom, working on skills, values, content, and methods (being, living together, knowing, and doing). Meaningful learning is recognized, which according to Ausbel et al. (1986), occurs when new knowledge is related in a non-arbitrary and substantial way to the knowledge the learner already has.

With this decree, the curriculum design by competencies is introduced and must be adopted by all Colombian universities. This curriculum design has its origins in the guidelines of UNESCO (1998) "...higher education (...) is confronted with an education based on

competences and the relevance of its curricula...." There is a correspondence with the exercise carried out by the European Union Tunning Project in the years 2000-2002; 2003-2004, which succeeded in unifying professional degrees based on competencies in the countries that make up the European Union (González & Wagenaar, 2005). Thus, by consensus, professionals' general and specific competencies were defined concerning a specific degree. The methodology used served as an example for many Latin American countries, including Colombia.

Decree 1330 of 2019: A new Decree on Qualified Registrations is issued and presented as the result of the systematization of previous experience, and its main objective is to simplify and streamline the process of approval and renewal of qualified registration and accreditation of an institution or academic program. Among the most representative modifications are: previously, each program had to present 15 quality conditions; now, the decree separates six conditions corresponding to the IES, and the program has to present and develop only nine conditions to obtain its qualified registration. Another modification to highlight is that the concept of curricular design by competencies is replaced by the learning outcomes, which serve the program as a parameter to evaluate and improve teaching and learning (Ministerio Nacional de Educación, 2019).

This leads HEIs to a new approach to curriculum design, moving from competencies to learning outcomes, which are defined as "the explicit statements of what a student is expected to know and be able to demonstrate at the end of his or her academic program (...); therefore, learning outcomes are expected to be in line with the profile of the graduate established by the institution and by the specific program" (Ministerio Nacional de Educación, 2019).

Models of Curriculum Design in Colombia From the Policy Perspective

A theoretical review of the different curriculum design models, complemented by the experience of the authors, and taking into account that restructuring or changing the curriculum approach implies changes in graduate profiles, curricula, teaching, learning, and evaluation methodologies, revealed the following:

Objective-Based Model of Curriculum Design

The objective-based curriculum design was the first model adopted in Colombia when the State was the sole curriculum designer for the entire educational system. Tyler presented the methodology used in this design in his work Basic Principles of the Curriculum (1973). The emphasis of this model is on the use of behavioral objectives. Among the pioneers of behavioral objectives were Charters (1923), who presented a list of behavioral objectives for elementary and secondary basic education in his work "How to Make a Curriculum."

According to Tyler's model, the curriculum design is structured in seven stages and is preceded by the curriculum planner's selection of essential and achievable objectives, which can be stated in different ways depending on the source consulted (Tyler, 1973).

The sources consulted were students, society, and specialists. The first stage was to find out from the learners (students) what the educational goals could be, understood as changes in human behavior involving thinking, feeling, and acting (Tyler, 1949). The second source of information was society, considering that many situations experienced in school reflect societal situations. The third stage consisted of consulting specialists who would give the

academic perspective on how the subjects contributed to the formation of the student. The specialists worked in commissions, and the school texts they produced included the respective objectives.

In the fourth stage, which emphasized the importance of the philosophy of education and the psychology of learning, these two sciences were used as filters. The first filter (philosophy) consisted in selecting, from the long list of objectives, those that were reasonable and related to the values of the school's philosophy. On the other hand, in the psychological filter, only those objectives were selected that would allow to achieve behavioral or attitudinal changes in the students, as a consequence of learning, simply, without investing a lot of time and effort.

Once the filters have been completed, the objectives were defined, and the fifth step is the selection of learning activities to achieve the proposed objectives, i.e., those to be carried out by the teacher.

The sixth stage refers to organizing the activities to be carried out to achieve effective learning. These activities are organized taking into account continuity, sequence, and integration criteria (Vélez and Teran, 2010).

The seventh and last stage is related to the evaluation of the activities. Tyler (1973) says that evaluation helps to verify the validity of the hypotheses on which the organization was founded. Its final result will make it possible to determine the positive elements of the curriculum and which, on the contrary, need to be corrected."

One of R. Tyler's followers with significant influence on curriculum design was Hilda Taba, who summarizes that every curriculum design should have a statement of specific goals and objectives, a selection and organization of content, particular teaching and learning norms, and a program for evaluating results (Taba, 1974).

Competency-Based Model of Curriculum Design

This type of curriculum design is intended to respond to two primary and complementary needs: first, to respond to the demands of the knowledge society and, second, to bridge the gap between the university, the Government, and enterprises.

Regarding this type of curriculum design based on competencies, it is impossible to speak of a single design that is universally valid and timeless because this type of design takes into account the spatial and temporal context in which it is developed, which implies a diversity of models. Authors such as Rué and Martínez (2005) point out three models of competency-based curriculum: Curriculum design focused on training for production, which is relatively simple. The curriculum design focused on professional practice, and the curriculum design aimed at personal training of professionals focused on individuals and their discipline-based training.

Another theorist who contributes to this type of curriculum design is De Miguel (2006), who proposes a model that focuses on planning the competencies to be acquired by students within a training context and an organizational context, which requires the definition of both teaching-learning methods and evaluation systems.

International educational institutions have developed other models in the first decade of the 21st century, such as the Instructional Performance Technology of Boise State University (Sutcliffe et al., 2005); the St. Xavier Model was developed at the Technical Teachers Training Institute and implemented at St. Xavier's Technical Institute, Mumbai, India (Earnest & De Melo, 2001). Solar and Sanchez (2008) proposed the Chilean model at the Latin American level.

This design, like Tyler's previous one, starts as a first stage, from the identification of the social needs of the program, taking as sources of consultation the interested parties, that is, employers and other beneficiaries, professionals and professional organizations; the academic community, to identify common points of reference, as well as the available resources or possible alliances for their use, to move from there to the second stage.

The second stage consists of defining the profile leading to the degree, both academic and professional, expressed in competencies, which include knowledge, understanding, skills, and abilities, expressed as generic competencies and specific competencies to be achieved in each program; these competencies serve as reference points for the design and evaluation of the curriculum and a common language.

The third stage is the content to be worked on, i.e., the definition of the study plan, which includes both the content and its structure or organization, expressed in modules and valued in credits.

The fifth stage defines the teaching-learning approach required for this curriculum design, which implies a student-centered approach oriented towards achieving the professional profile. It also defines how the educational activities are to be carried out in order to achieve the defined competencies.

The last stage refers to evaluation, which implies the implementation of strategies that make it possible to demonstrate the competencies achieved in the students' performances. This evaluation is conceived in the context of continuous quality improvement and must be carried out throughout the training process (before, during, and after).

Curriculum Design Based on Learning Outcomes

This new pedagogical approach has been experimental in Colombia since the decree was issued in 2019, just before the COVID-19 pandemic. This new curriculum design for Colombia under Decree 1330 of 2019, as well as the competency-based approach, is immersed in the practical curriculum design, and for its structuring, the same stages are fulfilled: The first stage is the identification of the social needs of the program; the second stage is the definition of the profiles based on the expected learning outcomes to be achieved by the professional after graduating from the institution; the third, fourth and fifth stages are related to the design, structure, content of the curriculum, pedagogical and methodological approaches and activities to be developed that allow the measurement and demonstration of these learning outcomes; the last stage includes everything related to the evaluation.

To give a more concrete idea of how curriculum design based on learning outcomes is carried out, from the personal experience of the authors, the curriculum design methodology carried out by the Doctorate in Management program of the University of Cartagena is presented:

The first step was identifying the training, business, economic, and social needs the program should respond to. For this purpose, studies of secondary sources such as internal institutional and external documents (related to education, government policies and regulations, business documents from unions and companies, and benchmarking of similar programs at regional, national, and international levels) were reviewed. For the primary information, focus groups were conducted with expert peers at the doctoral level, directors, and presidents of business associations.

After collecting and systematizing the information, we proceeded to define the program's strategic direction, i.e., its mission, vision, and purpose. For this process, several meetings were held with the Faculty of Economics of the University of Cartagena doctors until a consensus was reached.

This direction was then translated into a graduate profile regarding expected learning outcomes, as required by the normativity. This consensus is essential to continue the process.

A comparative analysis of the profile, competencies, and learning outcomes was then carried out, which started the construction and validation of the curriculum. It was determined that the teaching-learning approach should be student-centered, with teachers' guidance and a thesis director's advice from the beginning. Additionally, pedagogical strategies were defined to ensure compliance with the learning outcomes.

Finally, evaluation strategies were developed to measure the progress made in achieving the learning outcomes during the formative process. There are different ways to measure learning outcomes, which led to the construction of an evaluation tool that would allow a formative, contrasted, reliable, and validated evaluation (Mateo & Martínez, 2005). The instrument was the rubric (Alsina, 2013), which manages a set of criteria and indicators that are, in turn, divided into qualitative or quantitative descriptors that reflect the level of achievement of student learning outcomes.

Conclusions

In conclusion, it is noted that any curriculum design can be carried out according to four basic stages:

The first stage, contextualization, begins with identifying needs through consultation with the program's target audiences.

The second stage is the definition of profiles in coherence with the purpose of the program and the study of relevance, regardless of the way it is required (based on objectives, based on competencies, or based on learning outcomes) and the denomination (professional, academic, or graduate profile).

The third stage, called curricular structure, includes the curriculum, its contents, its organization, the definition of the teaching-learning approach, and the pedagogical strategies.

The fourth and last stage, called evaluation, is an indispensable requirement of any curricular design in order to be able to demonstrate the results and to proceed to the appropriate feedback in terms of continuous improvement within the quality assurance systems.

Regardless of the time that has passed from the first objective-based curriculum designs in 1991 to the current curriculum design based on learning outcomes, and regardless of each regulation of the Colombian State that leads to a new curriculum design, these four stages are still fulfilled, what changes is how each of them is implemented.

In the case of comparing the regulations, the first stage of contextualization would be in the denomination and justification; stages 2, 3, and 4 are included in the curricular aspects, organization of academic activities, research, relationship with the external sector, teachers, educational means, physical and technological infrastructure.

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Students' Perception of Their Experience in Courses Taught Through New Delivery Modes Compared to Traditional Modes

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Abstract
Since even before COVID-19, one of the most important challenges of Higher Education has been and continues to be the need for innovative and flexible educational methods. We could all agree that one of the goals of Higher Education is to equip students with a variety of intellectual and practical skills that, at the same time, can help them develop competitive advantages, such as adaptability and critical thinking. Universities should encourage students to be engaged lifelong learners, questioning the status quo to change it. New technologies and different delivery modes must be implemented to achieve that. One of the strategic goals of Universidad de Monterrey (UDEM) is to provide flexibility and achieve student satisfaction in the modes of delivering academic teachings. UDEM implemented a methodology that combines the face-to-face mode with synchronous and asynchronous modes. In this study, the experiences of 185 students in courses implemented through the New Delivery Modes were compared with those of 115 students in courses with traditional modes. Students openly chose either mode freely. After the experiences in 2020 and 2021, it is safe to assume that the face-to-face (traditional) delivery mode would be preferred among students. The results obtained in this study reveal that both delivery modes satisfy students and favor their learning process. The combination of delivery modes provides flexibility so that universities can include them in their academic offer as a response to the interests and learning needs of today's students.

Keywords: Flexibility, Student Satisfaction, New Delivery Modes, Combination of Modes, Academic Offer

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Introduction

During the Covid-19 pandemic, universities adopted various learning methods for educational activities. For example, the University of Sri Lanka implemented online classes in real-time without recorded lectures; face-to-screen, repeatable recorded online; Self, which consisted of only pre-recorded lectures; and mixed learning consisting of pre-recorded lectures and face-to-face learning. The study aimed to evaluate each learning method implemented to identify the preferred learning method of students.

It turned out that students enjoy interactive activities during classes and that there are no significant differences in grades between students taking courses through synchronous and asynchronous modes.

This study found that students preferred the mixed delivery modes, with online lectures in real-time, along with recorded lectures. Thus, they consider this the most appropriate to implement in the new normal [1].

In Bogota, Colombia, they measured the satisfaction level of 447 students through a survey to know the perception of their experience in virtual courses, taking into account elements of the pedagogical method of the University such as contents, materials, resources, teachers, and teaching strategies.

The results reported that only 23.5% of students are satisfied with participating in virtual courses. Therefore, they decided to take action to redesign the courses and teacher training programs. They concluded that they should strengthen each of the elements of the pedagogical model and review the program to select the courses to be implemented virtually [2].

Universities in Australia investigated synchronous and asynchronous class attendance as predictors of academic success in online education. Their results show that attendance to virtual or synchronous classes, plus the number of hours in which students interacted with the online learning system, had a significant relationship with academic success, concluding that the flexibility of online education can enable students to succeed in their studies [3].

At these universities, it was mentioned that the profile of their students and their needs are more diverse, as they may be older, part-time students, or part-time workers. Therefore, they need flexibility for their courses as they cannot attend at all times. Flexibility understood as the diverse offer of online and face-to-face courses to satisfy different needs.

In this research, it is reported that most universities have a traditional delivery mode (face-to-face classes); however, in the survey, the same institutions consider the importance of the profile of their students and have flexible modes to meet their needs. Thus, the improvement plans of universities are oriented toward a flexible and attractive teaching practice and innovative use of technology to create an interactive environment that promotes learning. Hence, universities continue to experiment with a wide variety of alternatives as regards delivery modes [4].

Globally, there is a need to expand the offer of delivery modes to make them more flexible and use new methods in courses that adapt to students' needs.

As a result of the analysis of global trends with international and national universities and in publications consulted, we found that flexibility is a crucial characteristic for students, academia, and employers. Flexibility is essential in lifelong learning, learning diverse subjects, developing a variety of transformative skills, making rapid prototypes, and generating proposals that are different from traditional ones [5-6].

At Universidad de Monterrey, as a result of new strategies, agile teams were created within the Vice-President's Office of Strategic Transformation, to work, with the SCRUM framework to solve the emerging needs of students, such as increased flexibility, among others. This study is based on the work done by one of the teams, the Curriculum and Competencies Agile Team.

To determine the flexibility level in the programs offered by the university, focus groups were conducted with students and teachers, as well as interviews with directors, who were asked about the different ways in which students can take their courses (face-to-face, synchronous, and/or asynchronous). The result showed low and medium flexibility, in more than half of the 39 programs explored, so we proposed to increase flexibility by offering more courses with different options of innovative modes to inquire about the level of satisfaction and flexibility in the delivery of courses. This is where the following question arises:

- What is the perception of students in their experience during courses taught through New Delivery Modes compared to those who take traditionally taught courses?

To answer this question and obtain evidence on the perception of the experience of our students by increasing the educational offer through New Delivery Modes, we programmed a pilot test at the professional level.

Goal

To compare the perception of students in their experience in courses taught through New Delivery Modes with the perception of those taking courses through traditional modes, at the professional level.

Hypothesis

Students' perceptions of their experience in the course is the same when taking courses through New Delivery Modes as through Traditional modes.

Methodology

An experimental study was carried out on a sample of 300 students who were enrolled, voluntarily, in eight subjects, offered in two groups each, 16 groups from different academic programs, with intervention in groups taught through traditional and New Delivery Modes.

In sessions with directors and teachers, the details of the pilot test, the description of the New Delivery Modes, the resources necessary for their implementation, and the support available for teachers to design their class sessions were discussed.

Among the support provided to teachers to modify and strengthen their teaching methodology, a self-managed course was offered, focused on Active Learning, with contents such as a Guide for designing class sessions, based on the "Training from the Back of the Room" Methodology, "Using Brain Science to Make Learning Stick" by Sharon Bowman (2009), strategies that promote active participation and individual student responsibility with the 4 "C" [7] and the Shape your class tool, which consists of a virtual space to design and organize class sessions. This tool contains options that teachers can choose to plan the moments of their class with different strategies, learning tactics, types of evaluation, and technological resources [8].

Personalized pedagogical consulting by instructional designers and personalized technological consulting were also assigned.

In the course offerings catalog, subjects were published with the specification of the corresponding delivery mode combination so that, when choosing the group, students would be aware of the delivery mode.

Teachers were instructed to explain to their students, on the first day of class, the details of the New Delivery Mode in which the course would be implemented, they were also asked for consent to participate in this study and to answer a survey at the end of the semester.

Variables

Traditional Mode was defined as courses taught by teachers entirely face-to-face.

New Delivery Mode is defined as the teaching delivery through different combinations of face-to-face classes, synchrony, and asynchrony, which consisted of the following:

- Face-to-face Alternative mode – Teacher-led course combining 60% face-to-face and 40% synchrony of the total number of sessions of the period.
- Asynchronous Alternative mode – Teacher-led course on a digital platform combining 40% synchrony and 60% asynchrony of the total number of sessions of the period.
- Flex mode – Teacher-led course combining 60% face-to-face, 20% synchrony, and 20% asynchrony of the total number of sessions of the period.

The dependent variable in this study is the perception of the students regarding the experience they lived during the course and type of delivery mode, valued through a survey with 6 attributes: Flexibility, Learning, Academic performance, Class participation, Self-management and Level of satisfaction, measured as the probability of recommending courses in new modalities to other students, based on the Net Promoter Score (NPS) indicator.

Survey

A specially designed survey was applied to 300 students. In the survey, it is informed that responses are voluntary and data privacy is assured. It consisted of 12 questions to explore the six attributes mention before and a question about a recommendation to other students.

At the end of the semester, the teachers of each group were requested to ask their students to answer the survey voluntarily, where each statement was rated on a Likert scale from 1 (strongly disagree) to 10 (strongly agree) on the most positive and negative aspects of their

experience. A measure of loyalty or recommendation was included, measured with the Net Promoter Score (NPS) [9].

Results

We used descriptive statistics to analyze the data. From a total study population of 300 students, we obtained a sample of 179 students, corresponding with 60% of the entire study population, accuracy level of 95% with a margin of error of 5%. Table 1.

Table 1: Surveys answered by groups of different methods

Delivery Mode	Population	Answers n	Answers n
Traditional Mode	115	66	57%
New Modes	185	113	61%
Total	300	179	60%

For data analysis, descriptive statistics and Student's t-test for independent samples were performed. Where the statistical hypotheses to be tested are H0= and H1= and the test statistic was:

$$\frac{\bar{x}_1 - \bar{x}_2}{S^2\left(\frac{1}{n_1}+\frac{1}{n_2}\right)}$$

When comparing at a general level the perception of the experience of the students in their courses between the type of delivery mode, we observe in table 2 that, although the averages are very similar between them, when performing the Student's t test, we obtain a p value of 0.141, so we conclude that there is no statistically significant difference between the averages of the Traditional Modes (M=9.66; DE=0.647) and the New Delivery Modes (M=9.48; DE=0.994).

Table 2: t-Student test between delivery modes

Delivery modes	n	Student´s perception during their experience (average)	Standard Deviation	Value t	Sig. (bilateral) p
Traditional Mode	66	9.66	0.647	1.481	0.141
New modes	113	9.48	0.994		

Table 3. As part of the research, the experience is the general average of all the attributes rated by students. We see that the Face-to-face Alternative mode stands out in all attributes; in the Flex mode, flexibility is significant, with academic performance and class participation as an area of opportunity, while in the Traditional Mode, class participation and self-management stand out, with an area of opportunity in flexibility. On the other hand, in the Asynchronous Alternative mode, the most significant characteristic is flexibility, and the rest

of the attributes remain as an area for improvement. This table shows that the experience is very similar among mode, except for the asynchronous mode, which had more characteristics to be improved.

Table 3: Comparison between the experience, rated by the students, in each delivery mode

Delivery Mode	Type of Mode	n	Flexibility	Satisfaction Level	Learning	Academic Performance	Class Participation	Self-management	Global Average
Traditional Mode	Face-to-face	66	9.3	9.5	9.6	9.6	9.7	9.7	9.6
New Mode	Asynchronous Alternative	23	9.0	8.8	8.6	9.1	8.7	9.2	8.9
	Face-to-face Alternative	35	9.9	10.0	9.8	9.8	9.9	9.9	9.9
	Flex	55	9.6	9.5	9.5	9.4	9.4	9.5	9.5

*averages

Table 4. In the following table, results are shown to compare the traditional delivery mode with each of the New Delivery Modes separately; when running all the hypothesis tests, we can conclude that, there does exist statistically significant difference in the averages of the traditional mode with the Asynchronous Alternative mode, situation that is not presented when comparing traditional mode with the Face-to-face Alternative and Flex mode, where the null hypothesis is not rejected, which means that the students' perceptions of the experience taking the course, is the same as taking them in different modes.

Table 4: Test t-Student between the traditional mode compared, individually, with each one of the New Delivery Modes

Comparison between delivery modes	N	Student´s perception during their experience (average)	Standard Deviation	Value t	Sig. (bilateral) p
Traditional face-to face	66	9.66	0.6466	-1.778	0.078
Face-to-face alternative	35	9.87	0.2950		
Traditional face-to face	66	9.66	0.6466	-2.184	0.031
Asynchronous alternative mode	23	8,90	1,51177		
Traditional face-to face	66	9.66	0.6466	1.274	0.206
Flex	55	9.47	0.9082		

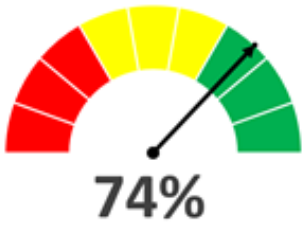
*p < 0 .05 - Student´s t test

What is the probability of you recommending a classmate to take a course through New delivery modes?

When analyzing students' answers, the NPS was 74%, which is interpreted as excellent in terms of recommending a classmate to take a course through a New Delivery Mode.

Table 5. Net Promoter Score (NPS) of New Delivery Modes

Type of student	%	NPS
Detractor	6%	74%
Passive	13%	
Promoter	80%	



- Seven out of 10 students would recommend a New Delivery Mode to other students.
- NPS Interpretation.
- A value greater than 50% is considered excellent.
- More than 70 is exceptional.

Discussion

In the research, with respect to the study goal, we considered the perception of the experience as the average rating of all characteristics (flexibility and satisfaction level, learning, academic performance, participation, self-management). We found that the overall average of the responses of our students show that students perceive their experiences with the New Delivery Modes without significant difference compared to the Traditional Mode although in the case of the Face-to-face Alternative mode, better rating averages appear in all attributes, and differences do not become significant (Table 2).

This evidence contradicts the myth of low student acceptance of online delivery modes. The pandemic of 2020 made us realize the need for a change in universities and their players to face the pedagogical, technological, social, and cultural needs to reformulate academic programs [10].

It is worth mentioning that in our university, the core is students and their needs, so changes were made in the educational offer, to increase flexibility, the satisfaction level, and the rest of the characteristics, face-to-face courses were implemented to compare them with New Delivery Modes, training and pedagogical changes were made, since all teachers participated in the training and the design of their class sessions, so they represent an important upside in taking care of the educational quality for our students [11-12].

This study was conducted to learn about students' perceptions of the changes in the educational offer. In the results, we find that although in general all the delivery modes analyzed in this study allow for the development of the six attributes, the New Delivery Mode Face-to-face Alternative was better evaluated than the Traditional mode. Students perceive all attributes positively, mainly the satisfaction level and flexibility, but no statistically significant differences were found, which confirms our hypothesis that students' perceptions of their experience is the same when taking their courses through New Delivery Modes as through Traditional mode (Table 3).

When comparing the Traditional mode and the Asynchronous Alternative Mode, a statistically significant difference was found. We consider it essential to analyze the factors that could have influenced this result in a following study (Table 4).

Regarding the NPS, the loyalty measure reports that seven out of 10 students would recommend a New Delivery Mode to other students, the figure above 50% is considered excellent, which confirms the students' satisfaction because they also recommend it (Table 6).

New Delivery Modes mainly provide satisfaction, flexibility, and self-management for learning, so students recommend them to their peers. This represents an innovation to broaden the options in educational offers and increase flexibility for our students. They are an essential option in Higher-Education systems around the world. As the global environment changes, new needs emerge, and the student body becomes more diverse, flexible delivery modes support students throughout their professional development and help prepare them to face the realities of an ever-changing world [13-14].

Conclusion

Students highly accept New Delivery Modes, and we recommend their adoption to increase the educational offer in universities in response to the interests and learning needs of today's students. We consider that the challenge for universities is flexibility, innovation, teacher training, and educational anticipation, to provide the necessary means for the greatest development of students, considering the educational offer according to the needs, trends, future scenarios, technological resources, and experiences favoring the best version of the student, so that they may become competent individuals capable of easily adapting to any environment.

The New Delivery Modes are highly accepted by students, so we recommend their adoption to increase the educational offer in universities in response to the interests and learning needs of current students.

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Gender Digital Divide: The Complexity of Digital Media Literacy Among High School Students With Professional Technical Training in Mexico

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Abstract
Nowadays, society faces a new era of digitization and virtualization due to the Fourth Industrial Revolution. This era has influenced all the complex aspects of human life. Therefore, it is vital to promote the digital media literacy of students in all educational levels, but it is needed in high school as a step before higher education. On the other hand, the digital gender divide represents a digital fracture that causes a lower representation of women in the digital world and access to STEM careers, even affecting female students' learning due to factors such as technophobia or stereotypes associated with feminine and masculine roles. This study presents the perception of the complex level of digital media literacy of 124 students (men=73, women=44, and non-binary students=7) in a high school center with technical professional training in computer science in Mexico. The data collection employed an instrument that measured three dimensions of digital media literacy based on gender. The sample considered just male participants in all groups, highlighting a gender gap in technical and professional education. However, men had a lower level in all three dimensions: Access to Digital Information (ADI) (*M*=3.05), Interpretation of Digital Information (IDI) (*M*=3.05), and Production and Socialization of Digital Communication (PSDC) (*M*=3.02) compared to women (ADI: *M*=3.10; IDI: *M*=3.10; PSDC: *M*=3.21). Although the results indicate differences in media literacy among high school students with professional technical training, the interaction between men and women is highly similar.

Keywords: Gender Gap, Gender Digital Divide, Digital Media Literacy, Technical Professional Training, High School

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Introduction

It is becoming increasingly apparent that Industry 4.0, also known as the fourth industrial revolution or 4IR, is impacting many aspects of people's lives nowadays (Muñoz et al., 2021). This involves incorporating advanced technologies into production processes to enhance efficiency, flexibility, and customization in product manufacturing (Rozo, 2020).

Industry 4.0 relies on digitalization, connecting objects and systems in production, automating processes, and utilizing advanced technologies to enhance production efficiency and quality (Cañas et al., 2021). This has opened up new opportunities and presents challenges regarding employment and skill requirements (Guillén et al., 2016). In order to keep up with Industry 4.0, it is necessary to have highly skilled professionals who can manage and utilize advanced technologies such as Artificial Intelligence, the Internet of Things, robotics, automation, Big Data analysis, and cybersecurity (Basco et al., 2018).

According to the United Nations (UN) (2022), the ongoing technological revolution can bring notable economic and social advantages but also presents significant challenges. As a result, the importance of digital literacy and skill development is highlighted, along with the need to create a favorable environment for innovation and entrepreneurship (UN, 2022).

In order to prepare individuals for the demands of Industry 4.0, it is crucial to possess optimal digital literacy skills (Sánchez, 2019). The abilities to utilize digital technologies effectively and adapt to the rapid changes in the job market are essential (Rosalina et al., 2021). The Inter-American Development Bank (BID) (2021) supports the idea that countries, including Mexico, must promote the education and training of professionals specialized in these technologies to harness the benefits of Industry 4.0. Therefore, digital literacy plays a fundamental role in the education of future professionals, who must acquire digital and technological skills to adapt to the constantly changing demands of the business environment (Coldwell & Cooper, 2019).

There are multiple definitions of digital literacy, and it constantly adapts to suit the demands of society and the digital landscape (Martínez et al., 2021). The United Nations Educational, Scientific and Cultural Organization (UNESCO, 2018) offers digital literacy's most widely accepted definition. It refers to the capacity to securely and appropriately access, manage, understand, integrate, communicate, evaluate, and create information using technology for work and entrepreneurship. On the other hand, Martínez et al. (2021) and Sandoval (2021) describe digital literacy as the process of acquiring knowledge and developing the ability to properly employ technologies in the digital world in order to facilitate people's participation in work, educational, and citizen ecosystems increasingly mediated by the use of electronic systems.

For instance, Kipper et al. (2021) emphasize the importance of media and information literacy as a crucial aspect of digital literacy for Industry 4.0. This includes the ability of workers to locate, manage, analyze, and assess media and information using critical thinking skills, as well as making informed decisions to engage with ICT. Media literacy is a vital component of professional training in the era of Industry 4.0 and contributes to developing other essential competencies in this field (Jalik, 2018). Ozdamar et al. (2015) define media literacy as the capacity to communicate and collaborate effectively using digital media, consisting of three dimensions: access to digital information (ADI), interpretation of digital information (IDI), and production and socialization of digital communication (PSDC).

According to UNESCO (2021), Technical and Vocational Education and Training (TVET) should prepare students with the necessary skills and competencies to enter the labor market and enhance their employability. Education, consequently, can play a significant role in promoting digital literacy and facilitating the growth of Industry 4.0 (Raman et al., 2019). TVET is thus regarded as a practical means of expanding access to education and learning opportunities and promoting social equity and inclusion in society (Muñoz, 2019).

TVET enrollment is divided between women and men in Latin American countries at 50.2% and 49.8%, respectively (UIS, 2018). Although women have greater access to TVET, they can still experience limitations and obstacles in their educational and professional process, including within TVET (Muñoz, 2019). Although policies and programs have been implemented to encourage women's involvement in technical and professional fields in Latin American countries such as Argentina, Brazil, Chile, Cuba, Peru, and Uruguay (UNESCO, 2022), gender-based career aspirations persist because of a complex mix of individual decisions, societal attitudes, and institutional structures that sustain social and work-related inequalities between men and women (Bloj, 2017; Sepúlveda, 2017). In this sense, gender segregation in technical and vocational education has been little studied and is still a potential source of social inequity (Sevilla et al., 2019).

Gender Gap

The gender gap refers to the situation in which women have fewer opportunities than men to develop equally in different areas (Davies, 2011). In the educational field, the gender gap has been observed for several decades, and differences in performance and learning styles between female and male students have been identified (Vantieghem et al., 2014). This phenomenon persists today due to traditional attitudes about gender roles transmitted by religion, parental education, and culture (Rivera, 2022). It limits women's progress and participation (Marchionni et al., 2018).

These days, multiple gender gaps restrict women in various spheres, such as education, work, society, or the digital world (Olarte, 2017). In the digital world, for example, the digital divide more profoundly restricts women than men due to gender roles and stereotypes established by society (Acosta et al., 2020).

The Gender Digital Divide

The Gender Digital Divide (GDD) reflects a digital inequality faced by women in accessing, using, and benefiting from Information and Communication Technologies (ICT) due to their societal role and social expectations regarding male and female use of ICT (Berrío et al., 2017; de Andrés et al., 2020). This gap is seen in different forms, such as ease of access to the Internet, possession of technological devices, training in digital skills, participation in technology-related fields, and equitable representation in the technology industry (Banerjee, 2019). This phenomenon can be magnified or diminished depending on nationality, social class, race, access to education, qualifications, age, and social position of women, who may face barriers or inequalities in accessing, using, and benefiting from ICT compared to men (de Andrés et al., 2020).

Additionally, the GDD is represented by the lack of educational materials with a gender perspective (Pedraza, 2021; Pérez et al., 2021; Wong & Kemp, 2018), the disinterest of girls and young women in the digital world (Yu, 2018), and the false identification of male-

dominated spaces such as computer labs (Gorlach & Agic, 2019). The GDD is also related to the absence of professional vocations in technology and engineering (Liu et al., 2022) due to exclusionary and self-exclusionary factors that limit women's interaction with technology, such as a pessimistic perception and technophobia (Rodríguez & Jiménez, 2020).

Several studies have highlighted the main differences and inequalities of the GDD in the educational field (Alozie & Akpan, 2017; Balay & Singhal, 2018; Bikos et al., 2018). In this regard, it is essential to identify the level of digital literacy among men and women in the current generations since limited research has measured the GDD. For example, a study compared differences in access, use, and ability to use ICT between male and female university students and showed a significant gender gap in ICT usage skills, with male students being more competent in software downloading and installation (Saha & Zaman, 2017). Another study demonstrated that men had better technology skills than women in higher education institutions in Mexico (Domínguez et al., 2020).

This phenomenon requires constant attention at all educational levels, as it was recognized in previous studies. It should include Technical and Vocational Education and Training (TVET), as it is an essential pillar for equity and can contribute to achieving the 5th Sustainable Development Goal (SDG) that aims for gender equality (UNESCO, 2022). Additionally, TVET has the potential to build a more inclusive society that balances the sustainable growth of men and women and the productive development of society (Rucci et al., 2015). Therefore, this study recognizes the importance of analyzing the complex media literacy level among TVET students and identifying if there are significant differences between male and female students. It is important to underline that this study is a component of a broader research endeavor focused on examining the progression of communicative literacy within Education 4.0.

Methodology

The research follows a descriptive and exploratory design with a quantitative approach (Creswell & Creswell, 2017) to collect data through a questionnaire measuring media literacy among students in TVET. The study aimed to analyze the complex level of media literacy among TVET students and identify if there are significant differences between male and female students.

To identify the level of media literacy among students, the three dimensions established by Ozdamar et al. (2015) were considered: a) Access to Digital Information (ADI), b) Interpretation of Digital Information (IDI), and c) Production and Socialization of Digital Communication (PSDC). The instrument used in the study was an adaptation of the instrument *e-complexity* (Vázquez et al., 2022). It consists of 18 items to evaluate the three dimensions, which was assessed through Cronbach's Alpha (p=.917), indicating a high internal consistency in the instrument's items and an acceptable internal consistency in each dimension: ADI (α=.820), IDI (α=.849), and PSDC (α=.735), (Viladrich et al., 2017).

Regarding the population, the sample consisted of students from the computer science technical program at a public TVET institution in the southern zone of Mexico City, Mexico during the August-December 2022 semester. An intentional and convenience sampling approach was used to select the participants, considering their availability and accessibility within the institutional context. Student participation was voluntary, and informed consent was obtained before including them in the study. Additionally, consent was obtained from the

participant's parents or legal guardians, as they were minors. The school also provided documented consent, ensuring that all parties involved were adequately informed and agreed to the study conducted in the school environment.

Results

The results of the study are described in two phases: a) descriptive analysis and b) inferential analysis. In the descriptive analysis, it was observed that the study population consisted of 124 participants, predominantly males (n=73, 58.9%), followed by females (n=44, 35.5%), and non-binary students (n=7, 5.6%). The age ranges were from 15 years (n=22, 17.7%) to 21 years (n=2, 1.6%), with a mode of 16 years among the participants (38.7%). The population was mainly in the third semester (n=57, 46%), (see Table 1).

		N	%
Gender	Male	73	58.9%
	Female	44	35.5%
	Non-binary	7	5.6%
Age	15	22	17.7%
	16	48	38.7%
	17	46	37.7%
	18	6	4.8%
	21	2	1.6%
Semester	First semester	24	19.4%
	Third semester	57	46%
	Fifth semester	43	34.7%
Total of participants		124	100%

Table 1: Study population by gender, age, and semester

The descriptive analysis of each dimension of media literacy shows differences between males and females in TVET. In terms of Access to Digital Information (ADI), it was recognized that males (*M*=3.21, *SD*=0.577) exhibit a lower level in this dimension compared to females (*M*=3.31, *SD*=0.569). When examining the different items that compose the ADI dimension, some interesting variations were found between males and females, as items 2, 3, and 6 show a higher level from female students. However, male students perceive themselves to have a better level in items 4 and 5. It is important to recognize that the most significant difference was found in item 1 regarding access to different digital media to obtain the same information. On the other hand, it is essential to mention that non-binary students perceive themselves to have a lower level than males and females in ADI (*M*=2.95, *SD*=0.458), (see Table 2).

Items of Access to Digital Information (ADI)	Gender					
	Male		Female		Non-binary	
	M	*SD*	*M*	*SD*	*M*	*SD*
Average of dimension (ADI)	3.21	0.577	3.31	0.569	2.95	0.458
Item 1. I access different digital media to learn about the same information.	3.08	0.812	3.55	0.663	2.86	0.378
Item 2. I use search strategies to find updated information (last week/month/year).	3.14	0.694	3.20	0.668	3.14	0.690
Item 3. I protect the information stored in my digital devices with biometric passwords.	3.32	0.780	3.41	0.871	2.71	1.113
Item 4. I use information search strategies based on logical operators.	3.01	0.858	2.93	0.789	3.00	0.577
Item 5. I recover and store information in digital media like Google Drive, Dropbox, Box, etc.	3.23	0.874	3.18	0.922	2.86	0.690
Item 6. I protect my personal digital information using secure passwords.	3.52	0.709	3.64	0.650	3.14	1.069

Table 2: Descriptive Statistics of Access to Digital Information (ADI)

The Interpretation of Digital Information (IDI) results show similar levels among the three groups. Male students got lower level (*M*=3.05, *SD*=0.620) than female students (*M*=3.10, *SD*=0.616), and non-binary students (*M*=3.11, *SD*=0.427). Analyzing each item that composes the IDI dimension showed that males obtained a slightly lower level (*M*=3.00, *SD*=0.782) than females (*M*=3.14, *SD*=0.702) in item 7 that is related to judging a piece of information and contrast it with different sources. However, item 10 shows that males can use tools to validate information (*M*=3.05, *SD*=0.848) better than females (*M*=2.91, *SD*=0.910). It is important to recognize that the better level in this dimension was for non-binary students (*M*=3.11, *SD*=0.427), (see Table 3).

Items of Interpretation of Digital Information (IDI)	Gender					
	Male		Female		Non-binary	
	M	SD	M	SD	M	SD
Average of the dimension (IDI)	3.05	0.620	3.10	0.616	3.11	0.427
Item 7. To judge a piece of information, I contrast it with different sources.	3.00	0.782	3.14	0.702	2.71	0.756
Item 8. I know how to estimate the credibility of information by differentiating between that which comes from reliable media and that which comes from unverified media.	3.08	0.777	3.20	0.795	3.43	0.535
Item 9. Before using the information, I evaluate whether it is fake news.	3.11	0.843	3.14	0.765	3.14	0.690
Item 10. I know how to use checking tools to validate the information from web pages and social networks.	3.05	0.848	2.91	0.910	3.29	0.756
Item 11. I reference an official page or a recognized author to interpret the information.	2.95	0.911	3.16	0.805	3.00	0.816
Item 12. I organize the information I recover using strategies such as shared folders, web bookmarks, local folders, social networks, etc.	3.12	0.725	3.11	0.813	3.14	0.690

Table 3: Descriptive Statistics of Interpretation of Digital Information (IDI)

Finally, it was observed that females had a higher level in the dimension of Production and Socialization of Digital Communication (PSDC) (*M*=3.21, *SD*=0.537) than males (*M*=3.02, *SD*=0.587) and non-binary students (*M*=3.09, *SD*=0.302). It is important to highlight that females show a superior level in two items. First, females consider themselves better (*M*=3.36, *SD*=0. 892) at sharing information using various means than males (*M*=3.10, *SD*=0.900) in item 13. Another item that shows advantages for females over males is item 16, which focuses on identifying recipients before sending, where males had a median of 3.05 (*SD*=0.832), while females had a median of 3.41 (*SD*=0.583). It should be considered that non-binary students had the lowest average in item 16 (*M*=3.00, *SD*=0.816), (see Table 4).

Items of Production and Socialization of Digital Communication (PSDC)	Gender					
	Male		Female		Non-binary	
	M	*SD*	*M*	*SD*	*M*	*SD*
Average of the dimension (PSDC)	3.02	0.587	3.21	0.537	3.09	0.302
Item 13. I have shared information using various media such as web pages, social networks, videos, podcasts, etc.	3.10	0.900	3.36	0.892	2.86	0.690
Item 14. The information I share respects the rules of digital citizenship, such as equity, ethics, objectivity, non-discrimination, etc.	2.96	0.841	3.18	1.040	3.14	0.378
Item 15. I cite the sources from which I obtain information when producing and socializing digital content.	3.07	0.855	2.91	0.960	3.00	0.816
Item 16. Before sharing digital information, I identify the recipients.	3.05	0.832	3.41	0.583	3.00	0.816
Item 17. I use design strategies and techniques to elaborate digital information.	3.04	0.824	3.23	0.831	3.43	0.535
Item 18. I have built a digital identity to socialize the digital information I share.	2.93	0.855	3.18	0.896	3.14	0.690

Table 4: Descriptive Statistics of Production and Socialization of Digital Communication (PSDC)

A Mann-Whitney U test for independent samples was conducted to identify if these differences were significant between men and women in the sample. However, the obtained p-value shows that the differences were not statistically significant in the three dimensions: a) Access to Digital Information (ADI) (z = -1.275, p = .202), b) Interpretation of Digital Information (IDI) (z = -.311, p = .756), and c) Production and Socialization of Digital Communication (PSDC) (z = -1.727, p = .084). After analyzing the previous results, it has been observed that there are variations in media literacy levels between genders in technical and professional education (TVET), although these results may not be statistically significant. It is crucial to acknowledge that these findings are based on a particular sample, and the conclusions may differ in different educational and cultural settings.

Discussion

The results revealed gender differences in the three dimensions of media literacy analyzed. Although men had a higher average in specific items, it is acknowledged that women displayed a superior level across all dimensions: ADI, IDI, and PSDC. Based on these findings, it is likely that public policies and programs promoting equity in Latin American countries, as described by UNESCO (2022), are yielding effects among the current generations of technical and professional students and that future generations of technical professionals will have a similar level of digital literacy. This suggests that there may not be a gender digital divide regarding digital literacy, as described by Domínguez Castillo et al. (2020).

Despite female students in TVET demonstrating higher levels of media literacy across all dimensions, it is crucial to emphasize a specific dimension. Women exhibited a higher level in the dimension of Production and Socialization of Digital Communication (PSDC)

(M=3.21, SD=0.537) compared to men (M=3.02, SD=0.587). At this point, it is relevant to highlight that this population of technical students showed increased engagement in the digital world, a skill essential for future professionals in Industry 4.0, as women need to actively participate in digital ecosystems for digital literacy in the current era (Sandoval, 2021). Moreover, these results might suggest that female students in technical and professional environments could perceive a better environment in their digital ecosystems. Consequently, various digital scenarios for women could be proposed since, as de Andrés et al. (2020) mentioned, the gender digital divide may either be exacerbated or diminished depending on each woman's specific environment.

It is essential to mention that the results obtained in this study may not apply to all Latin American scenarios, as gender inequalities in education are complex and involve multiple factors, including exclusion and self-exclusion, as mentioned by Rodríguez & Jiménez (2020). From this perspective, it is crucial to acknowledge that the study exhibits a lower representation of women, with only 44 female students out of the five groups that agreed to participate. This lower women representation could highlight the assumption put forth by Banerjee (2019) that women continue to be underrepresented in the technology industry.

Conclusions

In summary, the study revealed that women have a slightly higher level in the three dimensions of media literacy. Therefore, conducting a more detailed analysis of the context is suggested to identify the factors contributing to narrowing the gender digital gap in this technical-professional school. However, a higher representation of males in TVET was evident, where, despite intentional and convenience sampling, the participating groups reflected the typical situation in technical-professional schools, where women show less interest in technology-related professional vocations, as indicated by Liu et al. (2022).

From this perspective, it is relevant to implement actions that promote women's participation in technical and professional areas, as advocated in several Latin American countries (UNESCO, 2022), to close the gender gap and foster equity and access for women in technical-professional schools (Sevilla et al., 2019). Therefore, providing equal opportunities and empowering women to face the challenges of the digital world and build a successful future is crucial, as only through access to these spaces can the gender digital divide be reduced. This approach is supported by Sepulveda (2017), who recognizes that the education system perpetuates gender stereotypes in career choices; therefore, it is necessary to promote public policies that support reducing the gender gap.

Finally, it is essential to consider some limitations of this study when interpreting the results. Firstly, the sample was limited to TVET students in a specific institution in Mexico City, which limits the generalization of the findings to other populations and educational contexts. Additionally, the sample was predominantly composed of men, which may bias the results and not fully reflect the reality of women in TVET. Furthermore, a quantitative approach was used, which may have limited a deeper understanding of participants' experiences and perceptions.

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Design of the Performance Evaluation Indicators for Tunnel Engineering Course

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Abstract
The world is increasingly challengeable. High education would play an active role in this situation. As a traditional course needs redesigning, well-designed assessment for the course is necessary. Here is the design of the performance evaluation indicators for the Tunnel Engineering course at Chang'an University in China. Following the student-centred principle, an assessment system integrating students' learning and teacher's instruction grading is proposed to improve the course implementation. The student and teacher performance indicators focus on the students learning process and levels assessing, with the reference of the Bloom's taxonomy rubrics. 12 indexes are designed for learning performance to evaluate student's initiative, learning process and achievements, respectively. An indicator's grading is presented with the formative and summative assessments in an integrated dynamic mode. 10 indexes are applied in instruction performance grading in terms of the quality of preparation, class presentation, student's learning objective assigning, and the feedback, evaluation and instruction to student performance, respectively. The teacher's procedural performance is adjusted according to student's feedback, the effect of motivating and improving student's learning activities, while the final evaluation of a teacher's performance is checked with learning achievements on specified objectives. The quantitative or qualitative grading value for an indicator has been tuned both during instruction and at the end of a course or unit. The 12-year-practice results show that the designed evaluation indicators can provide connection between the course objectives and instruction and it is beneficial for evaluating and ultimately improving this connection to flexibly apply the evaluation indicators.

Keywords: Performance Evaluation Indicators, Student and Teacher, Design, Tunnel Engineering

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Introduction

The world is changing in various aspects. As digital issues play an increasing role in terms of personal lives and social activities, there are various newly-developed industries and numerous fields are increasingly reformed by the applications of the digital techniques. On the other hand, the world is increasingly challengeable. To adapt to the changing and challengeable world, high education would play an active role in this situation, such as through leading the reform of learning and teaching procedure in the engineering education. Since there appear new fields or industries with an increasing rate, the changing and challengeable situation in engineering education would be more urgent and significant.

Engineering education has a fundamental, global, and leading strategic position in social development (Li, 2020). Qualified and sustainable engineering education should be adapted to the requirements of contemporary and future society. The development and transformation of modern society benefits from the development and application of contemporary technology, and this trend will become increasingly significant in the future (OECD, 2015). In this process, engineering education needs to face the new requirements and challenges of the times (NASEM, 2018). In order to meet the requirements of the times, some emerging engineering education models (Graham, 2018; Stanford2025) or New Engineering Education Plan (Li, 2020) have emerged. Various innovations have been well recognized in terms of learning and teaching styles, such as Massive Open Online Course (MOOC), Small Private Online Course (SPOC), Flipped Classroom. Some innovation program in new engineering education, such as the Open-loop University in the well-known Stanford2025, the education styles at the Olin College of Engineering, have been well recognized in the world.

As there are new courses being added to meet the requirements of the new industries and some courses are even cancelled in the curriculum, a course for a specialty of relatively long history, such as Tunnel Engineering will share less time period. On the other hand, the contents of the existing course are also increasing with time. Therefore, the major curriculum needs adjusting in time, such as in terms of course and implementation plan design.

In terms of student-centered principle, the performance evaluation of both instructors and learners is vital to the success of a learning and teaching procedure. We instructors need know where we want students to be at the end of a course and how will we know if they get there or not. Assessment is vital to realize the planned target of a course. Although assessment is not new in education and a teacher is always engaged in an assessment, it is not an easy job to have a meaningful and effective assessment in practice. As assessment is to improve education or to service student learning, it should be based on the information about student learning and performance. Teachers would accordingly refine their teaching with the evaluation results of the students' performance. Here is the design of the performance evaluation indicators for the Tunnel Engineering course at Chang'an University in China.

Factors Under Consideration

The key factors under consideration for the design of the students and teachers performance evaluation indicators for the Tunnel Engineering course are presented as the followings.

1. Learning and Teaching Situations

In general, the learning and teaching situation is changing and challengeable. Education is in a constantly changing era, which is altered by the increasing information, various lifestyles. Of the engineering education situation, the key features include the followings.

(1) *Information is generally available for a learner but it is increasingly challengeable to cope effectively with the information around us*. There are various approaches of sampling information. The information available are much easy nowadays. It is vital to help the students to incorporate the sampled information into their knowledge system. For example, we are easily attracted by the information from Internet, WeChat, Tiktok, etc. It is convenient and fascinating to connectivity environment, such as enjoying the online shopping, information sampling and communication. The new information presentation and communication modes are generally beneficial to our living, studying and working. However, it is challengeable for an individual to take advantage of the information available, and the new living and working styles. It seems many aspects are changing, but some are not, such as the time itself to everyone. It is still 24 hours a day and 365 days a year. To education, the regulations of time schedule are almost unchanged, such as four years of college. In a narrow meaning, some of the new pattern information is easily abused, such as being our competition for resources, time, attention, and study enthusiasm.

(2) *Learning is a life-long issue and adaptation capability building is vital*. It is increasingly difficult to predict exactly what the new technology will be in the future, though all of us admit that there will be new breakthroughs in some fields. The capacity of adapting to the changing environment is one of the indexes of successful college student and is vital to students' profession development. Learning and work are to a large extent highly proactive and self-disciplined tasks. With self-management ability, one can take the initiative and all aspects would be smoother, such as in terms of effective work time increasing.

(3) *Techniques applied in learning and teaching are increasing*. Many information presentation styles are different from the traditional modes, which are mainly in forms of printed or handwriting. Although it is an effective way teaching with a blackboard, there are various other useful measures, such as PPT, video, flash, etc. However, it seems not an easy job to effectively use the techniques available in practice, especially at a specific learning and teaching stage or issue (Ma, 2023). Teachers should skillfully manage the techniques.

2. Course Features and Content Sampling

Tunnel Engineering is one of the sub-disciplines of Civil Engineering. To meet the requirements of development and usage of underground space in the world, tunnels increase in terms of types and the complexity of the structures. The information and knowledge system related to the subject Tunnel Engineering are increasingly accumulated with time, such as in terms of quantity, planning, design, construction, operation and management. The content related to the course Tunnel Engineering is increasing. On the other hand, as a traditional course, there is a decreasing tendency of the course hours in the curriculum.

To cope with the situation, the course design and implementation plan are accordingly adjusted with the course features under consideration. In course content preparation, the main points of the course should include planning and design, construction, operation and management in a system mode (Ma, 2022). For example, in the course information sampling,

with the consideration of tunnel performance and related factors, we focus on the required features of a planned tunnel and underground structure, construction plan and the environmental confinement of the related project, as well as their interactions in a tunneling procedure. In learning and teaching practice, the content should be specified to each step and stage in the learning and teaching procedure, respectively. For example, considering the students' knowledge building procedure and the course features in terms of the relationship between information, concept, structure and their components, activating points are designed to increase student engagement and systems thinking application (Ma, 2021, 2022). The evaluation measures and scales are accordingly designed in the course preparation.

3. Society Requirements

Education is timely tuned with requirements, in terms of personal and social issues. The social requirements are of general or macroscopic perspective and will be met through fulfilling personal needs. In terms of course design, the student's requirements are starting and procedure objectives, while the social requirements are ultimate objective. However, the both the personal and social requirements are changing. Therefore, the course design and plan implementation would be in a dynamic or iterative mode.

Student-centered course design and plan implementation will focus on student's capability development. As various factors will have influence on the results of the learning and teaching achievements, such as the current situation and characteristics of students, personal and social future perspectives, student's value shaping, college should create conditions for students and teachers should understand students' personalities and characteristics. For example, following "one person, one policy", each student has a specific training plan and responsible academic tutor. And therefore, everyone will stand out. However, we need consider not only the characteristics of personal requirements, but also the learning and teaching practical conditions. The learning and teaching performance will be with university characteristics, such as in terms of knowledge-level, personal abilities, and objectives.

4. Relationship of Learners, Instructors and Knowledge

Learning is a process of the interaction among the students, teachers and knowledge and would take place under certain context (Kozulin et al., 2003). Proper teaching practice is one of the key drivers to bear in mind for improving teaching quality and the academic achievement and motivation of students. The development of appropriate assessment instruments and intervention programs will allow instructors to service students' learning effectively. For example, a solitary achievement test is not enough. The assessment should focus on the level of student achievement indicating the learners' potential development through comprehensively considering their outcomes. A dynamic assessment is beneficial to present learner's learners' exact development, especially the potential progress in the future without assistance (Daneshfar & Moharami, 2018).

The purpose of curriculum design and classroom teaching reform is to enable students to comprehensively improve their learning level within a certain period of time. As the students' learning capability is various and changing, the syllabus of the course Tunnel Engineering is dynamically tuned, in terms of course content choosing, presentation styles, interaction between students and staffs, as well as effect evaluation. In simplicity, learning objectives, instructional strategies and assessments should be well aligned in the course design and plan implementation procedure. For example, the key factors to the learning and teaching results

of a course include: the content to be taught; the intentions and performances of both the students and staffs involved; as well as the course execution plan and evaluation measures. With the key focus of students' knowledge and capability building, the course assessments should reveal how well students have learned and what we want them to learn while instruction ensures that they learn it. Therefore, assessments, learning objectives, and instructional strategies should be closely aligned so that they reinforce one another.

5. Course Design and Implementation in a Dynamic Mode

In brief, course preparation should include content choosing, and also implementation and delivery plan in details, such as the roles of environmental/technical planning and instructional design. There also need student-staff partnership and interaction to filter and tune the course content and presentation styles, for the sake of being favorable to the student's capacity development. The actionable implementation plan, with specific content and presentation styles, are therefore prepared for learning and teaching practice (Ma, 2023). On the other hand, the outcomes should be timely assessed with the assumed criteria. Based on the feedback and evaluation results, the course design and implementation plan will be tuned in a dynamic way (Ma, 2023). As the course plan is executed in a dynamic mode, with special reference to the students' intentions and performance (Ma, 2022, 2023). In general, the results should be positively evaluated in time, such as to meet the student's various intentions of capacity development. The applied approach should be supported by the viability of the specified goals, the enthusiasm of the participants, the applicability and timeliness of the course information and resources.

As students' performance are evaluated, the staffs' intentions and performances are therefore checked in time, such as through discussion with students in a partnership way, quiz, test and assignment on the related learning contents. The experience shows that it is favorable to the student's capacity development that the students' performances are evaluated in an excitation mechanism (Ma, 2022).

Design of the Performance Evaluation Indicators

As the above-mentioned, both the students' and teachers' performance evaluations are included in the course design and implementation plan execution assessment. To design the both teachers and students performance evaluation indicators, the roles played by the learners and instructors should be under consideration. For example, in the full-life learning and teaching procedure, the quality of the student's learning outcomes are of the ultimate objective. Besides the parameters of design, assessment and evaluation, and facilitation under consideration, effective interaction is vital to create an effective learning community. In course procedure, the students will play an indispensable role (Ma, 2022, 2023). As the above considerations show that the design of the performance evaluation indicators will be learner-centered and outcome-based activities, the main focus is students' knowledge and capability building, which is evaluated with the Bloom's taxonomy (2001) in thinking skills or in terms of cognitive domains (Anderson & Krathwohl, 2001), as shown in Figure 1.

1. Instructors Roles and Performance Indicators

In the learning and teaching procedure, the instructor's roles include (Ma, 2023): (a) Subject matter expert; (b) Facilitator; (c) Manager; and (d) Assessor of student work. The performance evaluation will focus on the quality and results of the course preparation and

plan execution. In general, the intended outcomes could not be practical facts without effective activities, which would have been assessed in the related procedure, and experience is accumulated accordingly.

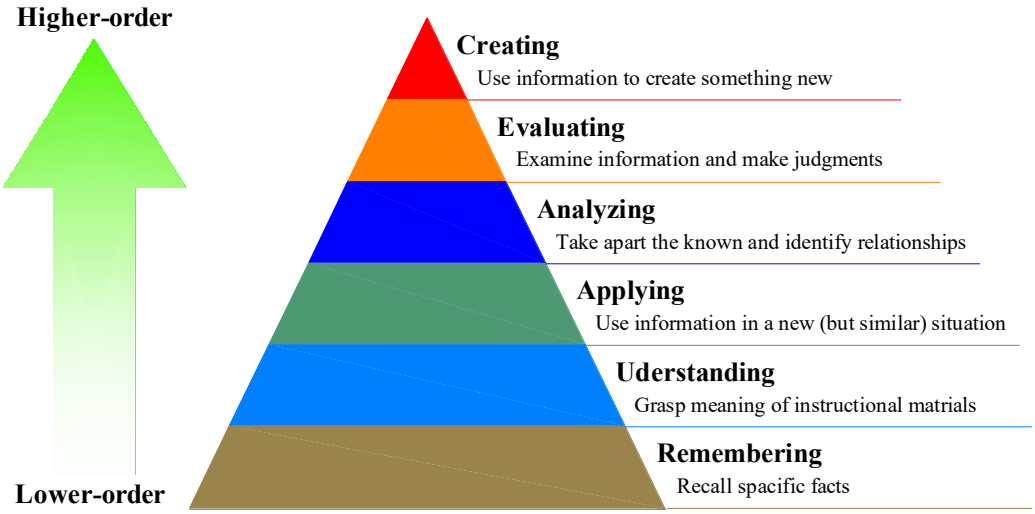

Figure 1: Sketch showing Bloom's taxonomy (2001) in thinking skills and cognitive domains

In general, teachers' performance indicators include: (1) Personal competence for an instructor, e.g., in terms of adaptability, education background, professional experiences; (2) Specific capability for a course teacher, as indicated with (a) Knowledge in the specified field, as an expert in course design or preparation; (b) Ability of course management or the performance in the learning and teaching procedure, as presented with six related items in Table 1; (c) Grade of the goal achievement and post evaluation. In terms of the course procedure, these indexes are presented as the performance in course preparation, learning and teaching process, and post evaluation.

Items No.	Indicators		Evaluation system			
			Indexes	Scale	Raters	Weight
1	Personal competence		Adaptability to the situation	1 - 5	Supervisors/Peers	0.7
					Students	0.3
2	Preparation	Course design	Content sampling and alignments	1 - 10	Supervisors/Peers	0.7
					Students	0.3
3			Implementation plan	1 - 10	Supervisors/Peers	0.7
					Students	0.3
4	Performance in the learning and teaching procedure	Performance in classroom	Lecturing	1 - 20	Supervisors/Peers	0.3
					Students	0.7
5			Interaction, guiding, flexibility	1 - 10	Supervisors/Peers	0.3
					Students	0.7
6		Performance outside classroom	Guiding and communication	1 - 10	Supervisors/Peers	0.3
					Students	0.7
7			Assignments and evaluation	1 - 10	Supervisors/Peers	0.2
					Students	0.8
8		Step and stage evaluation	Timely and effective evaluation	1 - 5	Supervisors/Peers	0.5
					Students	0.5
9		Tuning the design	Tuning timely and effectively	1 - 10	Supervisors/Peers	0.5
					Students	0.5
10	Post evaluation		Goal achievement and reflection	1 - 10	Teachers	0.5
					Students	0.5

Table 1: Teachers' performance indicators and evaluation indexes

The Teachers' performance indicators and related evaluation indexes are tabulated with 10 indexes, which are designed with specific scale. The value of the scale is related to the contribution or importance of index in the students' knowledge and capability building. The maximum total value of the 10 indexes is 100 points. In practice, the score of each index is assessed by student-self and supervisors' or peers' evaluation, with value range of 0.2 to 0.8, respectively. The total value of the teachers' performance will be in the range of 10 to 100, as calculated with the lift-side equation.

The evaluation of the indexes include index scale and weight presenting. The modes or approaches include: (1) Formative assessments, through (a) Questionnaire investigation, (b) Random Q & A, (c) Assignments and assessing results, (d) Ordinary performance recordings (esp. students); (2) Summative assessments; (3) Interaction and communication among these involved; (4) Achievement assessing and reflection. Based on the evaluated points by the raters with the scale system, the total value of the teacher's performance (T_{tp}) is calculated as: $T_{\text{tp}} = \sum_{i=1}^{10} S_i(W_{si} + W_{pi})$, where, S_i is the scale of the index i, with value range of 1 to 5 points, 1 to 10 points, or 1 to 20 points, respectively; W_{si} and W_{ti} are the weight of students' and supervisors' or peers' evaluation, with value range of 0.2 (20%) to 0.8 (80%), respectively.

1.1 Personal Competence

Teachers' competence could be generally presented with the adaptability to practical situation and is mainly related to their education background, professional and teaching experience, as well as their health condition. Since the competence is generally the basic requirement for a teacher, its evaluation scale is designed 1 to 5 points, which is assessed by supervisors/peers and students, with weight 0.7 (70%) and 0.3 (30%), respectively. The raters' weight is based on the significance to the evaluation results.

1.2 Performance in the Learning and Teaching Procedure

1.2.1 Course Preparation

Course design is the main point of course preparation, including content sampling and alignments, and implementation plan, with evaluation scale 1 to 10 points, and weight 0.7 and 0.3, respectively. Supervisors' and peers' rating is more significant than that of students.

1.2.2 Learning and Teaching Process

Teacher's performances in the learning and teaching procedure are presented with the performance in classroom, outside classroom, step and stage evaluation, and tuning the design. The performances both in and outside classroom are of importance and highly scaled, and indicated with two indexes respectively. The maximum of the total value would be 50 points, provided that they are 100% approved by the raters, as shown in Table 1. Considering the dominate position in teaching, lecturing is scaled 1 to 20 points. The interaction and guiding skills, as well as their flexibility in the procedure are scaled 1 to 10 points. Similarly, performances outside classroom, as indicated with guiding and communication with students, and assignments to students and effect evaluation, are scaled 1 to 10 points, respectively. As learning and teaching is a dynamic procedure and students' capability building would be in a spiral way, effective reflection to the goal achievement, especially for the step and stage

performance, is vital to improve in the future. As shown in Table 1, the weight of the rater's evaluation is valuated as 0.2 to 0.8, respectively.

1.2.3 Post Evaluation

The post evaluation is performed at the end of a semester, especially for the assessment for the course goal achievement following a summative test. Effective reflection to the goal achievement is helpful to the next learning and teaching procedure, especially for the improvement of the course design and implementation plan. The post evaluation is scaled 1 to 10 points and the weight of the students and teachers evaluation is same as 50%.

2. Learners Roles and Performance Indicators

Of the learner's role & performance, we focus on the students' learning and cognition developing, in terms of pre-course and during the course, respectively. Considering the interaction among the students, teachers and knowledge under a specific context, students' attitude (e.g., active or not), the quality of playing the roles, such as learner, team-work, contributor to the course, are of key factors under considerations.

The students' performance indicators include: (1) Personal competence; (2) Preparation; (3) Performance in learning and teaching procedure, as indicated with Attitude, Beforehand working, Performance in class, Performance outside class, Knowledge and capability building, Self-tuning, Contribution to the course, respectively; and (4) Grade of the goal achievement and post evaluation.

As shown Table 2, the students' performance indicators and related evaluation indexes are presented with 12 indexes, with specific scale for each. Similar to evaluation of the Teachers' performance indicators, the maximum total value of the 12 indexes is 100 points, and the score of each index is assessed by student-self and teachers' evaluation, respectively. The total value of the students' performance will be in the range of 12 to 100, as calculated with the lift-side equation. The total value of the student's performance (T_{sp}) is calculated as: $T_{\mathrm{sp}} = \sum_{i=1}^{12} S_i (W_{si} + W_{ti})$, where, S_i is the scale of the index i, with value range of 1 to 5 points, 1 to 10 points, or 1 to 15 points, respectively; W_{si} and W_{ti} are the weight of student-self and teachers' evaluation, with value range of 0.2 to 0.8, respectively.

2.1 Personal Competence and Preparation for the Course

In terms of course goal achievement, students' personal competence focuses mainly on the adaptability to the course learning and is of the characteristics of knowledge preparation for the course. The indicators of the personal competence and preparation for the course are generally of basic conditions and the related evaluation scale is designed 1 to 5 points. For the personal competence, the weight of student-self is 0.7 (70%) with the students' self-evaluation before the course time under consideration.

2.2 Performance in the Learning and Teaching Procedure

The students' performance is evaluated with the indicators of attitude, beforehand working, performance in and outside class, knowledge and capability building, self-tuning and contribution to the course, with single or double indexes, respectively, as shown in Table 2.

The maximum total scales of the indicators for the performance both in and outside class and students' personal knowledge and capability building are 55 points, provided that the related assessing results by the raters are all of the highest scores. The learning attitude and self-tuning are scaled 1 to 10 points and the other two indicators, beforehand working and contribution to the course, are scaled 1 to 5 points, respectively.

Items No.	Indicators		Evaluation system			
			Indexes	Scale	Raters	Weight
1	Personal competence		Adaptability to the course learning	1 - 5	Oneself	0.7
					Teachers	0.3
2	Preparation		Background knowledge	1 - 5	Oneself	0.5
					Teachers	0.5
3	Performance in the learning and teaching procedure	Attitude	Initiative and persistence	1 - 10	Oneself	0.6
					Teachers	0.4
4		Beforehand working	Pre-class task completion	1 - 5	Oneself	0.6
					Teachers	0.4
4		Performance in class	Attending and finishing	1 - 15	Oneself	0.5
					Teachers	0.5
5			Interaction, group work, communication	1 - 5	Oneself	0.3
					Teachers	0.7
6		Performance outside class	Assignment completion	1 - 10	Oneself	0.3
					Teachers	0.7
7			Reflection and self-evaluation	1 - 10	Oneself	0.8
					Teachers	0.2
8		Knowledge and capability building	Formative assessments	1 - 10	Oneself	0.2
					Teachers	0.8
9			Summative assessments	1 - 5	Oneself	0.2
					Teachers	0.8
10		Self-tuning	Tuning timely and effectively	1 - 10	Oneself	0.8
					Teachers	0.2
11		Contribution to the course	Feedback, criticizing and suggestion	1 - 5	Oneself	0.2
					Teachers	0.8
12	Post evaluation		Goal achievement and reflection	1 - 5	Teachers	0.3
					Students	0.7

Table 2: Students' performance indicators and evaluation indexes

2.3 Post Evaluation

The indicator post evaluation is designed to present the learning goal achievement and self-reflection from the course learning at the end of a semester. Effective reflection is helpful to the future learning. The post evaluation is scaled 1 to 5 points and the weight of the students' evaluation is 70%.

Discussion

The proposed performance indicators is based on the 12-year Tunnel Engineering course teaching experience at Chang'an University, in China. It is an iterative process, including the indexes choosing and raters defining, scale and the weight value evaluation, to design the indexes and their evaluating scales, raters and their assessing weights for an index. Of the total values of the performance, (1) the students' range in average is 65 to 85 points, with the maximum value 95 points; (2) the teachers' range in average is 65 to 84 points, with the maximum value 90 points. Being actively involved in the application of the performance indicators system is beneficial to the students' knowledge and professional thinking skill

development. The practice shows that the following points are vital to the effective application of the proposed performance evaluation indicators.

The Objectives of the Performance Indicators

Education is a social activity, in which learners are both participants and service recipients. A course is designed not only to transfer related knowledge to students, but also to improve their thinking capability. It is increasingly easier to know something, but it seems more challengeable to effectively incorporate the information available into one's own knowledge system. For a course with focus on professional knowledge, students' knowledge building and professional thinking skill development are the key goal achievement. Therefore, the indicators for the performance of both learners and instructors would service for this learning and teaching objective. The design of the performance indexes and related evaluation scales and weights would be favorable to realize the course goal achievement.

As the course procedure focuses on the student's knowledge and capability building, all of the indicators are designed to present their contributions to the related learning and teaching procedure. Considering effective learning is a self-discipline procedure and needs self-reflection, the indicators of the student's attitude, preparation ahead of the course, beforehand working, self-tuning and contribution to the course, are closely related to the students' performance. The results of the learning and teaching procedure are indicated with the learning goal achievement, such as in terms of knowledge and capability building. The indicators for the teacher's performance evaluation would be timely checked with the level of the student's goal achievement.

Relationship of the Involved

In a traditional learning and teaching procedure, teachers provide knowledge to students. As information and knowledge are easily available to students, it is necessary to modify our learning and teaching content and style to stimulate students' enthusiasm for personal knowledge system building and professional thinking capability development, such as in terms of acquiring and connecting knowledge, solving or defining problems, rather than just focusing on instilling knowledge. Therefore, students would play leading role in course learning and teaching procedure; teachers would be supporting role, such as course provider, director, guider, context and facility staff, etc. For example, there are numerous information available as we are increasingly immerged in a digital society. The importance of information sampling is accordingly increasing. The capacity of coping with the obtained information is more vital to both instructors and learners. The situation implies changing in course preparation and execution styles to adapt the requirement of the society.

As learning and teaching is procedure of the interaction between learners, teachers and knowledge in a specific context, which is usually presented with environment, facilities, culture and social values and expectations. In practice, teachers would design context for the specific issue and manage to prepare available facilities. However, good context is greatly depended on the relationship between learners and teachers, especially their positive and effective interaction. The evaluation scales and weights of the related performance indicators would effectively assess the performance of participant roles.

Dynamic Features

Course design and implementation plan execution are in a dynamic procedure, where there are interactions among students, teachers, environments and facilities etc. In general, there need pre-requirements for the application of the performance indicators, such as: (a) Course being well-designed; (b) Implementation plan being well-known, especially making it known to students before course time. The students' performances are more decisive to the level of the total values of both learners and teachers in a semester, esp. in the first few weeks.

The course knowledge is of system features, but student's learning is in steps. Effective learning is based on students' abilities, efforts, and active participation. Each learning and teaching step or issue must have a specific topic, which is previewed by students following carefully setting tasks and questions. And then students would actively engage in learning and teaching procedure. It is vital to activate students' subjective initiative, such as through process based assessment, students' participation in design, and joint construction between teachers and students. There need more opportunities for students' daily communication through various online and offline platforms to promote teacher-student communication. The commonly used approaches include instant feedback system, virtual teaching and research room, and process based assessment.

There are always adaptation and adjusting in the learning and teaching procedure, with the following features: (a) It is difficult and vital at beginning; (b) Assigning targets being in specific modes; (c) Applying both formative and summative assessments effectively; (d) Tuning the course design and implementation plan timely, with the learners' situation under consideration. The performance indicators and their evaluation would be favorable to this spiral progressive procedure, with student's initiative and persistence underlined.

Importance of Communication

As the performance indicators (Tables 1 and 2) show that communication between learners, supervisors and teachers is vital to the total course procedure, such as in content preparation, activities in and outside class, and post evaluation. There need responses from both learners, peers and supervisors to have effective course process. The results of the learning and teaching procedure would be assessed with evaluation indexes, which are performed by interaction and communication between the involved. For example, where interaction and communication are well, students will actively participate in the course process and will be favorable to activate students' subjective initiative. Received attention and respect from teachers, and students naturally responded positively. The daily communication could be online and offline platforms, such as instant feedback system, virtual teaching and research room, and process based assessment. Timely and effective communication would play a vital role to check and improve the course procedure and goal achievement.

Conclusion

Conclusions drawn from this study are: (1) Both students and teachers performance evaluation indicators are proposed for the Tunnel Engineering learning and teaching to improve student's learning achievement. (2) To be effective in the application of the performance indicators, the students' performances are more decisive in practice. (3) The application of the proposed performance indicators system would inspire the students being

actively involved and be beneficial to their knowledge and professional thinking skill development.

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An Empirical Test of Dimensions That Influence Community Members' Engagement With a University in Uganda

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Abstract
There is sparse empirically supporting information on explanatory dimensions influencing community members' participation in university-community engagement. An insight into these dimensions could provide an invaluable starting point for designing suitable community development interventions. This study investigates the dimension that influences Rwenzori local community members' engagement with Mountains of the Moon university in Uganda. Community members' engagement participation was examined with three dimensions: personal factors: (tribe, gender, age, beliefs, previous engagement experience), process factors (level of involvement, engagement focus, engagement approach), and community-level factors (nature of the economic activity, community trust, access to resources). The survey was administered to (n = 100) community members engaged with Mountains of the Moon university. These were selected through simple random and purposive sampling. A Partial Least Squares- structural equation modelling analysis technique was used to test the research model using Smart PLS (v3) software. The study findings significantly supported the paths from process factors and community-level elements to community members' engagement participation. The findings, however, showed that personal factors have no significant direct effect on community members' engagement participation. Therefore, the authors recommend that universities, organisations, and policymakers pay more attention to the process factors and the community-level elements to enhance participation. Future research should investigate the variables studied with a broader sample and/or in a different context to generalise the results.

Keywords: Engagement Participation, University-Community Engagement, Rural Community Members

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1. Introduction

At the centre of the university community engagement (CE) mission is the collaboration between the university and its local communities. However, elements inspire community members to participate in university community involvement activities are rarely investigated. This study assesses elements that predict local community participation in university CE activities. Gaining insights into these elements has multiple benefits to the university compelled to perform community engagement.

First, the university becomes aware of which components may aid in developing more profound and meaningful relationships with their communities. This enables tailoring their engagement activities to better correspond with community needs and establish productive collaboration (Clifford and Petrescu, 2012). Perhaps more crucial for the university, understanding these elements enables them to create CE initiatives that are inclusive of varied viewpoints and needs. According to (Mirri et al., 2018; Trencher et al., 2015), understanding elements that stimulate active community participation is crucial to foster fruitful collaborations. For instance, it guarantees contextualisation of the users' requirements and improved services and relationships between the institutions and their stakeholders (Foroudi et al., 2019; Mirri et al., 2018; Zavratnik et al., 2018).

Second, understanding the elements that support community members' participation is vital for a broader comprehension of the relevance of university CE. Scholars often emphasise the active participation of community members (Khodyakov et al., 2013). Participation is "a process in which individuals take part in decision-making in the institutions, programs, and environments that affect them" (Talò, 2018). Thus, universities ought to encourage diverse expertise and perspectives from the community to achieve common goals. Community partners are seen as essential wellsprings of information and ought to participate in the designing, execution, and dissemination of any investigation or development initiatives that influence them (MacDonald, 2012; Mirri et al., 2018). Therefore, universities often create room for active community participation in university engagement activities.

For example, in the effort to advance the CE Mountains of the Moon university in Uganda considers community interaction to be an essential component of its purpose. Recognising that a university's duty extends beyond academics, the university aims to use its resources and skills promote CE. For instance, the university prioritized CE initiatives with local farmers on research projects addressing agricultural challenges and enhancing best agricultural practices. Engaging with farmers is envisaged as an opportunity for the university to leverage this expertise and allowing communities to participate in improving their well-being. Other CE endeavours were organised by education faculty members and these involved training programs for local primary teachers to improve their teaching methods, subject knowledge, and classroom management skills. The business faculty also offered entrepreneurship training programs to community members and aspiring community entrepreneurs. However, Often, institutional efforts to advance CE initiatives have not reached their full potential. One of the key challenges is that the university lacks a comprehensive catalogue dimension that could influence community members' engagement participation.

The present research takes the initiative to assess the dimensions influencing the community to participate in university CE initiatives. Pinning down these factors underscores critical issues that should be addressed when designing CE initiatives to encourage active participation of the targeted population (Caffaro et al., 2020). Moreover, institutions could

benefit from a more defined understanding of what prompts individuals to participate in different forms of community activities. Thus, the current research findings are valuable in guiding universities and other organisations in developing effective CE strategies to encourage engagement participation.

1.1 Hypothesis Development

The University Community Engagement Activities

Universities frequently engage with their communities through various initiatives designed to enhance collaboration, information sharing, and mutual benefits. For instance, in terms of teaching, universities employ community-project initiatives in the curriculum, offering reciprocal learning opportunities for all partners (Suarez-Balcazar et al., 2013; Vargiu, 2014) (Brown et al., 2016). Students can collaborate with communities to gain practical skills and benefit the communities (Alice et al., 2021; Garber et al., 2010). Besides, universities implement research that recognises the community as a knowledge-rich partner. In contrast, the university's research capabilities become more accessible as a resource to respond to community needs or aspirations (Rojas et al., 2012). Community partners become involved in identifying their needs and participating in co-creating solutions (Frank and Sieh, 2016). Participating actively in these engagement activities is critical to obtaining successful university CE outcomes. To achieve mutual benefits, the university and community members should actively be involved in the engagement ventures. Therefore, drawing insights from the literature, we identified elements that could influence community members' engagement participation.

Relationship Between Personal Factors and Community Members' Engagement Participation

Researchers have systematically related different personal factors to community engagement participation(Chang and Chuang, 2011). According to (Wade and Demb, 2009), personal elements such as race, gender, personal values, motivation, epistemology, and previous experience could affect engagement participation. Personal factors in our study represent tribe, gender, age, beliefs, and previous engagement experience. Regarding tribe, people's sense of belonging to a specific tribe or group can substantially influence their involvement in engagement activities (Kamal et al., 2020). A strong sense of community may inspire greater interest and commitment to participate in university CE activities.

Furthermore, gender may influence active engagement in university CE activities due to social and cultural norms (Naud et al., 2019). Certain activities may have traditionally been identified with various genders, resulting in varying degrees of interest and engagement. Gender norms, expectations, and views of gender roles in culture can all influence community members' motivation to participate in specific university CE activities.

Another personal element is that age influences engagement involvement (Demb and Wade, 2012; Naud et al., 2019). Younger people may have different tastes and interests than older people, which might influence their involvement choices. Besides, life stage, responsibilities, and available time can all impact the amount of engagement among local community individuals.

Personal values also have a significant impact on engagement participation. Individuals are more disposed to engage in activities consistent with their beliefs and ideas (Kamal et al., 2020). They are more likely to join actively if an engagement opportunity corresponds with their beliefs or promotes a cause they expect (Brunton et al., 2017; Quillinan et al., 2018).

Individuals' propensity to participate in future events is influenced by previous involvement experiences(De Weger et al., 2018; Xu, 2007). According to (Dien et al. and Pratik et al., 2008), the individual's past collaborative experience is likely to impact the success of participation. Thus, positive experiences boost motivation resulting in increased levels of engagement, while negative experiences or a perceived lack of value, on the other hand, may dissuade local individuals from engaging with universities. From this theoretical information, we formulated our first hypothesis as:

H_1: Personal factors have a positive effect on community engagement participation in university community engagement activities.

The Relationship Between the Engagement Process and Community Members' Participation

In this study, we anticipate that the way engagement activities are organised, structured, and carried out substantially impacts community members' participation. When community members feel engaged, valued, and included in decision-making processes, it generally fosters a sense of ownership, commitment, and motivation to participate actively (Quillinan et al., 2018). According to this research, process factors are perceived as the level of engagement, engagement focus, and engagement approach the university utilises to enhance and generate opportunities for community participation. Regarding the level of engagement, the level to which community members are actively involved in decision-making or implementation processes determines their participation (Kenny and Regan, 2021; Kohler et al., 2011). For instance, when the university offers significant opportunities for community members to contribute their ideas, skills, and expertise, they are more inclined to engage. In contrast, restricted or passive involvement might reduce participation because individuals may believe their efforts are unimportant.

On the other hand, the engagement focus or goal of the engagement may influence community members' participation. According to Dempsey (2010) and Olutokunbo et al., (2018), Community members are more likely to engage and participate actively in university CE activities if the engagement emphasis is closely related to their interests and needs. Similarly, when the university CE emphasises community concerns and aspirations, community members may understand the need for their participation to create change(Khodyakov et al., 2013).

The engagement approach includes the university's tactics, methods, and channels to encourage community participation. For instance, (Frank and Sieh, 2016) and (Mbah and Mbah, 2018) demonstrated that engagement approaches that involve face-to-face encounters, such as co-creation, enhance active participation of the community in creating, designing, building, and implementing innovations. Such an approach not only supports active community members involvement in university CE initiatives but also enables ownership of the engagement intervention and increases the possibility of staying engaged throughout and after the process (Kearney, et a., 2013). Thus, we stated our second hypothesis as:

H_2: Process elements have a positive effect on community members' engagement participation.

The Relationship Between Community-Level Elements and Community Engagement Participation

In the current study, community-level elements are perceived as components or conditions in the community that influence community members' participation in university CE activities. Thus, we operationalise community-level elements to include the nature of the economic activity, community trust and resource access. The type and nature of economic activity in a community can shape engagement participation. For instance, in cases where the university CE activities offer economic benefits or job training to community members, it can encourage encouraging participation. (Clifford and Petrescu, 2012). Suppose the community relies on agriculture and university CE engagement opportunities linked to agricultural issues or sustainable farming methods. In that case, community members are more likely it participates in the university CE activities (Alice et al., 2021). Establishing activities that involve farmers' participation in activities that critically makes them aware of the realities that impede the development of their fish farming enterprises enhances their participation (Bamuturaki, Keneth, Oliver Schmidt, 2018).

Access to information and technical resources influences participation in university engagement activities (Cariani, 2016). For example, community members with minimal resources may confront participation difficulties. Lack of adequate resources, like financial resources, may hinder participation as community members with limited financial means may find it challenging to attend in-person university CE events or training.

Furthermore, the literature shows community trust in the university can drive or hinder community engagement participation (Di Napoli, Dolce, and Arcidiacono, 2019; Smith et al., 2013; Zanbar and Ellison, 2019). Community trust is the community members' assessment of whether the university's CE initiatives meet their expectations (Suarez-Balcazar et al., 2013). Trust provides a sense of security, collaboration, and the idea that their perspective will be acknowledged and considered (Cook and Nation, 2016). Furthermore, the literature emphasises that community participation can only be developed based on mutual trust between people and institutions (Talò, 2018). When the community trusts the institution,community members may be willing to participate in university CE activities (Molinillo et al., 2020). (Lavery et al., 2010) suggest that a better understanding of the community-level factors is to establish engagement participation. Thus, we suggested our third hypothesis:

H_3: Community-level elements have a positive effect on engagement participation.

2. Methodology

A convenience sample of 100 community members from the Kabarole and Kyenjojo districts in the Rwenzori region of Uganda responded to a survey between September and October 2022. Respondents who have previously participated in Mountains of the Moon university activities were deemed eligible to participate in this survey. The survey was divided into two sections: a) evaluating respondents' socio-demographic factors, as shown in Table 1.

Variable	Classification	Frequency	Percentage
Gender	Male	62	62.0%
	Female	38	38.0%
Age groups	21-30	20	20.0%
	31-40	36	36.0%
	41-50	27	27.0%
	51-60	13	13.0%
	61+	4	4.0%
Education level completed	Primary	12	52.0%
	Secondary	25	20.0%
	Diploma/ Polytechnique	28	10.0%
	Bachelor's degree	30	5.0%
	Others	5	13.0%

Table 1: Demographic characteristics of respondents

The second part of the survey examined constructs that predict community members' participation in university CE activities. Items that measured personal factors included (tribe, gender, age, beliefs, and previous engagement experience), revised from (Wade and Demb, 2009); process factors included (level of involvement, engagement focus, and engagement approach) developed from Kohler et al. 2011; (Khodyakov et al., 2013). Community-level factors included (nature of the economic activity, community trust, access to resources, and community readiness) were generated from (Bamuturaki et al., 2018; Cariani, 2016; Nanyanzi et al., 2022; Zanbar and Ellison, 2019). The questions in these sections asked respondents to judge how likely they were to agree that the personal, process and community-level elements influence their engagement participation. To obtain responses, the questionnaire featured a five-point Likert scale based on (1) Strongly disagree, (2) Disagree, (3) Neither agree nor disagree, (4) Agree to (5) Strongly agree.

3. Data Analysis

The Smart PLS 3 program was used to analyse the gathered information using partial least squares (PLS) based on structural equation modelling. Smart-PLS has the advantage of being employed in a range of research contexts and handling components assessed using single and multi-item measures (Sarstedt et al., 2021).

We examined the measurement model with all components of the proposed model. The model is supported by high loading values from 0.50 and above indicators, according to (Hair et al., 2014). Because of low loading values, we excluded two indicators of the latent variable personal factors: age (0.454) and personal beliefs (0.262), from the subsequent analysis. In addition, we examined the significance levels of the hypothesised associations using the latent variable scores derived from smart PLS. The bootstrapping process was used to assess the t-statistics of all indicators to evaluate if the postulated associations were significant. The observed sample represents the entire population in bootstrapping (Henseler et al., 2009). Therefore, the resampling bootstrapping approach was used with 5000 samples.

4. Results

4.1: Measurement Model Testing Community Members' Engagement Participation

The criteria (Hair et al., 2012) was used to assess individual item reliability and internal consistency (composite reliability). Table 2 shows the findings of individual item reliability. Items with low factor loading were eliminated from further analysis. Furthermore, we used Cronbach's alpha and composite reliability statistics to assess the constructs' reliability (Fornell and Larcker, 1981). According to the results in Table 1, the model has appropriate reliability since the coefficients of the lowest alpha of the constructs were (0.70), and the coefficient of composite reliability of the constructs was (0.83), meaning that they all met the minimal threshold value of 0.70. Besides, it is critical to examine convergent validity (CV) and discriminant validity (DV) in this kind of analysis. CV was investigated using AVE values. According to the findings, The AVE values varied from 0.654 to 0.775, exceeding the acceptable threshold of 0.50.

Construct	Factor loadings	Cronbach's alpha value	Composite reliability	Average Variance Extracted
Community-level factors (CLF)		0.819	0.881	0.654
Nature of community economic activities	0.836			
Community trust in the university	0.871			
Community access to the resources	0.874			
Community readiness for engagement	0.628			
Personal factors (PEF)		0.717	0.873	0.775
Gender	0.835			
Age	0.454			
Personal beliefs	0.262			
Previous experience	0.923			
Engagement process factors (EPF)		0.805	0.886	0.722
Level of Engagement	0.896			
Engagement Focus	0.764			
Engagement approach	0.882			
Community members' engagement participation (CEP)		0.784	0.874	0.698
Engaged learning activities	0.824			
Engaged research activities	0.840			
Engaged service activities	0.843			

Table 2: Measurement model results

The results of the discriminant validity are shown in Table 3. Accordingly, The DV is acceptable because the square roots of AVE were all above the relations between each pair of constructions. As a result, we concluded that adequate reliability, CV, and DV were obtained.

	Engagement participation	Community-level factors	Engagement process factors	Personal factors
Engagement participation	0.835			
Community-level factors	0.701	0.809		
Engagement process factors	0.710	0.522	0.850	
Personal factors	0.323	0.362	0.229	0.880

Table 3: Discriminant validity: Fornell Larcker criterion

4.2 Testing the Research Hypotheses

According to the results, the hypothesised path Community level factors (CLF) and community engagement participation (CEP) is statistically significant ($\beta = 0.434$, $t = 5.364$, $p < 0.014$) hence accepting H_1. Also, the model's hypothesised path of engagement process factors (EPF) and CEP is statistically significant ($\beta = 0.471$, $t = 7.065$, $p < 0.000$), thus accepting H_2. However, the hypothesised relationship between personal factors (PEF) and CEP was not statistically significant ($\beta = 0.058$, $t = 0.077$, $p < 0.380$) hence rejecting H_3.

Hypothesis	Relationship	Path coefficient	Standard Deviation (STDEV)	t-values	P Values	Decision
H_1	CLF -> CEP	0.434	0.081	5.364	0.014**	Supported
H_2	EPF -> CEP	0.471	0.067	7.065	0.000**	Supported
H_3	PEF -> CEP	0.058	0.077	0.878	0.380	Not supported

Table 4: Results of the hypothesised structural model

5. Discussion of the Results

This study investigated the elements influencing community members' participation in university engagement activities. A survey that involved 100 community members was conducted to get a better overview of this phenomenon. According to the study findings, Community level factors have a significant positive effect on community engagement participation. This finding is echoed in studies such as (Holzer et al., 2014; Lavery et al., 2010; Molinillo et al., 2020) who found that characteristics of the community's environment and dynamics influence the level of interest and participation in the university engagement activities. Thus, understanding community variables is crucial for designing strategies that encourage community members to participate in university community engagement initiatives actively.

Secondly, we found that the engagement process has a significant positive effect on community members' engagement participation. The findings suggest that universities must consider engagement process characteristics when developing engagement initiatives. For instance, the university may establish an environment that encourages active and meaningful participation by designing transparent, inclusive, and responsive processes, resulting in more impactful outcomes and a stronger feeling of community ownership of the engagement outcomes.

Finally, our results showed no significant relationship between personal elements and community members' engagement participation. On the contrary, studies such as (Naud et al., 2019) found that personal factors, for instance, gender and age have a positive effect on engagement participation. Thus, findings from our study seem surprising because, to participate in university CE activities, community members must be receptive. However, it might be claimed that when community members interact with universities, a vibrant relationship forms and that personal or individual considerations do not always disturb it.

6. Conclusion

In conclusion, the interplay of community-level, process and personal elements can encourage or discourage community members from actively participating in university community engagement initiatives. Therefore, universities and community organisations should consider these factors holistically to maximise community members' engagement participation. For instance, this can be achieved through developing a culture of active participation by creating a good community atmosphere, designing effective and inclusive engagement mechanisms, and addressing individual motivations for participation.

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Under Fire: Developing Micro-Level Partnership Practices Between a Ukrainian and United Kingdom University as a Rapid Response to Threats to Higher Education During Military Invasion

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Abstract
This research uses a case study design (Creswell and Creswell, 2022) to engage in a framework of reflection-in-action (Schön, 1983) exploring the implementation and impact of a series of small-scale micro-level events initiated between departments of education at a Ukrainian and UK university. This was as a response to the challenges faced by Higher Education Institutes (HEI) in Ukraine resulting from the major escalation of aggression by the Russian State on February 24th, 2022. The research briefly analyses current literature on the impact of recent conflict on HEIs globally, noting that much of it appears to focus on the immediate recovery phase post-conflict opposed to the current impact where Ukraine is still, literally, under fire. The impact of conflict on Ukraine HE generally and the particular HEI is discussed. Three of the 'micro-level' initiatives are described and analysed through a narrative process between the authors (Buckler and Moore, 2023; Cohen et al, 2017). These initiatives are: a digitally curated common-interest data-base; a digitally shared series of module sessions; a webinar engaging Ukrainian school teachers supporting UK school teachers who have Ukrainian refugees in their class; and this collaborative research. Possible lessons for the two HEIs and others in similar positions that require rapid response are discussed. Namely, the need to identify interventions that legitimately avoid stringent quality processes that UK universities operate within, the need to recognise and utilise student skills, and the advantage of a working relationship that recognises the importance of effective intercultural skills.

Keywords: Conflict, Higher Education, Ukraine, United Kingdom, Universities

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Introduction

Using the experience of two university departments working in partnership, the Social Work Department, Ternopil National Pedagogical University Ukraine (TNPU) - and the Department for Education and Inclusion, University of Worcester (UW), UK, this field note applies a form of reflection-in-action (Schon, 1987) regarding responses to the threat and challenges resulting from the increased aggression of the Russian state towards Ukraine since February 24th 2022. In particular, it examines a number of what we call micro-level, informal, activities formed at an individual staff level, independent of formal internal or inter-institutional agreements. The paper begins with a brief discussion of the existing literature on Higher Education Institutions (HEIs) in recent times of conflict. It then presents a summary of the current crisis in Ukraine, with a particular focus on the impact on the Higher Education (HE) sector. A brief discussion follows of 'reflection-on-practice' as a suitable methodological framework for exploring this recent and evolving project. It continues with a brief overview of the two universities and their responses to the crisis with a focus on TNPU as the site of stress. The activities that have taken place so far are discussed, and tentative lessons drawn as to what both partners have learned from the engagement.

Higher Education in Conflict – Recent Experiences Globally

Unfortunately, there is a necessary and growing literature examining challenges that arise for HE in a space of conflict. For example, limiting the discussions to the last decade only; Afghanistan (Darwish and Wotipka, 2022; Couch, 2020), Cote d'Ivoire (Johnson and Hoba, 2015), Libya (Milton, 2022), Sri Lanka (Russell, 2022) and Somaliland (Kester, 2021).

Much of this research analyses the role of HEIs in rebuilding in the post-conflict period. For example, Darwish and Wotipka (2022) examine the impact of conflict on education, including HE, and note, inter alia the problems caused by the destruction of infrastructure, decreased time spent on learning, the limiting of finances directed to education, the reduction of average years of education and the concomitant reduction in attainment. They also highlight problems caused by displacement and migration, "leaving a country with less-qualified teaching staff and a loss of the academic community" (p. 6). They note that gender impact is dependent on local circumstances: in some cases, females are more affected and in others, males, as they enlist in the military or enter the labour market.

However, there is less direct discussion of HE directly in the line of conflict. Pherali and Lewis (2019, p. 730) note that,

> *Research into the nexus between higher education and violent conflict is underdeveloped. Attacks on HE are not only damaging to the existing system of provision, but also have an enduringly debilitating impact on national capacities to recover from and reconstruct after conflict.*

Ukraine finds itself in this 'live' conflict and whilst there are already discussions as to how partnerships between Ukrainian HEIs and UK partners might help rebuild society post-conflict (Morrice, 2022), this paper involves itself in the fearful, disrupted present when TNPU is experiencing such impacts as described by Russell (2022, p. 899), "Key infrastructure can be destroyed, with … universities in some cases becoming battlegrounds …" Although TNPU is too far west in Ukraine to be the site of ground battles, this has happened to HEIs in the east of the country and TNPU itself has been increasingly impacted by long-range missile strikes,

which pose not just an immediate threat to life and property, but hamper the provision of electricity, communications services (including internet), water, etc.

A brief overview of the literature on the impact on HE of conflict demonstrates a growing body of work but most is focused on post-conflict recovery and the role of HEIs in assisting such recovery. There appears to be less on the immediate, ongoing, impacts in the immediate time of conflict though the description of the response at TNPU later in this paper provides rich evidence of such.

Reflection-on-Practice

This paper is written whilst conflict is in process and there appear to be no solution or resolution on any near horizon. We reflect on some simple, low-level, 'micro-interventions' with the aim to share with other interested parties and to consider what lessons we might learn as we seek to develop such interventions further. As this is an ongoing and developing set of practices, we invoke the use of Schön's notion of reflecting in-practice (i.e., whilst an event is in process) rather than a reflection on-practice (after the intervention) (Schoen, 1987). Barab and Kay (2001) postulate that by so doing the practitioner is better able to understand the context and learning experience and thus enhance the effectiveness of practice within these. Reflection-in-action can be viewed as a process of interaction encouraging a simultaneous "doing and reflecting at a competence level in which the practitioner reflects on experiences and adjusts their practice according to the development of a situation" (Tannenbaum et al, 2011, 250).

Developing this further, Ng et al (220, p. 313) note that, "Reflective practice is a way of practising in indeterminacy that involves drawing upon personal and experiential knowledge in addition to scientific knowledge to solve messy problems in practice." The phrases 'practising in indeterminacy' and 'to solve messy problems in practice' are rather understated when such indeterminacy and messiness involve (for example) the need to flee a learning situation because of a potential missile attack, but such events themselves offer crucial if unsought for, learning opportunities.

Shutte (2018, p. 177) offers a notion of reflection-in-practice useful in conceptualising what we, in a limited way, seek to achieve via our micro-interventions.

> *... The 'reflection' involved in 'practice', is best understood as a dialogue between different partners, whether individuals or groups. Such reflection ... can ... uncover values embedded in the practice which, however limited the practice, can have a wider, even universal, scope.*

As this paper draws on an analysis of our own practitioner-narrative discussions (Buckler and Moore, p. 2023), we use our own names when necessary in the text below (Ana, TNPU; Gareth UW).

The War in Ukraine

The war that started in Ukraine in 2014 with military actions in Donetsk, Lugansk, and the annexing of Crimea, damaged all spheres of life. After the escalation in February 2022 almost all northern, eastern, and some central regions of Ukraine suffered the direct attack of Russian troops and weaponry. The rest of the country has not been spared either as there are numerous missile and bombing attacks from the air. The Russian war against Ukraine has caused the

largest wave of refugees since World War II (Shevchuk and Shevchuk, 2022). Five million are displaced internally and seven externally, four million of whom registered for temporary protection in Europe (Ukrinform, 2023). Not only do people suffer, but infrastructure too. Some cities are totally ruined, others to varying degrees. This leads to ecological, social, and humanitarian catastrophes (Pantuliano, 2022). Naturally, the Higher Education system is also engulfed in this human-made disaster.

The Impact on Higher Education in Ukraine

Ana considers the ways the war fundamentally affects the quality of education, including HE. Her observations reflect many of the issues discussed in the brief literature review above. The most important and the most difficult challenge for HE in wartime is to continue to provide services and ensure safety for all participants in the educational process. At the same time, HE faces many challenges:

- Occupied and ruined infrastructure: most of the HEIs located in cities that suffered massive attacks are totally ruined. All HEIs from temporarily occupied territories were relocated. HEIs in western and central regions of Ukraine fared somewhat better though nowhere in the country is out of range of missile strikes or immune from the disruption of basic services.
- Absence and creation of a 'safe' environment for the provision of educational services: HEIs provide possibilities to study offline, online (synchronously and asynchronously), or in a mixed format. However, students studying online and on campus, due to intermittent power, lose the opportunity to study systematically.
- The quality of the education process deteriorates in war. The curriculum and content are adapted to conditions, decisions are made immediately. Many topics and tasks are set for students' self-study. HEIs pay more attention as to how to organise work and less to the quality.
- Retarded growth of knowledge: infrastructure is ruined, electricity is intermittent, staff and students are among refugees or internally displaced persons.
- Financial problems: lack of support from the state and inability to earn money hinder processes. Only the most important fields are financed. The outflow of Ukrainian and foreign students also affects the financial situation of institutions.
- Motivation: even if students can continue studying, many are in danger of losing motivation and lack the morale to study. Staff is on the verge of professional burnout due to constant stress and the criticality of the situation. For all, this can have long-term consequences, including under-skilling and under-education for careers in the post-war period.

No matter how unfortunate it may sound, war provides opportunities as well as threats. Shevchuk and Shevchuk (2022) posit the following: the development of international academic mobility for teachers and students (though no longer for males), intensive implementation of IT, the application of flexible learning, cooperation between Ukrainian and foreign HEIs, implementation of lifelong education, the introduction of full-fledged distance education as a mode. Further, for students: the opportunity to study and work at the same time (obtaining practical experience), and for teachers, to work in educational and other fields (enhancing transfer of practical experience to students), improvement of the territorial organization of HE in Ukraine (relocation of HEIs from territories where active hostilities are taking place to large cities) and the opportunity to reveal and deal with organizational problems in HE.

The Partnering Universities

Ternopil Volodymyr Hnatiuk National Pedagogical University (TNPU) is located in Ternopil, western Ukraine. It has a key role in providing education for future teachers as well as a broader offer in the sciences and humanities. It achieved the full status of University in 1997. It is one of the biggest pedagogical universities in Ukraine. It incorporates 10 faculties, the University Preparation Centre and the Postgraduate Education Centre, running 128 educational programs (EPs) at Bachelor, Master and PhD. In 2022, there were 812 associate professors and assistants, and just under 6000 students. Half the EPs have a pedagogical profile. Students represent all regions of Ukraine. There are a small number of international students.

The University of Worcester (UW), is an institution borne out of conflict. It was formed in 1946 at the end of the Second World War as an emergency teacher training college when teachers were in short supply. Its purpose was to 'win the peace through education' (UW, 2019). In 2005 it was granted full university status. It currently has approximately 10000 students studying full and part-time programmes. Education, Healthcare and Sports Studies remain key elements of its offer, but it also maintains a wider range of degrees in the arts, humanities and sciences. A new School of Medicine to train doctors and other medical staff is due to open in September 2023. Recent years have seen a dramatic increase in international students, particularly at Masters level in Business, Health and Education courses.

The Nature of the Response – Ternopil National Pedagogical University (TNPU)

The war that started in 2014 escalated dramatically on the 24th of February 2022. This coincided with the beginning of the second semester at the University. All students were on campus at that time. As a result of the invasion TNPU closed to students for two weeks. Students were sent home and the university management developed an action plan. After two weeks, everyone returned to studying and working online.

From the first days of the war, the university rapidly provided a range of services beyond its educational remit. TNPU hostels became shelters for many refugees from places of more active hostilities. The campus became one of the biggest volunteer hubs in the town, providing support for refugees with food, clothes, medicine, children's items, equipment and services for people with disabilities, as well as gathering and distributing supplies for soldiers (clothes, medicine, cars, etc.). The Volunteer Center continues working. Staff and students, outside of their normal academic commitments are the main volunteers there.

Staff and Masters students from the Department of Psychology and Department of Developmental Psychology and Counseling volunteered their services in the Socio-Psychological Service Center at TNPU to provide psychological support to refugees, staff and students.

Staff of the Department of Social Work and Management of Sociocultural Activity and the Department of Special and Inclusive Education became volunteers at railway and bus stations, focal points for large numbers of internal refugees, providing social services and emergency care to people in need.

Ukraine had been forced to adapt rapidly to the Covid crisis of 2020 (Okulich-Kazarin et al, 2022). Ironically, this left the university well-prepared for the subsequent escalation in military aggression. On the 24th of February 2022, TNPU had a good material and technical base, a

well-qualified scientific and pedagogical staff used to working in crisis conditions, and a good understanding that the educational process should continue and how that could be achieved NAQA (2023). Implementing the TNPU strategy from the 2020 time of Covid-19 helped to ensure the continuation of provision of educational services as the war commenced. Appropriate approaches for the development of the digital environment of the University were implemented. The University is an ecosystem divided into profile clusters: technologies, education, science, and management and marketing (Henseruk et al, 2021). It allows for the continuation of all pedagogical and managerial processes to work distantly. At the end of 2020, all EPs at the University were present on the Moodle platform. That allowed for the continuation of distance education (Falfushynska, 2021).

The Nature of the Response – The University of Worcester (UW)

The sudden escalation of aggression by the Russian state led to a rapid response within the university in terms of the expression of moral support for the people of Ukraine and its HE sector, but also at a very practical level. For example, various funds and collections were set up to procure and supply much-needed medical supplies to the people of Ukraine who found their access to medicines needed for conditions such as diabetes suddenly curtailed. The university offered large parts of its student accommodation as emergency housing for Ukrainian refugees over the summer, although that offer was never taken up. English classes for TNPU staff were held online in July 2022 and in October 2022 a memorandum of understanding between the universities was signed. To provide a focus for partnership working it was decided initially to form links between those departments at each university which have a focus on education.

Joint Responses

We briefly describe and discuss three micro-level activities between the Department for Pedagogy and Psychology, TNPU and the Department of Education and Inclusion, UW. We use the term ‘micro-interventions’ as they are of a scale capable of implementation through actions at each university that legitimately avoid protracted institutional procedures in terms of management processes needed to implement deeper level changes to courses and practices. Such processes, which while helping to maintain quality standards, can be detrimental to a fleet of foot response necessary in emergency situations such as discussed in this paper.

1. Sharing of Interests

The authors set up a document, shared in the cloud, that allowed staff from TNPU, to indicate their interests in cooperation, and UW staff to indicate which of these they felt able to respond to. The authors applied a system of numbering to allow for easy cross-referencing. A short extract, with names and various details redacted, is provided in Table 1 indicating how this works.

Initial suggestions from TNPU

A. Fields of possible cooperation **(projects/research, etc):**

A.1 Physical Education and Sports, Olympic education… (plus 14 further items of a project/research nature)

B. We are interested in **lectures** in:

B.1 Physical Education and Sports… (Plus 12 further…)

C. We would like to receive **assistance/professional development** in:

C.1 Exchanging experience on the educational process… (plus 8 further…)

D. **Other** cooperation possibilities:

D.1 Cooperation in Postgraduate Certificate Programs, Cooperation in making courses for bachelor programs. Etc.

UW offer in response to the TNPU ideas above -

Feel free to add/edit. Put yourselves in groups if you wish to explore working on something as a team.
The TNPU colleagues can also see this so they will contact you to discuss taking ideas forward.
Do get in touch with me [Gareth] if you want to discuss anything further.

Cross-referenced to the TNPU items in sections A - D in the list provided by TNPU above (Indicative, not exhaustive). Feel free to enter further possible items.

Name	Contact details	Areas of academic interest	A. Possible cooperation	B. Lectures	C. Assistance/ prof. Dev.	D. Other
yyy	yyy@uw.ac.uk	HE Pedagogy		B.6		D.1
xxx	xxx@uw.ac.uk	Educational identities of teachers and pupils	A.8, A.10		C.9	D.5, D.6

Table 1 – Exploring potential areas of cooperation.

2. Participation in Module Sessions

Gareth was teaching a face-to-face module for second-year undergraduates in semester one (September 2022) on the theme of special and inclusive education in the global context. It explores various global statements and policies and how far these are reflected and enacted in individual countries. Thanks to the experience of both HEIs in responding to Covid it was relatively easy, with the permission and active agreement of the UW cohort of students, to include TNPU students via Microsoft Teams in various of the sessions.

3. Joint Webinar

There are many children from Ukraine in UK schools because of the conflict. A member of the administration team in the School of Education UW had observed the small, rural school his children attend trying to adjust to accommodate some of these Ukrainian children. In response, the authors organised a webinar in which Ukrainian teachers in schools in Ternopil known to TNPU, presented on various aspects of the Ukrainian school system (curriculum, pedagogy, expectations of staff, parents and children at school). UW invited local partner schools to attend. Over 20 attended including two from a partner university in the Netherlands. After the webinar, Gareth set up a Yammer group inviting all participants to join. A recording of the webinar was provided in the Yammer space, alongside various other materials made available by the Department of Education, UK (DFE, 2022) regarding supporting Ukrainian children in UK schools.

Reflections in Practice

1. Sharing Interests for Cooperation

The use of a table, carefully cross-referenced, hosted in the cloud, offered a quick means of gathering information. Currently, despite the initial enthusiasm from TNPU in suggesting ideas for cooperation and a strong response from UW staff, only the items discussed in this paper have come about. Considering why this might be, the authors postulate that the early energy and enthusiasm of the TNPU staff were soon overshadowed by the necessary exigencies of surviving in a context under direct attack from missile strikes and coping with the day-to-day stress caused by intermittent water, electricity, and internet supply. Pherali and Lewis (2019, 740) speculate that,

> *Academics from the West might subconsciously expect outcomes beyond the capacity of partner organisations in conflict-affected contexts. This may be reflected in terms of meeting deadlines …, quality of outputs … and levels of communication between partners during a given project.*

There is no evidence of this at UW but it reminds coordinators of such initiatives to communicate clearly to all what the stresses and strains are and how these might affect take-up and engagement.

One advantage of the document is that it provides a very clear view of possible future work. The authors will revisit this information and suggest progress that might be made in the coming academic year in a limited number of areas.

It is interesting to note that section D in the table above proposes "Cooperation in Postgraduate Certificate Programs, Cooperation in making courses for bachelor programs. Etc.". Early in 2023 various opportunities arose in the UK HE sector for universities to bid and apply for funding to develop such cooperation and course development. However, there was little capacity in the DEI/UW to be able to invest in such speculative bids. This demonstrates a challenge that will be familiar to many of the smaller, teaching focussed HEIs in the UK. Nevertheless, the micro level initiatives demonstrated in this paper could provide good evidence for future, larger scale bids.

2. Shared Module Sessions

This proved to be highly useful for all. The students were able to practice their skills in communicating with international colleagues. In the case of the TNPU this involved the medium of English. The UW students demonstrated the use of translation facilities in the Microsoft Teams space. Both groups actively explored and compared policies and practices that support learners with SEN in each country. The UW cohort experienced for themselves the challenges their TNPU colleagues faced in trying to maintain their studies. Indeed, the increasing rate of missile strikes meant the final two planned joint sessions had to be abandoned. The UW students commented on these experiences in the following semester, noting it had been a significant experience for them in understanding the reality of the situation for Ukrainian students. The authors will consider similar possibilities and how they might be made more effective. The necessity to prepare the student cohorts for eventualities arising out of conflict is clearly important.

3. The Webinar

It was clear from the webinar feedback that UK participants found this to be a very valuable event. They learned useful background information about their new students' previous experiences prior to coming to the UK, and were also able to ask and discuss very specific questions about individual cases. The Ukrainian teachers expressed their appreciation for the way UK schools and staff had taken in the pupils and were pleased to be able to offer support and become involved directly. It was clear they were having to deal with a very adverse situation. It was touch and go as to whether the webinar would proceed as there were major power cuts in the city that day and the internet was limited to one area. We alerted the UK participants to the fact that an air raid warning would mean the webinar being cancelled whilst still in progress. It was salutary to see one of the presenters losing her lighting halfway through and another having to constantly switch between laptop and smartphone to try and maintain a signal.

The original Yammer posting containing the recording of the event received over 700 visits. However, the hope that this space would continue as a place for shared and ongoing discussions between parties was not realised. It would be interesting to know why this is and whether an alternative digital space might be more useful. Maintenance of such spaces appears to be a common issue and the need for time to be set aside over time should be taken into account (Beales, 2016).

Conclusion

A review of the literature indicates there is little discussion of HEIs in the immediate time of conflict. It would be worth engaging in a broader, systematic collection of data from academics, administrators and students in Ukraine documenting their day-to-day experiences. Our reflection in practice shows us that engaging in low-level, micro-events, run via the goodwill of engaged staff and students, independent of broader managerial systems, can offer tangible pedagogical and moral benefits to participants. They might lay the foundations, through the accumulation of understanding, experience, and the construction of relationships, to build longer-lasting and deeper collaborations rooted more firmly in formal partnership and quality frameworks.

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Digitizing Specialized Assessments for Educational Professionals in the United Arab Emirates: A Conceptual Analysis and Innovative AI Driven Approach

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Abstract
This conceptual paper reveals novel insights on ways that digitized psychometric testing of subject matter and pedagogical competencies is developed as part of teaching professional credentialing procedures in the United Arab Emirates (UAE). As global fields continue to embed technological advancements, digitizing assessments is becoming more widespread in education. In the UAE educational professionals successfully complete digitized assessments as part of obtaining a license which assures alignment of high-quality teaching practices across the nation. Incorporating innovation, the use of evidence-based test design processes is bolstered by content developers, psychometricians, and international experts. The reader will understand how literature covering test theories, virtual professional learning community (vPLC) and community of practice frameworks bolstered in reflective practice underpins testing design. Supported by the author's specialist research expertise in networked learning, virtual professional learning communities of practice and educational theories, the paper uncovers how Rasch modelling analysis, collaborative situated learning and professional reflection models are used to steer committee experts and test specialist project managers as they contribute expertise in educational assessment, specialized subject matter knowledge, educational pedagogy and cultural awareness. There is also a concluding inference on how artificial intelligence and machine learning processes are used to facilitate and refine iterative cycles of test designs and evaluations with an innovative and efficient approach towards developing digitized ipsative assessment methods for education professionals working in the UAE. This paper is of importance in highlighting the UAE's robust approach of developing teacher licensure testing, with a unique perspective.

Keywords: Virtual Communities of Practice, Digitized Assessment, Item Response Theory, Professional Licensure

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INTRODUCTION

Maintaining a high quality of education underpins the building of a successful nation and measuring quality can be achieved by robust testing procedures. In line with future focused sustainable global goals, developing workforce competency components and bolstering further career professional development, monitoring and testing are important factors that guide success. Through recent decades, the face of testing has undergone changes. Measuring achievement in education is now increasingly being conducted through online assessments, administered and managed through the medium of computational technologies using electronic devices and the internet.

The United Arab Emirates' Centennial 2071 national vision (UAE, 2023) sets out aims towards achieving the best for its country through its future focused government objectives. Guided by cutting edge international research in educational assessments and digitization as technologies continue to move further forward into the web 3 era (Wan et al, 2023), there is a dedicated directorate in the UAE Ministry of Education responsible for the design, administration and evaluation of national and international tests set for different educational populations in the UAE. A diverse range of national tests are administered, some geared towards school learners known as the Emirates Standardized Test (EmSAT), a series of low stakes and high stakes tests which are designed to chart the progress of students through their school years and measure their college readiness for entry into the tertiary system of education. Other tests, known as Teacher Licensing Systems (TLS) specialization tests are developed and well-grounded on principles and empirical evidence in psychometric assessment practices and procedures. They are high stakes tests geared towards validating education professionals who are tasked with facilitating student progress within the nation. These tests cover domains of subject matter content in relation to candidates chosen teaching specialism. Irrespective of the educational discipline or position, whether it is for teachers, school leaders, or other school staff such as counsellors, special needs coordinators or technicians, the license indicates how UAE-based education professionals are equipped with desired competencies for providing excellence in theoretical and practical knowledge, providing records of the ability to compete globally. Therefore, these TLS high stakes tests which forms part of professional licensing processes within the UAE, are completed by education providers who have successfully completed preceding stages linked to attesting their qualifications and demonstrating proficiency in pedagogical teaching techniques and skills. The paper focuses on outlining evidence-based approaches incorporated in test design development and evaluation, including classical test and item response theory (Lord, 1980; Wright, 1968), virtual professionals learning communities (vPLC) (Hord, 1996) communities of practice (CoP) (Lave and Wenger, 1991) and Schon's (1983) reflective practice framework employed in practice.

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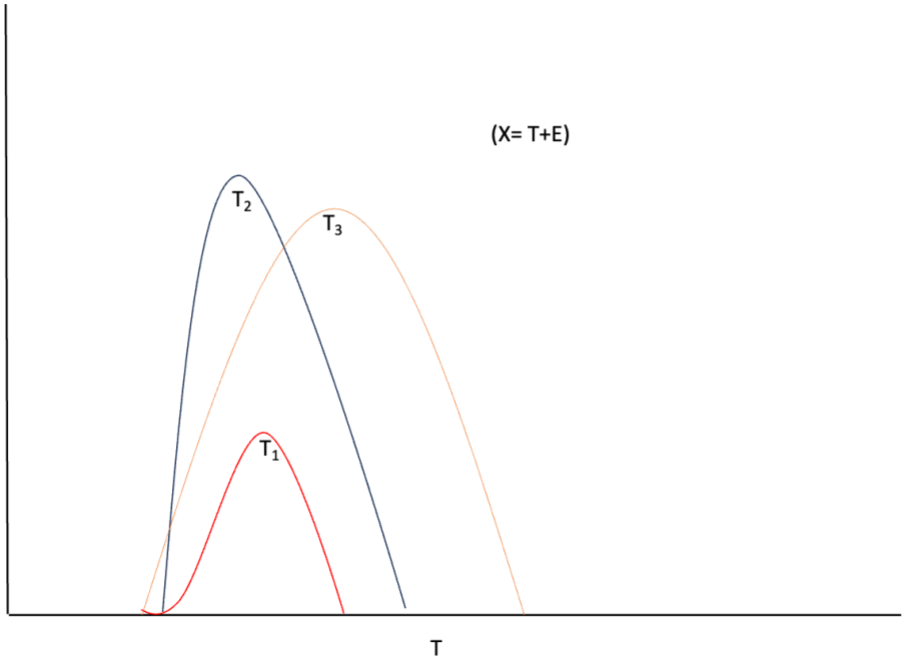
Test Theory Frameworks: Classical Test and Item Response

Classical test theory (CTT) and item response theory (IRT) frameworks are implemented in the design and scoring evaluations of psychometric assessments. CTT scores with a traditional sum-of-points approach whereas IRT scores with a latent scale approach. They provide a quantitative representation of test item quality and content validity. From the latter half the last century, test theory frameworks have been evolving and through the work of psychometrician and mathematician scholars such as Frederick Lord (1980) and George Rasch (1960), IRT is becoming more firmly fixed as part of the paradigm shift that is

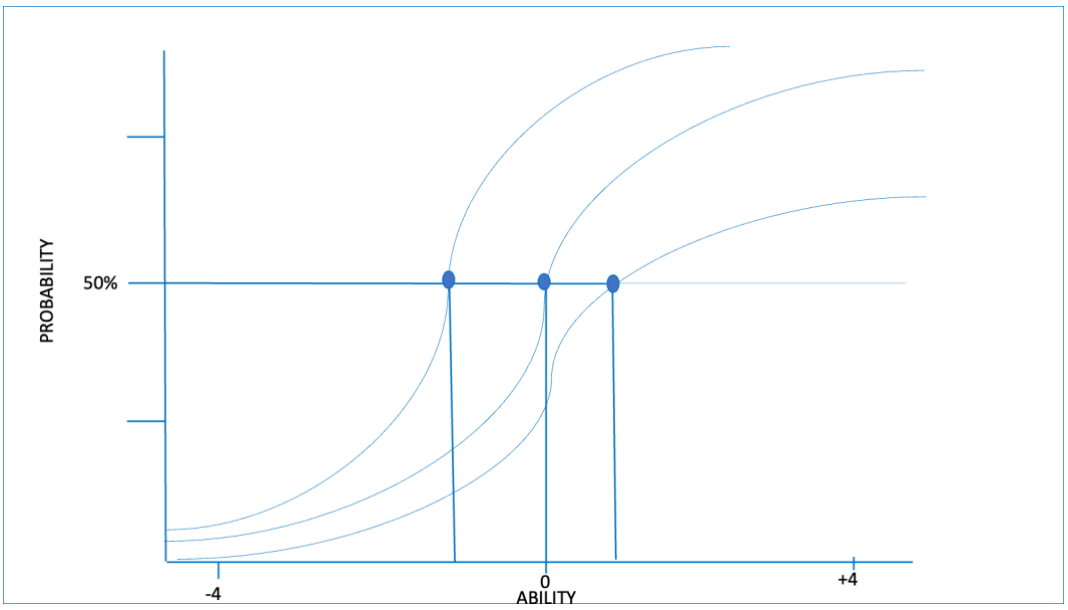
occurring in educational fields. CTT frameworks, which precede IRT frameworks, analyze tests based on a theory of a combination of true scores with an element of error. The error element is estimated using reliability coefficients and is useful when the questions to be administered are of a uniform design, that is, a design that does not consider question difficulty, discrimination, or a guessing factor. This theory carries an assumption of linearity between true score observations and error measurements, meaning that an observed score (X) is regarded as a true score (T) plus some degree of error (E). It also carries an assumption that the errors are normally distributed with a mean score of zero. This is typified in Fig 1:



(Fig 1: Classical Test Theory [X=T+E] assumptions)

It is important to indicate how well a test evaluation considers subject content alongside latent traits such as variation in candidate abilities. Literature denotes CTT as a traditional approach that has limitations when considering latent factors and this has resulted in IRT being more common practice in the development of digitized assessments using theories and techniques known as mathematical Rasch modelling (Linacre, 2002). Rasch modelling involves applying mathematical probability calculations to the evaluations of responses to an item bank of questions administered. The calculations consider candidate performance, measuring candidates' abilities in a personalized manner. Thus, compared to CTT, IRT is a more modern framework that incorporates latent traits. It serves to analyze test items with a statistical prediction applied to responses based on properties related to item difficulty and candidate ability. The predictions involve probability based mathematical calculations and algorithms that consider candidate ability and the likelihood of them achieving the correct answer based on the difficulty of the question. Probability estimates are comprised of three parameters, one measuring student's ability, one measuring item difficulty and a third measure indicating its discriminatory feature. Involving processes of machine learning from human behavior to improve problem solving, saving time, and reducing analytical efforts, it is now used in educational test design and making predictions of individual capacity. IRT theory has added to classical test theory, incorporating mathematical models to improve the testing process (Weiss and Kingsbury, 1984). It incorporates both accuracy and fairness because it incorporates the difficulties of test items alongside examinees abilities (de Ayala,

2009) thus providing an analysis of the relationship between test item characteristics, candidate ability and their test scores. Whilst IRT is a modern approach, it is important to note that test frameworks are chosen respectively to achieve set objectives in test design. Therefore classical test theory can still be an appropriate framework if say, tests are of the same difficulty. This is not the case for digitized assessments administered to educational professionals in the UAE. The primary testing theory used for these TLS assessments is the Rasch one-parameter logistical model (Rasch, 1960) which follows dichotomous scoring. A detailed treatise on how mathematical analysis is applied in scoring of test items will not be given in this paper, however as an overall summary, key indications of test items are given on item characteristic sigmoidal (S) curves (Figure 2), which indicate the degree/percentage of probability between observations of how a candidate performs against expectations of how a candidate should perform. Each item has characteristic curves based on their item difficulty. A nominal reference of ability (0) is assigned to an item relative to their difficulty that indicates a 50% probability of success with infinitesimal indications left or right of that reference.



(Fig 2: Item Response Theory characteristic curves)

With a critical limitation of IRT being that replication of psychometric estimates is dependent on sufficient sample sizes, items must be developed within an item bank and through iterative test administrations and evaluations, they are scored with a consideration of both the candidate ability and item difficulty with an assigned mathematical probability based on modelling and statistical functions. Fundamentally, it involves an odds ratio of probability representation – or a logarithmic function 'logit' representation. Using a logit function to represent relationships, IRT carries practical advantage in that the computation involved provides a powerful context to draw robust inferences.

Test items are developed by subject matter experts and become populated in an item bank. An item bank is a composition of carefully designed questions that develop, define, and quantify a common key indicator or theme, thus providing a variable that can be measured (Wright and Bell, 1984).

As opposed to an item considered on its own, an item bank houses an ever-expanding population of questions that undergo a series of calibrations following test administrations and has associated psychometric features in relation to its design quality. The quality and calibration of test items are informed and guided by scoring and evaluations from successive administrations. The performance of test items is measured and continually represented through the infinitesimal growth of the S-curve generated by mathematical probability calculations. Candidates that sit the test of a certain ability will achieve a specific score on a test item.

Educational assessments designed by global organizations around the world, driven by market forces, have gradually shifted from paper based to online assessments. In tandem with this, there have also been developments towards incorporating computational psychometrics with semantic technologies, artificial intelligence and machine learning applications. With advances in computational power over the last decade, storage with rapidly increasing volumes of data and greater efficiencies in sharing of virtual information, there are now assessment system software companies that specialize in aligning the theory and mathematical application of IRT digitized assessments. The UAE MOE uses the item calibration software Winsteps ® (Linacre, 2023) to evaluate and inform assessment cycles accordingly. In accordance with an increasing prevalence of item response theory test designs, well established software companies continue to develop platforms that provide testing specialists with viable options to include artificial intelligence (AI) methodology in their assessment development. As a result, this facilitates greater efficiencies for the UAE Ministry of Education directorate to lead in combining technology advancements, big data management, and algorithmic computational analysis as they develop national and international assessments.

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Virtual PLC/CoP Committees Incorporating Reflective Practice and Complementing AI Guided Test Development

With a population comprised of over 200 different nationalities from all over the world living and working alongside national citizens across the seven emirate regions in the UAE, it is a leading country that is recognized for its innovational growth, and an established region of the world that attracts international teaching professionals to work in public and private sector educational organizations. Variation in licensure processes to certify teachers exists across the world and this requires detailed understanding as professionals come from a diverse range of countries. Added to this, there are key UAE policy directives which encompass high standards and appreciations of unified cultural values across each emirate that should be exemplified in relevant areas when considering testing design. To represent this unique breadth of considerations, building future focused knowledge-based professional learning communities of practice is a central pillar in iterative project management procedures for test cycle development stages. Ipsative assessments are carried out in recurring cycles to inform item bank development with both quantitative evaluations and a subject matter expert's reflective and qualitative input. These high-quality learning spheres and professional communities convene with a hybrid approach, engaging in discourse through both in-person and virtual settings to support the burgeoning of digitization in the country across varying sectors. This is guided by framework models of professional learning communities postulated by Hord (1996) communities of practice developed by Lave and Wenger (1991) reflection models such as that developed by Donald Schon (1983).

Virtually mediated communication tools which facilitate professional learning communities of practice have grown in popularity through the Web 2 era (DiNucci, 1999) and are now commonplace in educational settings. There are various platforms centered around digital technologies and software applications which facilitate critical discourse have been implemented such as, videoconferencing, online blogs, discussion boards and social media messaging applications (Carlen and Jobring, 2005; Duncan-Howell, 2010; Williams, 2018). Learning management platform systems such as Microsoft Teams ® and environment hubs like Google Meet ® used to house virtual learning communities over recent years has become vital and can meet the multifactorial needs in enabling cyber secure big data capture and management by public and private sector organizations. Understandably, the implementation of virtual PLC's (vPLC) using these online settings have been popularized due to their suitability in facilitating smarter ways of working.

Cognitive anthropologist Jean Lave, and educational theorist Etienne Wenger are seminal pioneers of Communities of Practice (CoP) a framework model to maximize purposeful collaboration and problem solving (Lave and Wenger, 1991). Additionally professional learning community models postulated by Hord (1996), places reflective dialogue as a central focus with success being achieved through its typified framework characteristics shown in Figure 3. These characteristics underpin committee member focused actions. With collective enquiry, committee members engage in vPLC environments with a concerted focus on making continuous improvements as they work through reviewing and preparing test item content using reflective practices. Practical approaches to aid reflective practice can vary in dialogical communication modes using visual, audio, and written formats. Virtual spaces that capture information in real time, encourages communicative engagement, creative participation and deep situated learning (Selwyn, 2016). From an educational perspective, considering the construct representation of pedagogy, subject specialist domain areas and statistical data elements in test item development, reflective practice aids the quality of expertise shared.

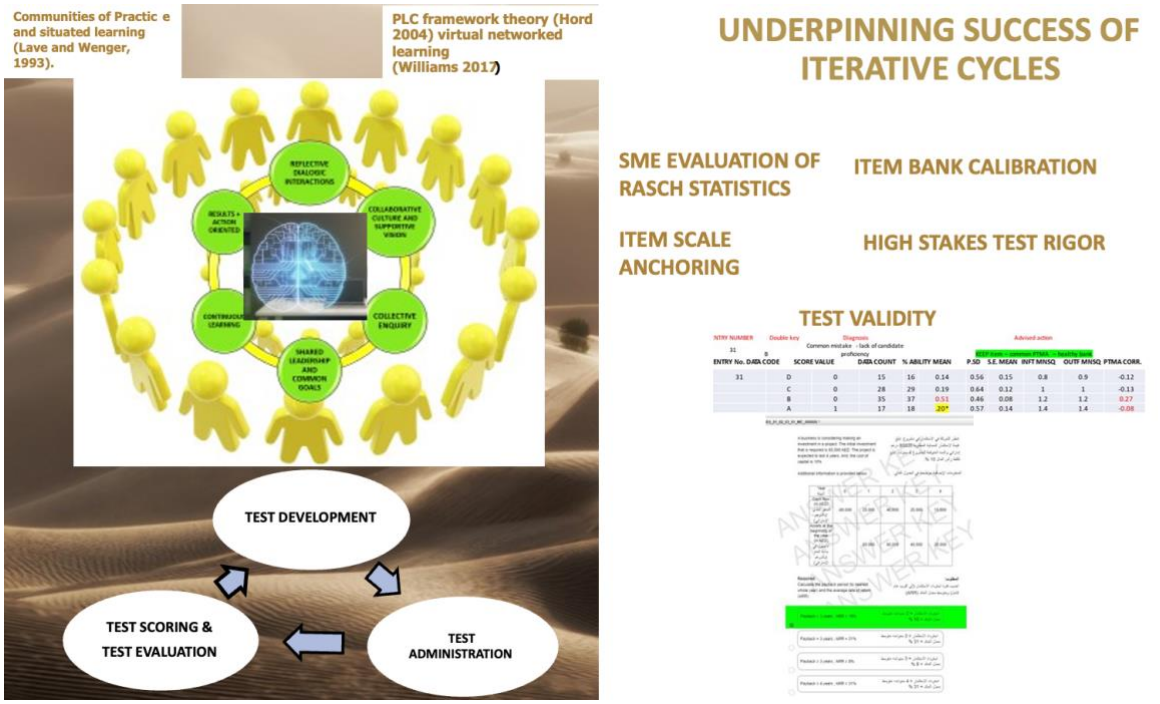
(Fig 3: Key characteristics of a professional learning community)

In line with international standards in test development (APA, 2000), TLS digitized assessments are developed from an internationally benched framework which details subject specific standards, grounded by a critical review from a range of continents such as the Gulf region, USA, UK, Europe and Australia. Test frameworks are developed and reviewed by expert stakeholders from a range of national and international organizations which make up the professional learning community before being ratified. Experts are comprised of educational and industrial professionals from the all over the world involved in curriculum development, governmental policy, higher education and subject content based career fields. There is also concerted focus on aligning test item development with international strategies, related specific subject matter areas and remaining in accordance with laws and practices relevant to the UAE constitutional decrees. Frameworks developed for each specialization test provide comprehensive detail on testing domain areas, providing rationale for topic inclusion, item difficulty, complexity and scaffolded competencies. Guided manuals for candidates are also developed and reviewed by committee members which lay out the test scope and indications of how tests will be administered. A selection of test items is given which provide information on the question format. vPLC committee members are then dedicated to the wide development of customized questions which are populated within a computer-based test item bank. This item bank contains a range of questions that are prepared by subject matter experts in domain areas, reviewed both internally within the directorate and externally by experts from around the world. Each item is also carefully designed to enable clear duality in languages English and Arabic – this is unique.

The vPLC settings complement the iterative nature of project management involved in digitized assessment development, it is a vital resource to facilitate situated learning amongst committee members. Clear records of communication can be shared to all, real time patterns and responses to situations are readily available and then used to highlight areas for committee members to be aware of when considering inherent criticalities, thoughts and actions which guides their semantic development of item constructions and reviews. Whilst the subject matter is evidence based and grounded through international benchmarked frameworks, it is important to consider test rigor and validations for these high-stakes examinations. Factors to address include justifying concepts around the semantics employed in the test construct, the plausibility and quality of test item distractors and associated translation concerns with the dual language nature of the test item development being in both Arabic and English. The quantitative data collected for test items can be analyzed in depth with bespoke vPLC members taking into consideration their subject matter and industry expertise with an underpinning critical eye to ensure cultural and national visions and practices are upheld.

Discussing quantitative statistical parameters which provides an indication of test quality can be analyzed in multimodal fashion, and then corroborated or disputed when liaising with subject matter experts and the international review committee members relevant to each subject. Through a systematic review of quantitative psychometric data with a subject matter expert analysis of test item quality, certain items are deemed to be exemplars and serve as referenced material to improve and further guide the validity and accuracy of the tests as their growth and development continues in successive cycles. In concordance with CoP and PLC framework models, an authentic voice from members can be captured through both observed interactions and vPLC discourse guides test item formations from a shared ‘reflection-in-action’ problem solving perspective. By gathering information from focus group discussions and individual committee member responses, interactions and reflexive interpretations, qualitative data collected can then be re-referred to with a deeper reflection-on-action model

approach (Schon, 1981) at later stages of the iterative cycle. This is notably advantageous to facilitate the steering of the community by content developers, psychometricians and project managers when making evaluative decisions about quantitative statistical data pertaining to item calibrations. Through dedicated analysis of quantitative statistical information alongside qualitative rich discussions taking place in the growth of item bank populations, it can therefore be surmised that this fresh and unique approach creates a human centered subject matter expert (SME) 'prompt engineer' styled outlook using artificially intelligent data to drive developments in bolstering content creation and validity of digitized assessments. Thus, offering a unique perspective on how a global vPLC contributes an innovative approach towards digitized assessment development for UAE international education professionals.



(Fig 4: Successive iterative cycle stages of UAE Digitised TLS Specialized assessment)

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Further Research Considerations

As typified in figure 3, over the course of each stage of successive iterative cycles, test items are calibrated accordingly to serve as exemplars, or anchors in the mathematical model evaluations of further test cycles and informing committee member item writers and reviewers. Regular discussions are held with vPLC committee members to discuss test item quality based on the statistical results given, and there are times that items may then have to be redeveloped, removed or identified accordingly based on qualitative and quantitative analysis. Incorporating national and international specialists who are experts in their academic and industrial fields, project managers within the directorate steer this powerful brain center for the purposes of growing the item bank accordingly with calibrated and well anchored items. Whilst procedures such as standard setting and scale anchoring of items is incorporated into connecting test content evaluations to scored interpretations, further development is being incorporated to consider differential factors that affect analysis in relation to the candidates. (Cowan et al, 2020). As with the nature of teacher licensure assessments, variations in sample size of candidates, their performance rating and their experiential levels are areas to consider for further research.

The fast-paced developments occurring within the web 3 era create challenges. Whilst there are benefits to keeping abreast of latest technological trends, there are controversies surrounding the ethical sustainability of areas such as generative artificial intelligence and associated machine learning that seem to be developing an overarching presence in the world today. Therefore, it goes without saying that moving towards a digitized system of assessment carries with it associated concerns with cybersecurity. Areas related to securing browsers, embedding remote proctoring, encrypting data, authentication of Ips and integrating AI based deep learning strategies are most certainly considerations that further research can be centered on.

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Conclusion

This paper has provided conceptual critique revealing how digitized assessments are conducted for educational professionals working in the gulf region. It has provided insight on evidence based literature and frameworks which underpin assessment design and administration of specialized digital assessment for international education professionals working in the Gulf region A treatise of classical testing theory and item response testing theories was given, with contemporary considerations on virtual networked learning communities and reflective practice frameworks. The paper has uncovered a novel way to use these frameworks to capture subject matter experts' contributions in an open, transparent way and through a shared AI driven critical lens; inform, engineer and bolster test design procedures. This creates further ideas towards strategies that can be implemented incorporating human expertise, varying depths of and situated learning within a global community of academic experts to facilitate the building of content validity and test design mastery over consistent and iterative cycle stages when preparing digitized tests for education professionals.

The UAE Ministry of Education is embedding the digitization of their assessments into their testing strategies and division developments. This is to ensure the country is ready for the future in line with their Centennial 2071 vision. They want their residents, citizens and those that are tasked with the responsibility of delivering excellent education to their society to be adaptable, flexible and future focused. As market forces continue to drive web-based technologies, new ways of working, designing, and developing the quality of measuring education performance across the sector with an aspirational and pro-active perspective is being adopted by UAE project managers, content specialists and psychometricians within the national testing directorate. Conscious processes such as these which enable the capture and analysis of quantitative and qualitative big data, bolsters the validity, accuracy and rigor of these high stakes digitized assessments. Therefore, laying a concrete foundation for further technologic developments involving machine learning techniques and generative AI technologies.

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An Investigation of University Students' English-Speaking Problems and Needs

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Abstract
International trends, compounded with the effect of globalization, have made English communication skills become much more crucial for university students. Of the four aspects of English skills, namely listening, speaking, reading, and writing, speaking instructions have not been adequately provided to university students in Taiwan. Nonetheless, there is a national educational goal that university students should be able to speak adequate English outside of school and in the workplace after they graduate. The purpose of the study was to investigate English-speaking problems and needs experienced by university students. The target population for this study was students at a selected university in northern Taiwan. This study employed a qualitative approach. Specifically, students were interviewed to gather useful information regarding their English-speaking problems and learning needs. Results of the investigation pinpointed problems associated with the current instructional delivery and design of English-speaking courses. In addition, students' specific learning needs were identified. Appropriate teaching strategies were suggested to improve instructors' teaching effectiveness. Comparisons with other universities in Asia were made to explore cross-cultural differences. With the aim of helping instructors of speaking courses to achieve maximum improvement, practical recommendations were offered for instructors to modify their pedagogical designs and deliveries to address the problems and needs of students.

Keywords: English Speaking, EFL (English as a Foreign Language) Teaching, English Learning, Course Design, Learning Problems

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Introduction

The internationalization of higher education has made it even more significant to have a solid command of English. As the global importance of English and its proportion of non-native speakers have continued to increase, higher education in Taiwan has prioritized university students' English proficiency levels. Certainly, it is becoming increasingly essential for Taiwanese university students to possess adequate English skills in order to carry out effective international communication.

The National Development Council outlined new policies to enhance Taiwan's proficiency in the English language and improve the country's overall national competitiveness. The initial goal was to develop Taiwan into a bilingual nation by 2030. The Ministry of Education in (MOE) Taiwan has been actively promoting Taiwan's bilingual policies (Ministry of Education, 2022). The policies aim to accelerate the integration of bilingual education, the expansion of English language proficiency testing, and the improvement of civil servants' English proficiency. Nevertheless, simply achieving adequate scores on standardized English proficiency tests does not always lead to the acquisition of practical English skills. English benchmark policy for graduation in Taiwan's higher Education places perhaps an even stronger emphasis on standardized test scores. Although there is a social consensus about the implementation of the graduation benchmark for English in Taiwan's higher education, but the policy has not achieved the MOE's goals to raise college students' overall English proficiency. For many students, these tests induced fear, pressure, anxiety, and frustration. The policy did not bring about any meaningful changes in the educational settings as intended. Nonetheless, the MOE seems keen on continuously encouraging universities to set their graduation thresholds using standardized English proficiency tests. Students' passing rates would also continue to be one of the indicators for college evaluation (Chu & Yeh, 2017). It has been suggested that the English graduation requirements might have to be modified in the subsequent policies for more meaningful and practical results. Furthermore, it is worth noting that the policies also aim to increase international interaction and boost the development of multicultural education. Thus, changes in the English education system in Taiwan need to be made to catch up with global trends.

An important shift from general English to practical English is taking place. Of the four aspects of English skills, namely listening, reading, writing, and speaking, instructions in the area of speaking have not been provided to Taiwanese university students sufficiently. In short, speaking skills is the most deficient aspect of Taiwanese university students' overall English competency. In reality, however, students need to enhance their English-speaking skills continuously to engage in effective international communication (Nickerson, Gerritsen, & Meurs, 2005).

International trends, compounded with the effect of globalization, have made English communication skills become much more crucial for university students. There is a national educational goal in Taiwan that university students should be able to speak adequate English outside of school and in the workplace after they graduate. In Taiwanese higher education, the expansion of English language proficiency testing has been widely implemented. Nevertheless, simply achieving satisfactory scores on English standardized tests is no longer adequate for students in the 21st century. Of the four facets of English skills, namely reading, listening, writing, and speaking, instructions in speaking have not been adequately provided to Taiwanese university students. Speaking skills is still one of the most underdeveloped aspects of Taiwanese university students' English competency. English speaking is a

challenging learning objective for EFL (English as Foreign Language) learners owing to the lack of practicing environments (Chen & Hwang, 2022). This still holds true in the Taiwanese EFL context.

Considering the importance of effective international communication, the English-speaking curriculum should be carefully examined and formulated strategically. There have been some implications for developing English-speaking curriculum. First, the curriculum of speaking should be well-designed. Second, lecturers should design English-speaking curricula integrated by technology and social media that makes students enriched with culture, knowledge, and experience from around the world. Third, lecturers should facilitate their English-speaking curriculum with the English-speaking community so that the students will have more chances to speak English inside and outside the class (Wahyuningsih & Afandi, 2020).

Taking the inevitable trend of globalized education into careful consideration, adequate English-speaking skills are becoming significantly more critical for Taiwanese university students to partake in international exchanges. Ensuring the quality of English instructions provided to students to develop adequate English speaking is not just beneficial for their studies, but also raises students' overall employability and competitive edge in the international job market. This is especially important during a time that cross-cultural communication is more frequent and wider in range than at any time in the past. The purpose of the study was to investigate English-speaking problems and needs experienced by Taiwanese university students.

Methodology

This section presents the research methods employed in the study. The selection of the target population and participants are introduced in the following paragraphs. Data collection and data analysis procedures are also explained in this section.

The target population of this study was the students at a selected university in the northern part of Taiwan. Three English-speaking classes with a total of 63 students took part in this study during the Spring semester of 2023. The 63 students were from 16 different academic programs. Seventeen groups of three to five students were interviewed to collect data for the study.

A qualitative approach was utilized to conduct the study. In qualitative research, the researcher serves as the instrument for data collection (Creswell, 1994). The instruments used included interview questions about students' English-speaking problems and needs. Additionally, the interviews were designed to acquire useful information regarding students' perceptions of the quality of English-speaking instruction.

Six interview questions in total were designed by the researcher. The questions concerned the students' problems associated with the English learning environment, appropriateness of English classes for speaking skills, causes of low-level English-speaking skills, perceived difficulties associated with English speaking, specific needs in the area of English-speaking instruction, and proposed solutions. In an effort to assure the quality of the interview questions, two EFL researchers with experience in conducting qualitative studies were asked to assess the validity and reliability of the contents. Minor changes in the wording were made

based on the feedback from the two researchers. The interviews used the six prearranged questions.

The interviews were conducted at the beginning of March 2023. Each group interview, completed entirely in English, lasted about 25 to 30 minutes. In the case that the participating students' responses were not sufficiently clear, follow-up questions were asked to seek further information.

Results

Group interviews were conducted to collect data from the participants. This section summarizes students' interview responses.

Question 1: What problems can you identify with the English learning environment, especially concerning English-speaking instruction, at your university?

Due to various cultural behavioral reasons, students are not active in speaking activities. This was expressed by a surprising number of students. The word "shy" was brought up many times when students responded to this question.

Courses that supposedly should be taught using EMI (English as a Medium of Instruction) are not really carried out entirely in English. Despite the course description given by the academic unit and the instructor, many courses do not completely adhere to the all-English policy. This is especially evident in courses taught by instructors that are not adequately fluent in English.

Domestic students have little opportunity to interact with international students. Despite the increasing number of foreign students on the campus of the selected university, students felt that actual interactions with their international counterparts are infrequent. This is considered a waste of opportunity for students to engage in meaningful communication.

Students in speaking classes possess varying levels of speaking proficiency. Although this is a common problem for foreign language classes, its negative effect is even more apparent in speaking classes. Activities could be dominated by certain students' monologues or diminished by other students' inactivity.

Question 2: How appropriate and adequate are the general English courses for speaking skills at your university?

The great majority of students stated that the general English courses are not adequate in preparing them for effective oral communication. Traditional English classes in Taiwan have emphasized test scores for decades. Instructions on reading and listening take up the great majority of class time. For students to pass graduation threshold exams, which encompass reading and listening, most instructors still emphasize reading and listening over speaking. Speaking, among the four skills, is still largely neglected. Therefore, these classes are considered neither appropriate nor adequate for students to improve their speaking skills.

Class size is generally too big for speaking activities to be effective. Most students feel that 20 students or more are too many for a speaking class. They pointed out that they receive less

individual attention and feedback from the instructors. Moreover, they feel that their opportunity to practice public speaking is proportionally less when the class size is larger.

There is an awkwardness in communicating with other classmates in English once they know each other. This is typically not a problem at the beginning of the semester when the students are not familiar with each other. However, they begin to feel awkward using a foreign language to communicate with each other after several weeks.

Question 3: What do you think are the reasons for Taiwanese students' low English-speaking skills?

Cultural factors including ranking, hierarchy, and prestige influence educational policies. University ranking is taken very seriously by administrators in Taiwanese higher education. A part of this ranking is determined by students' scores on standardized tests. As a result, a stronger emphasis is placed on training students to achieve higher test scores and pass certain exams. In the subject of English, this would mean further enhancing students' reading and listening comprehension skills.

Mistakes and the prospect of "losing face" prevent students from speaking up. Students feel that making mistakes in the presence of other classmates is rather discomforting. This concern hinders their desire to speak more during class time.

Students have traditionally been instructed to "listen first" in a teacher-centered learning environment. This is especially true in K-12 education in Taiwan. Once they get into postsecondary education, they are then expected to think critically and speak their mind. This—along with the fact that English is a much more direct language than Chinese—makes it very difficult for certain students to adapt in a short time.

Students also pointed out that the focus of English education has largely been on grammar and vocabulary acquisition. Actual communication skills have never been truly taught. Although the goal of communication is often mentioned, it is not reflected in how English is taught in Taiwan.

At the current time, the education system generally favors test scores over real-life applications. Test scores can immediately show students' proficiency levels. However, real-life communication skills are much harder to measure and quantify in order to show results.

Question 4: What are your main problems with speaking English?

Students feel compelled to overcome their accents. Despite the majority of English speakers in the world speaking the language with an accent, there is an over-glorification of having perfect English pronunciation in Taiwan. This can be seen as an underlying factor that impedes students' confidence and willingness to speak up.

As previously mentioned, an overwhelming number of students reported feeling afraid of making mistakes or embarrassing themselves when speaking English. Students are not willing to speak up until they feel confident that their response is free of mistakes. They also believe that the lack of sufficient practice leads to their low levels of confidence.

On a different note, a small number of students reported having to translate between Chinese and English when speaking. This is not an uncommon phenomenon among foreign language learners. Moreover, several students reported limited vocabulary as a problem that makes their speaking disfluent.

Question 5: What specific needs do you have in the area of English-speaking instruction?

Fluency is found to be a common goal for most students. Even though most students identified speaking accuracy to be more important than fluency, they indicate a stronger desire to speak more fluently. Surprisingly, students simply demand more opportunities to improve their speaking skills. Students feel that the previous English education they received did not provide ample opportunities for speaking practice. This is a somewhat reasonable claim considering the academic culture in Taiwan.

Students expressed the desire for a stress-free learning environment conducive to developing English-speaking skills. This echoes their fear of making mistakes in front of classmates. It also highlights once again the cultural factors mentioned earlier.

In addition to conversation skills, which are the primary content of most speaking classes, students expressed the need for more specific instructions. Specifically, students pointed out that public speaking, presentation, and negotiation skills should be taught in English-speaking classes. They believe these specific skills are of benefit for their career in the future.

Question 6: What are the solutions and suggestions that can improve the current situation to enhance the English-speaking skills of students at your university?

Students suggested that speaking instructors should actively coach them and motivate them to speak well. They pointed out that instructors should also take on the role of a coach. They expressed that in addition to providing instructions, instructors should constantly give feedback to better students' speaking performance.

For speaking courses, students should be placed in different classes based on their speaking proficiency rather than standardized test results, which are largely based on reading and listening skills. This could ensure that in-class communication and instructions are appropriately suited for students' actual speaking proficiency.

Classes should be more interaction-based, learner-centered, and outcome-oriented. English courses should strive to equip students with actual communication skills. More English-speaking classes should be offered to non-English major students. This is especially emphasized by students from non-English programs as they found the number of courses offered to them to be extremely scarce.

Discussion

Learning problems identified by the students themselves could be of benefit to instructors. This also holds true in the EFL context. A relatively similar study was conducted in Indonesia to investigate English-speaking problems found by the students and explored some implications for speaking curriculum development (Wahyuningsih & Afandi, 2020). That study also utilized a descriptive qualitative approach and part of the data was taken from semi-structured interviews. The findings revealed that the problems encountered by the

students in speaking English cover the lack of appropriate vocabulary, the lack of grammar mastery, the lack of correct pronunciation, the lack of input of English outside the class, the lack of confidence, and the lack of English-speaking curriculum development. Except for grammar mastery, the other findings are noticeably similar to the present study. It is interesting to note that students from Indonesia and Taiwan share similar problems in English speaking.

Sung (2009) conducted a survey study to identify attractive quality attributes of English language teaching at an Indonesian university and a Taiwanese university. Students from the two universities from two different East Asian countries showed different preferences in English language instruction. Despite the different learning presences, however, students in the aforementioned studies revealed similar learning problems in terms of English speaking.

Another quantitative study that made use of students' questionnaires revealed Saudi EFL learners' speaking challenges (Al-Hassaani & Al-Saalmi, 2022). The study also contributed to finding solutions to the challenges the Saudi EFL learners encounter in their English-speaking skills. The study concluded that Saudi EFL learners need enough time to practice English-speaking skills in the classroom. They also revealed that should speak English outside the classroom as well. These motivations are not different from that of the Taiwanese students in the present study. Similarly, the Saudi students also revealed that the syllabus and teaching materials of the English-speaking skills courses need development to match the needs of the learners in their daily lives and to meet the demands of the labor market. These once again match the needs expressed by the Taiwanese students in the present study.

A very recent study on the topic of English speaking was conducted in another Southeast Asian country, Thailand (Sukrutrit, 2023). The study investigated students' perceptions of speaking English in front of the class versus speaking English via self-recorded videos posted on a private Facebook group. The study revealed that very similar to their Taiwanese counterparts, most Thai students are shy and have less confidence in speaking English. It was also revealed that most Thai students prefer speaking English via self-recorded videos posted on the private Facebook group as opposed to speaking English in front of the class. Surprisingly, this finding is different compared with another study by Sung (2022) that Taiwanese students showed a noticeable preference for direct interactions with their classmates than using a chat-based communication platform. For perspectives, another study revealed that the English exit examinations policy and practice in Thailand might raise awareness of the importance of English and motivate Thai students to improve their ability, but it is not likely to guarantee expected English proficiency levels (Wudthayagorn, 2022). As discussed earlier, the situation is not dissimilar in Taiwan.

Some instructors may not have been sufficiently trained to teach speaking effectively. An interesting revelation points out international students' contrasting desire to carry out communication with domestic students using Mandarin. Foreign instructors should recognize cultural differences while engaging students in speaking activities. Although not an aim of the present investigation, many instructors were found to be lacking the necessary pedagogical and language skills of teaching professional courses using EMI. Despite this, a study conducted in China found that non-native English-speaking instructors could communicate with students about their learning difficulties better. Their instruction was considered more intelligible but rather teacher-dominated (Qiu & Fang, 2022). This sheds light on the

advantages of non-native English-speaking instructors' advantages as long as they possess satisfactory speaking competence.

Conclusion

In Taiwanese higher education, speaking, among the four skills of English proficiency, is still the most neglected skill despite the well-promoted benefits of international communication competence. Despite all established and well-recognized goals of practical English education, real-life applications of English skills are an ideal but not a reality at present. Traditional educational goals, compounded with cultural attitudes, influence students' performance in English speaking. Taiwanese university students' mindset and confidence level influence their willingness and ability to perform in English speaking tasks. The current English curriculum in Taiwan's higher education needs adjustments in its practical focus and instructional approach.

A considerable portion of class time in general English classes should be devoted to speaking practice. English-speaking classes should be divided based on students' speaking competency rather than standardized test scores on reading and listening. Instructors today need to further shift away from teaching test-oriented content to teaching practical communication skills. Lastly, universities should strategically utilize the presence of international students to help facilitate students' language exchange.

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Exploring the Efficacy of Context-Based Instructional Strategy in Fostering Students' Achievement in Chemistry in Agbani Education Zone, Enugu State Nigeria

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Abstract
The study investigated the effect of Context-Based Instructional Strategy (CBIS) on students' achievement in chemistry. CBIS was used as experimental group and Expository Instructional Strategy (EIS) as control group, sources showed that students' poor achievement in chemistry is from teaching strategy adopted by the chemistry teachers. Two research questions were answered and two null hypotheses were formulated and tested. This strategy recognizes the need for student-centered, relevance of tasks and students' voice; it also helps students develop creative and critical learning skills. A quasi-experimental (Non-equivalent, pretest, posttest control group) design was adopted for the study. The population for the study comprised all senior secondary class one (SSI) students who were offering chemistry in co-education schools in Agbani Education zone. The instrument for data collection was a self-developed Basic Chemistry Achievement Test (BCAT). Relevant data were collected from a sample of SSI chemistry students using purposive random sampling techniques from two co-education schools in Agbani Education Zone of Enugu State, Nigeria. A reliability co-efficient of 0.85 was obtained for the instrument using Kuder-Richardson formula20. Mean and standard deviation scores were used to answer the research questions while two way analysis of covariance (ANCOVA) was used to test the hypotheses. The findings showed that the experimental group taught with Context-Based Instructional Strategy (CBIS) obtained a higher mean achievement score than the control group in the post BCAT; male students had higher mean achievement scores than their female counterparts. The difference was significant. It was recommended, among others, that CBIS should be given more emphasis.

Keywords: Context-Based Instructional Strategy, Expository Strategy, Student-Centered

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Introduction

Science is taught in Nigerian junior secondary schools as Basic science. However, at the senior secondary levels, science is taught in compartmentalized disciplines as chemistry, physics and Biology. All these branches of science have their individual contributions to the technological advancement of any nation. One of such disciplines is chemistry. Chemistry is a branch of science that deals with the composition, properties and reaction of matter in its different forms. Aniodoh (2002). It is an important aspect of science, since it provides mankind with knowledge, skills, principles and facts that find application in virtually all aspects of human endeavors. Mastery of it facilitates candidates' chance of enrollment in many professional courses. Such professions are teaching, agriculture, engineering, medicine, pharmacy, nursing, among others. In teaching, chemistry teachers transmit knowledge of chemical concepts and principles from one generation to another. Among the candidates who sat for the chemistry examination only 21.39% scored credit 22.25% had pass while 52.8% failed. So a total of 74.53% could not use their result for further studies.

Students' poor achievement in Chemistry has been blamed on poor quality of teaching method (Aniodoh & Egbo 2014). According to Nworgu (1997), traditionalism is a tendency to carry on with old ideas, and old ways of doing things, operating with old systems and frames, and ignoring for too long, waves of change blowing across and over the globe. To reverse rigidity in traditional education, such strategy as Context-based Instructional strategy is used. It recognizes the need for student-centeredness, relevance of tasks and students voice (Walters, 2004). Schwartz (2006) provides us with a metaphor which shows a clear picture of curricular problem to address when developing Context-Based Instructional strategy (CBIS). "Most of us who are scientists have enjoyed climbing this ladder as part of our education. We revel in the lofty view from the top. Unfortunately, many students do not see the connection between the successive rungs. They are not told and do not discover· why and where they are climbing. Before long, they develop vertigo. Often they jump or fall off the ladder before they reach the top. All they take from the experience is distaste from science" (Schwartz, 2006:981).

According to (Schwartz, 2006) while using the traditional framework, the students do not see the real-life connection of what they study, why they should study it or the usefulness of what they study. So they end up with frustration, poor achievement. Students' achievement in senior secondary school certificate examination (SSCE) has not been encouraging. This is equally evidenced from WAEC chief examiner's Report 2015 - 2020; Eze, Egbo and Omeje 2020, Egbo 2014, Ani and Egbo 2015. The West African Examination Council (WAEC) chief examiner's Report (2002: 143) corroborated the fact that student's achievement in chemistry has been consistently poor. According to WAEC chief examiners report, Candidates had difficulties tackling questions dealing with reasoning, deductions/ application of principles and calculations. Their responses indicated shallow knowledge of some topics, like electrochemistry/ IUPAC nomenclature for both organic and inorganic compounds. Expressions, definition and explanations were poor. Other areas of difficulty included: poor numbering/mixing up of number of answers to questions, writing of questions, inability to draw and label energy profile diagrams properly, linking practical experience with theoretical knowledge, use of wrong chemical terms. (WAEC 2015: 143). Eze, Egbo and Omeje (2018) emphasized that: "when science teaching is dull, confusing, trivial and makes limited and sometimes meaningless demands on students' intelligence, capabilities and talents, then learning is bound to be stunted, if it occurs at all. "This calls for a teaching strategy that is more meaningful and leaner-centered.

Context-Based Instructional strategy is a teaching strategy which uses questioning skills and "broad socio-scientific events based on real-life experiences, to expose the students to the context of science phenomena under study. The instruction is enriched with relevant teaching materials or use of informal science experiences (zoos, factories, nature centers). Information is not provided by experts the authority but come from multiple sources. Focus is on finding out the unknown rather than testing established theories. The students on their own part work collaboratively as a team. The strategy is learner-centered, flexible and democratic. It is rooted in Dewey's pragmatic philosophy of progressive education (Williams 2006). The method sustains the learners' interest. The theories learnt in the class go simultaneously with hands-on-activities." Context-based can give meaning and coherence to new knowledge. The learner is enabled to contextualize. There is possible usefulness of the knowledge outside school. It is supposed that students who use context develop wider web of chemical concepts. So, the chemical concepts are weaved together vertically and horizontally to establish interdependent relationship between that is learnt in the kinetic theory and gas laws with their real life applications. The teacher guides the instruction but most times uses students as experts in facilitating the class instruction. Chemistry students' achievement may be enhanced by the use of Context-Based Instructional strategy. So, the treatment may serve as an intervention package.

Gender as a factor in science achievement, has generated the research interest of some science educators worldwide. Williams (2006), in his study to determine the efficacy of Contextual Learning Instructional Package (CLIP) on Learner's Academic Achievement in Biology revealed that no difference existed in the performance of male contextual learners and their female counterparts in an achievement test. He discovered that contextual learning was gender insensitive as there was no significant difference between the mean achievement score of male and female learners in Biology. Ani & Egbo (2015) corroborated this indifference in gender achievement in chemistry. Egbo (2014) observed that male chemistry students achieved slightly better than their female counterparts. Considering all these views, one cannot draw conclusion on the effect of gender on achievement in science. Therefore, there is need to consider gender as a factor in this study. All these forgoing discussions make this study inevitable. Therefore, it becomes necessary to address the effect of Context-Based Instructional Strategy· (CBIS) of teaching chemistry on students' achievement in Agbani Education zone.

Use of Context-Based Instructional Strategy in Teaching Chemistry

The word "context" originates from the Latin language in the verb form "contexere" meaning "to weave together". The noun form "Contextus" means "Coherence", "connection and or, "relationship" (Gilbert 2006). According to Hornby (2006) "context" is the situation in which something happens and that helps you to understand it. Context is created through the use of driving questions based on real world experience and the use of anchoring events, which expose students to the phenomenon under study (Walters 2004). The relevant materials for teaching the subject matter are brought into the class. Context can be created by the use of diagram, model chart, film or map; the context created is the focal event that is put in the spotlight. Context provides a mental surrounding" to which subsequent ideas can be related (Gilbert 2006). Implied, CBIS is a method which uses questioning skill and a broad based socio scientific focal event based on real world experience to expose students to the context of science phenomenon under study. The teacher needs to bring together the students' views of a context and its socially acceptable attributes. As the teacher weaves together the views, interconnected concepts from natural and social science is obvious and web like. Context

facilitates transfer of knowledge from one discipline to another. Concepts are related to their applications. Applications affect the meaning attributed to the concepts. A concept in a science may be changed when it is applied in technology. For instance, in chemistry "pure water" is a single substance not containing other substances and having specific thermodynamic properties. On the other hand, in 'environmental chemistry "pure chemistry" is water that is safe to drink and contains no toxin. Context is formed by the juxta-positioning of concept and application in a students' cognitive structure (Gilbert 2006). The greater the degree of reproducibility in the relationship of concepts and application the more science. Context-Based instructional strategy is based on Dewey's progressivism which advocated for the relationship between a child's experience and interest with application to real-life (Williams 2006). Context-based learning instruction demands that the learner appreciates the real world applications of what is studied in school science learning contexts. Students are more motivated to find out what they find relevant to their lives. For the learner, "context" is a situation defined through interactions in and with the world that are themselves historically situated and culturally idiosyncratic (Walters, 2004). Students actively learn in group .In places that offer learning opportunities such as classroom, laboratory, field, factory or web site. At any time in the learning process, the learner sees the point of what he is doing. Theory and practical activities are combined in a lesson. This is an intervening method in the present study: According to Walters (2004), "The instructional design involves the following four phases:

Meeting phase: Pupils are familiarized with the context.

Curiosity and planning phase: students are encouraged to question; everyday life-referred and specialized chemical aspects are considered; the pupils' questions are collected.

Development phase: Pupils solve aspects of problem and their questions as independently as possible.

Recess and cross linking phase (making connections): Vertical linkages with contents from the preceding instruction; horizontal linkages with concepts generated within the contexts. The information come from multiple sources and are weaved together to form a web of interrelated concepts. So many concepts are connected to the context. This is an intervening method in the present study.

Expository Method

The Expository Method is the most commonly used method of teaching science it is referred to as "positivist", "idealist", "traditional", approach. In method, the relationship between the teacher and the learner is linear (Walters 2004). The teacher is seen as an expert and a reservoir of knowledge while the learner is a novice in the learning process. Learning is seen as the process of adding new concepts to the repertoire of concepts held by the learner in order to arrive at an ever increasing perfect conception of the phenomenon (Mbajiorgu 2003). According to Fusco (2001), it does not give enough room for students to discover new truths, new ideas and techniques of solving life problem. The student’s task is to assimilate with minimal interference to the teaching process, the ideas information being passed on by the teacher. He can ask questions, only to clarify uncertain aspects of the ideas (Mbajiorgu 2003). Students have the tendency to memorize facts and principles, most of which they do not understand but only to regurgitate them during examination. The teacher combines "chalking" and "talking" simultaneously. The teacher does most of the talking. Real life

experiences are not capitalized upon in the learning process. It does not also give opportunity for conceptual understanding and development of process skills.

Purpose of the Study

The study sought to explore the efficacy of Context-Based Instructional strategy on student's achievement in chemistry. Specifically, the study intended to:

1. The effect of Context-Based Instructional strategy CBIS (experimental) on students' achievement in Senior Secondary One (SS1) when taught Kinetic theory and gas laws as measured on Basic chemistry Achievement Test (BCAT);
2. The influences of gender on SSl students' mean achievement scores in Chemistry when taught Kinetic theory and gas laws, using CBIS and Expository method (EM), measured on a Basic Chemistry Achievement Test (BCAT).

Research Questions

The following research questions guided the study:

1. What are the mean achievement scores of SS1 Chemistry students when taught kinetic theory and gas laws using Context-Based Instructional strategy and Expository Method measured by Basic Chemistry Achievement Test (BCAT)?
2. What are the mean achievement of male and female student taught kinetic theory and gas laws using Context-based Instructional strategy and expository Method, as measured by Basic Chemistry Achievement Test (BCAT)?

Hypotheses

The following hypotheses which were tested at 0.05 level of significance were formulated to guide the study:

HO_1: There is no significant difference in the mean achievement scores of SS1 chemistry students when taught kinetic theory and gas laws using Context-Based Instructional strategy and Expository Method as measured by Basic Chemistry Achievement Test.

HO_2: No significance difference exists in the mean achievement scores of male and female SS1 chemistry students when taught kinetic theory and gas laws using Context-Based Instructional strategy and Expository Method as measured by Basic Chemistry Achievement Test.

Methodology

The design for this study is quasi-experimental research design, specifically pretest, posttest, non-equivalent control group design. The design was used because of non-randomization of the subject. The research subjects were not randomized because of problems of re-arrangement or re-grouping of intact classes. The population for the study consisted of all senior secondary class one (SSI) chemistry students in public co-education schools in Agbani Education Zone of Enugu State Nigeria numbering one thousand seven hundred and fifty two students (1752).

The choice of co-education secondary schools was that gender was a factor in the study. Sample of three hundred and twenty (320) chemistry students were used. Random sampling technique was purposive used to select two co-education schools. In each of the sampled schools all the SS1 chemistry students were used as research subjects. One intact class was

assigned to Context-Based Instructional Strategy (CBIS) group while the other intact class was assigned to Expository strategy (EM) group. Basic Chemistry Achievement Test (BCAT) was used as instrument for the study. The instrument consisted of forty (40) multiple choice objective questions developed by the researchers. The choice of SSI students was due to the fact that kinetic theory and gas laws are under SSI chemistry scheme of work as contained in the chemistry curriculum of Federal Ministry of Education.

Procedures

Two instructional methods were used for the study. The context-based instructional strategy (CBIS) and expository method (EM). CBIS was for the experimental group while the EM was for the control group. The regular chemistry teachers were used for the treatment both the pretest and posttest were administered to the experimental and control subjects in the first and fourth week respectively. One hour was allowed for both the pretest and posttest. The question papers and the answers collected from each student in both the experimental and control group. The reason for retrieving question papers was that the same question will be used for the post test. After the treatment, the pretest were reshuffled and printed on a coloured paper to give it a different look, before it was used for the posttest. The subject teachers did the supervision and invigilation. The scores for the two groups were kept separately and used to answer the research questions and test the hypotheses. The treatment was administered for a period of four weeks. The test retest technique was used to determine the reliability co-efficient of the instrument and the reliability co-efficient of 0.85were obtained. Data collected were analyzed using mean and standard deviation specifically mean and standard deviation were used to answer the research questions while analysis of covariance ANCOVA was used to test the hypothesis at 0.05 level of significance.

Result

Research Question One: what are the mean achievement scores of SSI chemistry students when taught kinetic theory and gas laws using Context Based Instructional strategy and expository method measured by Basic Chemistry Achievement Test (BCAT)?

Table 1: The mean and standard deviation scores of SSI chemistry students when taught kinetic theory and gas laws, using Context-Based Instructional strategy and expository method as measured by BCAT.

Method	Statistics	Pretest	Posttest
Experiment	Mean	12.05	20.49
	N	160	160
	SD	7.39	6.65
Control	Mean	10.83	14.75
	N	160	160
	SD	5.76	6.18
Total	Mean	11.44	17.62
	N	320	320
	SD	6.65	7.02

Table one showed the mean scores and standard deviation of SS1 chemistry students taught kinetic theory and gas laws experimental and control groups measured by BCAT. It indicates that the experimental group obtained mean achievement scores of 12.05 and 20.49 respectively in the deviations of 7.39 and 6.65 respectively in the pre-BCAT and the post-

BCAT. On the other hand, control group had mean scores of 10.83 and 14.75 respectively in the pre BCAT and the post-BCAT. The standard deviations for the control group in the pre BCAT. The standard deviations for the control group in the pre BCAT on the post BCAT were 5.76 and 6.18 respectively. The results presented in the table one indicated that the experimental group obtained a higher mean score (20.49) than the control group in the post-BCAT (14.75).

Research Question Two: What are the mean achievement scores of male and female students taught kinetic theory and gas laws using Context Based Instructional strategy and expository method, as measured by Basic Chemistry Achievement Test (BCAT)?

Table 2: The mean and standard deviation score of male and female students when taught kinetic theory and gas laws using context based instructional strategy and expository method measured by (BCAT).

Pretest Posttest Gender

Gender	Statistics	Pretest	Post test
Male	Mean	12.48	18.07
	N	155	155
	SD	6.47	6.83
Female	Mean	10.46	17.19
	N	165	165
	SD	6.68	7.19
Total	Mean	11.44	17.62
	N	320	320
	SD	6.65	7.02

Table 2: Indicated that male students obtained the mean scores of 12.48 and 18.07 in the pre-BCAT and post- BCAT respectively. The male students got standard deviations of 6.47 and 6.83 in the pre- BCAT and post- BCAT respectively. The female students had mean scores of 10.46 and 17.19 in the pre BCAT and post- BCAT respectively. The female students obtained SD of 6.68 and 7.19 in the pre- BCAT and post BCAT respectively. The result presented in the table two indicated the male students had higher mean achievement scores than their female counterparts.(17.19).

Hypotheses

HO_1: There is no significant difference in the mean achievement scores and SS1 chemistry students when taught kinetic theory gas laws using context-based instructional strategy and expository method, as measured by BCAT.

HO_2: No significant difference exits in the mean achievement scores of SS1 male and female chemistry students when taught Kinetic theory and gas laws using Context-Based Instructional strategy and Expository Method, measured by BCAT.

Table 3: Analysis of covariance of students mean achievement scores in BCAT (Instructional Method x Gender).

Dependent Variable: Post-test.

Source	Sum of sq	df	Mean square	F	Sig	Decision
Corr. Model	2997.17	4	749.29	18.53	0.00	NS
Intercept	20651.27	1	20651.27	510.68	0.00	NS
Pretest	204.79	1	204.79	5.06	0.03	NS
Gender	16.31	1	16.31	0.40	0.53	S
Method	2424.67	1	2424.67	59.96	0.00	NS
Gender*Method	135.45	1	135.45	3.35	0.07	S
Error	12738.32	315	40.44			
Total	115070.00	320				
Corr. Total	15735.49	319				

R Squared = .190 (Adjusted R Squared = 180); N5 not significant; S significant

Table 3 showed that the calculated F-value for the effect of Context-Based Instructional strategy on students' achievement (BCAT) was 59.96, significant at 0.05level of significance. This was less than 0.05 level set for the study.

The null hypothesis was therefore accepted. It meant that no significant difference existed in the mean achievement scores of chemistry students taught with Context-Based Instructional strategy and those taught with expositor method.

HO_1: There is no significant difference in the mean achievement scores and SS1 chemistry students when taught kinetic theory and gas laws using context-based instructional strategy and expository method, as measured by BCAT.

HO_2: No significance difference exists in the mean achievement scores of male and female SS1 chemistry students when taught Kinetic theory and gas laws using Context-Based Instructional strategy and Expository Method, measured by Basic Chemistry Achievement Test.

Table 3 showed also that the calculated F-value for the effect of gender on students' achievement in the kinetic theory and gas laws was 0.40 significant 0.53.1evel of significance. It was greater than 0.05 level set for the study null hypothesis was rejected. This meant that there was a significant difference in the mean achievement scores of male and female students in post-Basic Chemistry Achievement Test.

Table 3: analysis of covariance and students mean achievement scores in BCAT (instructional method and gender) dependent variable: posttest.

Discussion

Result on table 1 showed that experimental group obtained a higher mean score than the control group in the post-BCAT. The findings showed that students taught with CBIS achieved better in Basic Chemistry Achievement Test than those exposed to Expository Method. This was in agreement with the findings in William 2006 found in their separate studies that treatment was more effective than the expository method in enhancing students' achievement.

The findings in table two revealed that male students had high mean achievement scores than their female counterparts. The finding is in line with the result of an earlier study by Mbajiorgu (2003) that male students achieved better in sciences than those taught with expository method, male students equally achieved higher than their female counterparts using CBIS.

Conclusion

Chemistry students taught using context based instructional strategy achieved better than those taught with expository method, male students equally achieved higher than their female counterparts.

Recommendations

The following recommendations were made.

(1) The use of CBIS should be given greater emphasis in the curriculum for the pre-service teachers of chemistry and other science subjects.
(2) Curriculum planners should incorporate and emphasize the use of CBIS in the senior secondary school chemistry and other science subjects in general.
(3) Authors of chemistry books should develop books with reflect context-based instructional method with the teacher's guide.

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Hope in Times of Trouble: An Academic Development Perspective of Learning and Teaching During a Crisis

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Abstract
Higher education experienced unprecedented disruption with the arrival of COVID-19. While the pandemic has dissipated to some extent, the lessons learned helps to consider responses to disruptive events in the future. This paper explores the reflections of two academic developers' experiences from two diverse institutions, as they supported academic staff with the transition to remote learning and teaching during the COVID-19 pandemic. Through shared displacement, isolation and reflections on our own learning processes, we identified a pattern that emerged in the way we engaged with teaching staff to assist with the rapid transition to online learning and teaching. Using Schön's reflective model, we consider our actions during this disruptive time as well as the lessons gained. Within the South African context, the pandemic highlighted the hauntings of our unequal past, as our respective institutions ensured that access and success remained centred. While the challenges of rapidly transitioning learning online created a barrier, through our reflections of this experience, we were able to identify the three zones that we transitioned through. In this article we share the three transitionary zones of action, which we refer to as the Three T-zones of trauma, transition and transformation. Each accompanied by phases of learning, unlearning and relearning. We argue that the crises created the opportunity to innovate; to transform and consider new ways of being and doing. We reflect on our role as academic developers and the urgency to be flexible and prepared for continued disruptions and uncertainty in the learning and teaching environment.

Keywords: Academic Development, COVID-19, Pandemic, Displacement, Dispossession, Remote Learning

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Introduction

The COVID-19 pandemic disrupted the traditional landscape of education throughout the world. The mandated closure of higher education institutions led to a sudden shift to remote learning accompanied by the loss of physical connections and resources that had long been central to the educational experience. In South Africa, the sudden closure brought into focus the disparities and inequalities that continued to plague higher education. The pace at which universities could pivot to remote emergency learning and teaching was impacted by institutional, staff and students resource availability and access. In our paper we aim to reflect on our observations of shared feelings of displacement and dispossession we experienced as academic developers along with academic staff and students during this challenging period. We recognise the emotional and psychological impact the pandemic induced and through our reflections attempt to shed light on the various dimensions of this shared experience. Drawing upon personal narratives, personal observations, reflections and relevant literature, our paper examines the various phases through which we transitioned We discuss the challenges and the opportunities faced, the coping mechanisms employed, and the potential long-term effects on the educational approaches at our respective institutions. The paper concludes by highlighting the importance of acknowledging and addressing these shared feelings to foster resilience and support the well-being of academic staff and students in future disruptive events.

Literature Review

The impact of the COVID-19 pandemic on higher education institutions has been well documented as a pivotal moment in time. At the start of the crisis they may have been assumptions about the ease of which classes could transition online. As noted by Le Grange (2020) who draws our attention to the prior use of learner management systems (LMS) in learning and teaching to varying degrees within higher education. The expectation was that, students and academic staff would be familiar with the LMS, whether used as an information sharing platform or as part of a blended learning and teaching approach (Le Grange, 2020). Despite the varying degrees of preparedness, researchers, Taylor, Bearman, Scarparo and Thomas (2022) suggests that the sudden pivot to the online space, emergency remote learning and teaching practice remained challenging. Furthermore, well-resourced institutions, that had sufficient experience and background in online leaning and teaching, and or innovative educational technologies enjoyed a significant advantage as they were able to swiftly and effectively transition to Emergency Remote Teaching (ERT) with relatively short notice (CIHE, 2020; Crawford et al., 2020; QAA, 020). Universities not as well-resourced faced more significant challenges with the pivot the online learning and teaching. In part, as a result of the scarcity of resources to innovative and technological infrastructure prior to the pandemic. All universities encountered major hurdles, including academics facing limitations in their home office setups, a lack of skills and competencies to adapt to ERT, and limited knowledge of distance learning pedagogies (Crawford et al., 2020).

Even though the pandemic fast-tracked the transition online and blended learning, Dhilla (2017) suggests that the online environment presented several challenges that academic staff and students had to contend with. These included pedagogical and philosophical dilemmas, requiring reconsideration of long held assumptions, a letting go of familiar learning and teaching practices, and finally assumed positions of authority. According to Kilgour et al. (2019), this boundary crossing to remote teaching required significant shifts in teachers' ontological and epistemological stance, as they grappled with threshold concepts that may

have conflicted with their existing approaches to learning and teaching. These shifts could possibly have evoked feelings of liminality, uncertainty, and anxiety, as transformative learning takes place, often accompanied by a sense of loss as previous ways of thinking and being are transformed (Timmermans, 2010) in a time characterised by rapid shifts, emotional turmoil and significant trauma.

For academic developers, prior to the COVID-19 pandemic, held diverse roles that encompassed teaching (both formal and informal), project work, and staff support. Compton and Gilmour (2022) refers to the delicate balance that academic developers found themselves in. This between space, of competing forces of meeting institutional requirements to develop a response to the pandemic while supporting academic staff and students with the transition. At the onset of the crisis, initial support provided by academic developers was reactive and aimed at helping staff adapt to online teaching, (Compton & Gilmour, 2022). To support the transition to ERT, guiding staff through a "low-tech, high-impact" became a priority, with a focus on equipping staff and students with the necessary technical capabilities and knowledge to deliver online classes. Furthermore, according to Naylor and Nyanjom (2020), the transition to online teaching took a considerable toll on the emotional energy of academics, who reported experiencing both positive and negative emotions due to the rapid pace of change and the perceived level of institutional support. In addition, Sahu (2020) suggests that staff and students' working from home, their technological capabilities, access to data and devices, and having to share such resources and spaces with others who are working from home can further create a sense of uncertainty and anxiety about the status quo.

For academics, this uncertainty may have caused a sense of discomfort as they transitioned from the physical and social technologies which according to Buys (2020) has the ability to further create a disconnect between individuals. This disconnection from the familiar physical classroom and face-to-face teaching has the ability to result in feelings of displacement and dispossession. The university community, irrespective of the nature of the work needed to re-adjust daily routines and life confined to working from home. This loss of in-person contact further impacted on the daily lives of academic staff and students from a socio-emotional perspective as suggested by UNESCO (2020). Similarly, Huang et al. (2021) found that educators had mixed feelings regarding institutionally driven shifts to blended learning, as they felt motivated by their commitment to student welfare but were simultaneously demotivated by a lack of autonomy. These emotional complexities place instructors in a vulnerable position as they seek practical solutions while simultaneously reevaluating their long-held academic assumptions and beliefs (Baran, Correia, & Thompson, 2013).

Despite the challenges, academic staff demonstrated resilience and a commitment to student success. They embraced the opportunity to experiment with different instructional methods and assessed their effectiveness through continuous reflection and feedback. This willingness to adapt and learn, allowed them to navigate the uncertainties of the pandemic and support their students in their learning journey. Koris and McKinnon (2022), shared more about the help seeking behaviours of academic staff to adapt and learn during the pandemic. This included informal engagements and collaboration with colleagues within disciplines. and institutions. As the rapid shift demanded technical skills and a reimagining of pedagogical practices, academics self-organised to offer support, and knowledge sharing through social media, webinars and online offerings such as workshops and courses. among colleagues (Fekete & Divéki, 2022).

Jandrić et al. (2021) argued that emergency remote learning and teaching served as a survival reflex during the pandemic. The writers suggest, as academic staff adapted to the changing requirements of online learning and teaching, in addition, the pandemic touched on social, psychological, and educational aspects, but more significantly highlighted the contagious nature of hope. Individuals continued to hope, learn and teach as a means of survival. Academic staff confronted a steep learning curve, acquiring digital fluency, and embracing various educational technologies.

Method

We utilised Schön's (1987) reflective model which provided a valuable framework for analysing our actions during the disruptive time of the COVID-19 pandemic and the lessons we have learned. By engaging in reflective practice, we were able to critically examine our approaches and identify areas for improvement. Schön's model consists of two main types of reflection: reflection-in-action, which occurs during the actual experience, and reflection-on-action, which takes place after the experience.Our action as academic developers in the South African context, s focused on ensuring that access and success remained central to our institutions despite the challenges presented by the pandemic. We recognised that the pandemic highlighted the remnants of our unequal past, with disparities in access to technology, resources, and support. This necessitated a proactive and inclusive approach to address these inequities and support all students and academic staff. Through reflection-in-action, we adapted our strategies and interventions in real-time to meet the evolving needs of our community. We actively sought feedback and engaged in ongoing communication with teaching staff to identify barriers, provide guidance, and implement effective solutions. This iterative process allowed us to make timely adjustments and improvements to our support mechanisms.

Reflection-on-action played a crucial role in deepening our understanding of the challenges faced and the lessons learned. We critically examined our approaches, seeking insights into what worked well and what could be enhanced. We recognised the importance of flexibility, adaptability, and the need to embrace innovative approaches to remote learning and teaching. We also acknowledged the challenges and opportunities of providing comprehensive support systems, including technological assistance, professional development opportunities, and emotional support, to ensure the well-being of our academic community.The pandemic experience reaffirmed the urgency of addressing systemic inequalities in higher education. We recognised the need for long-term solutions that go beyond the immediate crisis response. This included advocating for policy changes, increasing investment in infrastructure and resources, and fostering collaborations to bridge the digital divide and promote equitable access to education.

In conclusion, Schön's reflective model allowed us to critically analyse our actions during the disruptive time of the pandemic and gain valuable insights. We learned the importance of adaptability, innovation, and comprehensive support systems to address the challenges faced by our academic community. The pandemic served as a stark reminder of the inequalities that persist in our South African context, reinforcing the need for ongoing efforts to ensure that access and success remain centred at our institutions.

Reflections

Our reflection in-action focused on the initial responses we observed to the Covid-19 pandemic at our respective institutions. The impact of the COVID-19 pandemic significantly affected the continuation of the academic project, forcing both institutions to shutdown with an eventual transition to remote learning and teaching. Located at a University of Technology (UoT) and a traditional Historically Disadvantaged Institution (HDI), students enrolled come from mostly disadvantaged communities. When considering our respective contexts, the pandemic exacerbated challenges for students who were already resource constrained.

As academic developers we observed that students and staff struggled to adapt to the online learning environment, despite being familiar with the use of the LMS (Le Grange, 2020). In addition, we noted that students experienced difficulties with managing their time, staying motivated, online class attendance and engaging with course materials online. Reflecting on possible reasons behind these challenges, we soon realised that the sudden shift to online learning, the lack of face-to-face interaction, in some ways constituted a loss of connectedness for both staff and students. We noted this initial period was marked by uncertainties and displacement, we referred to this period as a Zone of Trauma. Below we outline the transitionary phases as moment of unlearning, learning and relearning, the actions taken along with the lessons learned.

Zone of Trauma: Uncertainty and Displacement

As we reflected on the initial phase of the pandemic, we noted this period was characterised by a sense of fear and anxiety. In the beginning the spread and severity of the COVID-19 virus remained unknown, making it incredibly difficult to plan for the future. For us, this uncertainty created a profound sense of fear and panic, resonating at both personal and professional levels. At a personal level, our initial concerns were focused on the health, safety, and well-being for ourselves, family, friends, colleagues and students. This was followed by concerns around the unfamiliarity of online learning and teaching which heightened anxieties. On a professional level, as academic developers the sudden removal from familiar spaces and places on campus, lead to a sense of displacement and dispossession. The loss of the physical classroom environment and the structured programmes that once contained our development practices created a profound shift in academic identities. Taylor, Bearman, Scarparo and Thomas (2022, p.178) refer to this sense of loss (uncertainty and displacement) as a mourning, suggesting “that educators are experiencing a deep sense of grief for what has been lost. The researchers contend that such “transition requires ontological and epistemological shifts as teachers grasp threshold concepts that conflict with their existing approaches to teaching such that they experience feelings of liminality, uncertainty, and anxiety” (p. 178). In this phase, we, along with students and academic staff had to cross a threshold, unlearn familiar ways of being and doing, and navigate the challenges of teaching in a new and unfamiliar landscape. Beyond this, we had to reflect on our own assumptions and beliefs about effective learning and consider how to adapt to this new context. We found ourselves transitioning into a new space or zone, one in which we were eager to adapt and learn.

Zone of Transition: Adapting and Learning

During this phase, we observed ways in which academics came together to work towards adapting their teaching practices to the remote learning environment. Collectively, they

embraced new technologies and pedagogical approaches, undergoing a process of learning to develop new skills. The transition involved grappling with the challenges of online teaching, exploring new strategies to engage students, and harnessing the potential of digital tools to create meaningful learning experiences, crossing the threshold, moving out of those liminal spaces (Kilgour et al. 2019). We noted that as continuous engagement ensued, drawing on knowledges and theories, online learning best practices, and research on student engagement assisted in deepening our own understanding of the issues students and staff were facing. Furthermore, at an institutional level, gathering student feedback, guided the design and implementation of interventions to support students in overcoming their challenges. This included developing online resources and guides on effective time management, providing virtual workshops on study skills and online learning strategies, or facilitating virtual peer support groups as well as how to access academic development support initiatives remotely. Ongoing engagement through feedback and evaluation enabled us to reflect on the effectiveness of the interventions, consider what worked well and what needed to be adjusted or revised. This approach helped to refine and adapt academic development and support strategies to better address the specific needs and challenges faced by students and staff in the online learning environment. In this Zone of Transitioning, we engaged in adapting and learning new ways of doing and being.

Zone of Transformation: Embracing Innovation

Finally, the Zone of Transformation emerged as a result of the ongoing adaptation and learning process. We realised that, academic staff, having navigated through the trauma and transition phases, began to embrace innovation and new ways of learning and teaching. More collaborative engagements across disciplines and fields became evident, through webinars and workshops. Interactions with university structures, spaces and engagement with faculty and students, pointed toward a digital transformation. Even though conversations about digital transformation is not new (García-Morales, Garrido-Moreno & Martín-Rojas, 2021) this transformation would involves profound changes in teaching pedagogies, essential competencies, as well as assessment methods. Working in the online space would require a re-evaluation of the entire learning process. Further, we began to witness a remarkable resilience, adaptation, and learning among academic staff and students during this extraordinary time. Academic staff actively reached out for professional development opportunities to enhance their digital literacy skills and pedagogical knowledge, collaborating with colleagues and learning communities to share best practices and innovative ideas.

We referred to this phase as the Zone of Transformation. We recognise this zone represents a stage that follows the initial phases of trauma and transition, where academic staff had overcome the immediate challenges of the pandemic and started to embrace innovation and new approaches to learning and teaching. In this phase, academic staff began to recognise the potential and opportunities presented by the remote learning environment and actively seek to create transformative learning experiences for their students. Within the Zone of Transformation, academic staff demonstrated transformed pedagogical approaches that embraced innovative technologies, new pedagogical methods, and instructional design strategies. Discussions about the efficacy of traditional teaching methods online in the digital age and an openness to reimagining their roles and practices to align with the evolving needs and expectations of students emerged. Embracing innovation in the Zone of Transformation involves incorporating emerging technologies, interactive online platforms, and multimedia resources to enhance student engagement and participation. This experimental phase was characterised by inquiry, leaning more about ways in which to integrate virtual reality,

simulations, gamification, or other interactive elements to create immersive and interactive learning experiences. Others considered pedagogies that included flipped classroom models, asynchronous and synchronous online discussions, and collaborative projects that leverage digital tools and platforms. Collectively, we recognised the opportunities presented by the remote learning environment and sought to create transformative learning experiences for students. This phase marked a significant shift in pedagogical approaches, with academics actively reimagining their roles and practices to meet the evolving needs of the digital age. The Zone of Transformation represents a shift in mindset, where educators embrace the possibilities of the digital era and harness technology as an enabler of transformative learning experiences. By adapting their teaching approaches to leverage the potential of digital tools and resources, they strive to create dynamic and meaningful educational experiences that prepare students for the demands of a rapidly changing world.

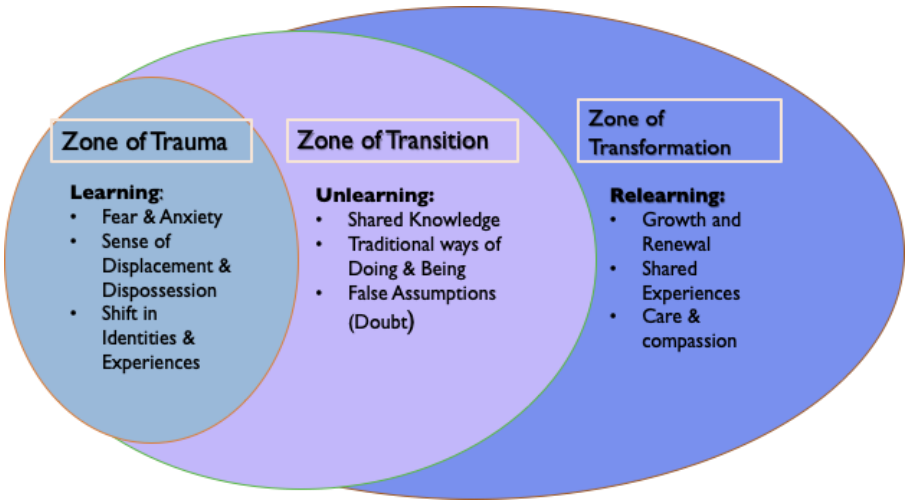

Fig. 1 Three T-Zone of Learning in Times of Disruption in Higher Education: Source Pather & Cupido (2020)

Final Thoughts

Through our engagement with academic staff, it became apparent that the pandemic impacted on learning and teaching resources with the dispossession of place and space. Resources previously available to academic staff were no longer accessible. The underlying assumption was that all staff would be prepared or capacitated to work remotely from home. This created false assumptions on staff readiness for emergency remote learning and teaching. Academic developers, teaching staff and students, as part of a university ecological system, began to explore new ways of being and doing to adapt to the new normal. This led to an increase in the sharing of knowledge and practices across disciplines, leading to new networks on a local, national and international level.

We noted significant shifts within the learning and teaching space, we all started to unlearn old ways of doing. Through this, a pattern of resilience and commitment developed, a hope that not all was lost. Most importantly, the pandemic heightened the need to teach with care and compassion, which created a sense of connectedness with students that was not observable during face-to-face teaching. The learning and teaching approaches were carefully considered to ensure that "no student would be left behind." As we reflect on the transformative changes that started to occur, the words of Emily Klein [8:80] resonates with our experience as academic developers engaging with academic staff through this difficult time:

> By learning...to build new pedagogical content knowledge relevant to the school's philosophy and design...By unlearning...letting go of deeply held assumptions about what it means to be a teacher, what classrooms look like, what the essence of learning and teaching is...relearning is the process of creating new understandings and behaviours around the same concepts—what it means to be a teacher, what learning and teaching looks like, etc.

Reflecting on actions, it is evident that this experience has led to much growth and renewal within the academic setting as all staff and students were impacted in some shape or form, although not equally so as the equity gap for staff and students became apparent. Out of these circumstances, the shared experience of staff, which in some ways have always been there for students, has led to new learnings, one framed by care and compassion as we navigate this journey together. This relearning has developed into a growth and renewal allowing for a release and letting go of old assumptions and behaviours. In our engagement with academic staff, it was evident that they felt confident to unlearn old ways of doing to deal with their own uncertainties. This created an opportunity for growth, innovation and change, which could be seen in the number of professional development opportunities and community of practices which emerged. Also possibilities to re-invent new ways of learning and teaching. So what have we learnt from this experience?

Lessons learnt during the COVID-19 pandemic have underscored the significance of cultivating hope amidst adversity. The unprecedented challenges brought about by the pandemic necessitated a shift in our approach to staff engagement and interaction, resulting in a newfound sense of connection that was previously overlooked. By embracing experimentation and curiosity, we discovered innovative methods to foster active participation and collaboration, harnessing the potential of discussion forums, chat rooms, and breakout sessions to facilitate meaningful dialogue and peer-to-peer interaction.

The transition to remote and blended learning compelled us to critically examine our pedagogical approaches, leading to heightened engagement and the acquisition of essential digital literacies that were previously lacking. The pandemic served as a catalyst for recognising the importance of comprehensive student support and the creation of inclusive learning environments. This resulted in academics being more mindful of the emotional and mental well-being of their students. Moreover, as a university community, we proactively addressed concerns regarding digital equity by providing accommodations and alternative assessment methods, ensuring equitable access to educational resources for all students.

Furthermore, the pandemic compelled us to think about our role as academic developers to reflect and embrace the continuous professional development needed in this space. We draw on the reflections of Stanton and Young (2022) and Barbara Grant's who describe academic developer as 'a light-footed shape-shifter who slips around the cracks of our institutions' and engages in 'mindful role-playing' (2007, p. 41). The researcher suggest that academic development has to be characterised by an openness and willingness to let go of "fixed identities and positions." Instead the authors encourage academic developers to "hold authority lightly… not claiming absolute knowledge or exclusive expertise, but rather taking the 'it depends' approach has allowed us to be flexible and improvisational. That humility and deftness, the willingness to find the best answer wherever it may lie, has helped us to distinguish the signal from the noise so that we can recognise new patterns in our work and move forward" (2022, p. 212).

Conclusion

In this paper, we reflected on our experiences and the emergent three zones of action that emerged during this tumultuous time: the zone of trauma, the zone of transition, and the zone of transformation. These zones, accompanied by phases of learning, unlearning, and relearning, provide insight into the lived experiences of academics as they grappled with the challenges brought about by the pandemic. It is our hope, that the three T-Zones of trauma, transition, and transformation provides a framework for future disruptions, to help others in the educational or non-educational space to become unstuck, to confront and overcome challenges, adapt to whatever the new circumstance may be. As we move forward, it is crucial to build upon the lessons learned and leverage the newfound possibilities of digital education to shape a resilient and inclusive higher education landscape.

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The Application of the Bilingual Online Dictionary Brazilian Sign Language/Portuguese in a Brazilian Higher Education Institution

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Abstract
This work supports the issue of accessibility for deaf students in Higher Education, developed by the Inovar+ project with support from CEAD (Coordination of Open and Distance Education). Its objective is to understand, from the perspective of Brazilian Sign Language (Libras)/Portuguese Translators and Interpreters (TILSP), the use of the Bilingual Libras/Portuguese Dictionary as a pedagogical tool in the communication process in the classroom, in a Higher Education Institution (HEI) in the Zona da Mata Mineira region. To glimpse the possibilities of support provided by the Dictionary in this context and data collection, we applied workshops with this audience, taking into account the qualitative approach of the research in two campuses of the same institution. Thus, the workshops with TILSP focused on presenting the Dictionary as a translation tool, using it as an instrument to consult the signs of the areas of knowledge of the disciplines taught. Thus, throughout the interaction process with the workshops, we perceived the obstacles and potentialities of the ICT (Information and Communication Technology) in question. As results, we verified TILSP pointed out positively the viability of the tool as support in the process of acquiring Libras as second language for hearing individuals. Therefore, we hope that after data collection and necessary improvements, the tool will be used in the classroom as support in the teaching and learning process of deaf students in Higher Education, aiming to minimize obstacles that hinder this process.

Keywords: Accessibility, Libras, Dictionary, Translator and Interpreter

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Introduction

The formulation of public policies and affirmative actions, specifically with regard to higher education, supported initiatives to generate equity, given the historical exclusion of social groups that did not fit into socially constructed standards (be they religious standards, aesthetics, social insertion, political position and economic power). This context strengthened struggles that culminated in the formulation and approval of different prescriptions on inclusion in Higher Education (HE), such as Law 12.711/12, which refers to the entry into Brazilian Universities of self-declared black, brown and indigenous people, from families who have income equal to or less than 1.5 minimum wage per capita, and who attended high school in public schools (Brasil, 2012). Law 13.409/16 changes the first, by determining that there is a reservation of vacancies in secondary and higher technical education institutions for people with disabilities (Brasil, 2016).

The entry of deaf people into Higher Education (HE) brought changes to formal education and highlighted major challenges for the permanence of these subjects and the completion of their undergraduate courses. The situation of school evasion was quickly evidenced by the institution that covers the research. Among the four deaf students who were enrolled shortly after Law 13.409/16 came into effect, two dropped out in less than a year.

Empirically, we evidenced the need for initiatives and structural and methodological adaptations to support the redefinition of teaching practice, such as the elaboration of signed classes, cataloging of signs referring to scientific terminologies and production of online teaching materials. Therefore, Assistive Technologies [1] (AT) and Information and Communication Technologies (ICTs) prove to be efficient pedagogical supports related to the use of visual resources, favoring pedagogical and linguistic exchanges. In this perspective, Miranda, Mourão and Gediel (2017) describe that the formulation of materials Didactics can support the promotion of inclusion by valuing the use of visual resources, when explored and accessed through ICTs.

The diagnosis of the need to develop technological-pedagogical tools at the HEI in question has been studied and developed in order to expand access to scientific knowledge in Libras (Lima; Gediel, 2015). Thus, the process of elaborating an online Libras/Portuguese Bilingual Dictionary begins, IES that represents this study, located in the interior of the state of Minas Gerais, Brazil. The Dictionary is the result of conceptions and research and traced through an institutional project popularly called Inovar +. This project consists of an interdisciplinary team, involving professors from the Departments of Literature, Social Sciences, and Biology in partnership with the IES Distance Education Center. The team involved in the creation and improvement of the software is made up of deaf people, TILSP, researchers from different areas, undergraduate and graduate students and technicians with training in Libras and IT. This tool is one of the AT that Inovar + has been producing, and one of its functions is to support the teaching and learning of Libras by/for the deaf and hearing people.

The discussion about the performance of professional Brazilian Sign Language Translators and Interpreters - Libras - Portuguese Language - Libras (TILSP) to collaborate with the inclusion of deaf people in ES presents challenges. This article aims to present the results of a survey, carried out at the mentioned HEI with the collaboration of TILSP, to understand the

[1] According to Its Brasil (2012), Assistive Technologies are tools that have the purpose of promoting greater autonomy, independence and quality of life for people with disabilities, in order to generate inclusion.

challenges and potential of using the Dictionary for translation and interpretation activities in ES, since one of the focuses of the tool's development is the construction of a sign of specific areas, which mainly contemplates the courses that offer disciplines for deaf students regularly enrolled in this institution.

The methodological route was based on ethnographic precepts, taking advantage of participant observation, field notes and field diary (Oliveira, 1996). Still, we took advantage of the Human-Computer Interaction (HCI), from the experimentation (test-phase) to analyze the potential of the tool (Rocha; Baranauskas, 2003). Thus, the research experience shared here has as its guiding theme the inclusion of the deaf in higher education, specifically thinking about the use of ICTs as a tool for including students both in the classroom and in other spaces on campus.

For the composition of this study, initially, we wove a brief discussion about ICTs and their importance in the scope of inclusion, in the sense of facilitating the educational mediation of deaf people, enjoying the visual, a modality that encompasses the linguistic perspective of Libras. Then, the development of the Dictionary and its different functions are presented. And, also, a brief theoretical argument that involves the role of the professional translator and interpreter in the educational context. Subsequently, we describe the context of the research, the data collection instruments, the profile of the research collaborators and the steps taken to collect and analyze the data. Finally, we will discuss the data and present the main results and final considerations in relation to the perspectives of the deaf participants in the research regarding the improvement of the tool.

Theoretical Framework: The Bilingual Online Dictionary Brazilian Sign Language/Portuguese

The Bilingual Online Dictionary Libras/Portuguese is a software developed by the Inovar + project, accessed through the link[2] corresponding to the address, and can be used through computers and smartphones. Access is still restricted to developer projects (Inovar + and Distance Education Center) until the tool is improved and possible rejections by users are mitigated.

What differentiates the Dictionary from the others found in the Portuguese/Librassão version: *i)* the phrases for the application of signs in Portuguese and in glosses,[3] favoring the learning of signs within a context, in order to make vocabulary acquisition effective in the language; *ii)* the search for hand configurations, which facilitates the handling of the tool by deaf users and contributes to the learning of Libras linguistic parameters by listeners; *iii*) the sign of specific areas, which currently has basic concepts in the disciplines of Literature, Mathematics, Chemistry and Biology, in need of expansion; *iv)* initial presentation of the Dictionary in Libras.

This tool was designed to help in the communication process between deaf and hearing people, whether they are teachers, students, subject monitors or TILSP, which interact in the different teaching and learning environments at the HEI. Thus, the Dictionary directs itself to the actions foreseen in the laws of inclusion and accessibility of the deaf in education, paying attention to the creation of pedagogical didactic materials.

[2] https://sistemas.cead.ufv.br/capes/dicionario/.
[3] The glosses were defined by Paiva, et al. (2016), as oral language words spelled with a capital letter representing an approximate meaning with signs of the visual-spatial language.

When accessing the site, on the home page in the center, we see a flagged video, with subtitles in Portuguese, in which the Dictionary is briefly presented. On the left side of the screen, there is a search bar, where the words in Portuguese for the searched signal are entered. And, below the search bar, you will find the themes available in the Dictionary, so it is not necessary to search only for the word in Portuguese, as it is possible to find the desired word from the theme in which it is grouped. All these functions are illustrated in the images that follow.

Figure 1: Bilingual Online Dictionary Brazilian Sign Language/Portuguese - home page top.

The Dictionary also has a search feature by hand configuration at the bottom of the screen, corresponding to one of the five phonological parameters of Libras. The search by handshape is one of the aspects that contribute to the bilingual characteristic of the software, since deaf people who still do not master the Portuguese language can use the resource to search for the desired words.

Figure 2: Bilingual Online Dictionary Brazilian Sign Language/Portuguese - home page bottom.

As it is a dictionary aimed mainly at the HE context, the resource searches by sign of specific areas of knowledge, currently containing three areas: Biology, Languages and Mathematics. In the future, research is sought, coming from different areas of knowledge, aiming at the development of the signal through the mapping and cataloging of scientific terms, supporting the process of permanence of deaf people.

The entry pages are like the picture below: on the upper left side the searched word stands out, and in the center of the page the execution of the corresponding sign video. Below, we identify the application of that word in a sentence in Portuguese and in glosses and hand configuration referring to the signal.

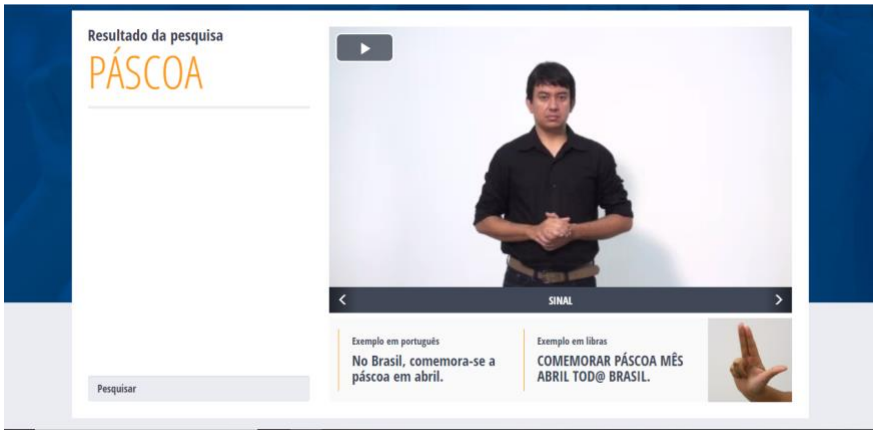

Figure 3: Bilingual Online Dictionary Brazilian Sign Language/Portuguese - signs page.

It is important to point out that the Dictionary is in the process of being developed, even with a small amount of signs added, due to the extensive process of cataloging, correcting, recording, reviewing and inserting the signs in the software. In addition, based on the tests, there are several indications of functions to be carried out in the coming years.

The Translator and Interpreter of Libras/Portuguese in the Educational Context

The inclusive educational model provides for the presence of a professional translator and interpreter of Brazilian Sign Language and Portuguese (TILSP) in the classroom, combined with methodological resources and teacher training (Brasil, 2002; Brasil, 2005). But even so, the methodological adaptations did not happen as necessary, and, for this reason, efforts remain active so that visual resources are explored, and, through the implementation of Assistive Technologies (AT) and ICTs, bilingual education is valued.

The presence of TILSP in classrooms and other educational environments was an important achievement that enabled communication between deaf people and listeners and promoted access to content in the first language of the deaf (Monteiro, 2006). The insertion of this in the classroom brought about a great transformation and, as already mentioned, made possible a gain in the education of the deaf. But together with this educational transformation and the entry of deaf subjects into regular schools, new challenges also emerged, as presented by Quadros (2004) in the document supporting the education of the deaf. The author points out the difficulty that teachers have in understanding that interpreters are not tutors of deaf students, they are not responsible for the student, nor are they responsible for promoting educational development in terms of acquiring specific knowledge. Therefore, the production of tools and the development of actions that seek to circumvent the difficulties of prior access to the interpretation content are increasingly necessary.

The role of TILSP is to develop actions in the field of interpretation in different contexts, mediating communication between deaf people and hearing people in educational, cultural, professional, religious, legal, political and personal areas (Monteiro, 2006). to the deaf Community through the performance of translation skills and linguistic competences,

translating in real time (simultaneous translation) or between short periods of time (consecutive interpretation) from an oral language to a signed language or vice versa (Quadros, 2004). The exercise of the functions of TILSP comes as one of the results of the movement for claiming rights by the deaf Community and researchers mobilized by the discussion in the area of education for the deaf, which seeks to prioritize Libras in communication and pedagogical processes through bilingual education (Quadros, 2005). Thus, this educational model encourages the acquisition of Libras as L1 (first language) and Portuguese as L2 (second language) for deaf students.

As a consequence of this change, the TILSP professional starts to work in different contexts and situations that demand different skills that enable a multipurpose performance, by meeting the demands of areas that do not dialogue with their basic training. For this reason, we believe that ICTs can be important allies to the translation and interpretation process, as they minimize problems such as access to content that is not part of the professional's communication repertoire. In this way, the usability test was an important process for the development of the tool, also for us to understand the demands presented by the TILSP, which is an important group of target users of the Dictionary.

Regarding the context of Higher Education (HE), Santos (2015) points out that the performance of TILSP requires greater flexibility to enable training in different skills that are demanded. With regard to the characteristics that the ES TILSP needs to gather in its profile, the author mentions the attitude of complying with the ethics of the profession, linguistic training that allows the identification of translation problems and the dexterity to overcome them, interpersonal skills, efficiency of interpretation in specific areas (Santos, 2015, p. 119). As highlighted by Santos (2015), the professional translator and interpreter is required to have a multipurpose performance, since the request that TILSP supports the most varied university contexts, in different areas of linguistic service, is factual. Therefore, the importance of continuing education activities so that professionals can meet the demands of Higher Education, such as the emerging use of technologies, practical activities for the application of knowledge that go beyond the classroom.

For this reason, this research was important for us to understand how these needs emerge in the performance of TILSP professionals in the context of the researched HEI, and what are the professionals' considerations regarding the tool. In this sense, the data presented below point out the main challenges and potential of implementing the Dictionary as a catalyst ICT in the translation and interpretation process.

Method

For the analysis of this interaction, we opted for a methodology based on ethnographic precepts, such as participant observation, field notes and field diary (Oliveira, 1996). Still, we take advantage of the HCI, from the experimentation (test phase) that analyzes the prototype (Rochar; Baranauskas, 2003). HCI is analyzed through computational tools such as image and voice recording applications11, in combination with qualitative research (Rocha; Baranauskas, 2003). The objective of the analysis based on the observation of usability tests is to investigate and identify possible failures for improvement and adequacy to the reality of users. Users follow pre-prepared test scripts according to the research objectives, and are free to express opinions during the test.

The research took place from the observation of the use of the site by two TILSP professionals who work in the academic activities of students regularly enrolled in the IES, through the usability test and analysis of the Human Computer Interaction (HCI). This analysis is established from the exploration by the user of the functionalities that the product offers, to generate understanding in relation to the satisfaction, the demands and the interactions generated. Therefore, the ways in which users interacted and reacted to the commands offered showed what is necessary for adapting the tool to the specificities and demands, according to Pereira (2011).

In the application of the test with the TILSP, a script was created so that the dialogue between the participants corresponded to the research objectives, since the participants took the test simultaneously, demanding a different mediation, which would guarantee the participation of both. The team consisted of 1 (one) mediator and 1 (one) observer who interacted with the participants, exploring doubts and reactions that were not pre-established, but which were perceived throughout the test.

The test was carried out in a computer lab at the HEI, where all participants had the same conditions of use concomitantly. Both received a printed script with the necessary steps to test the tool, with each step performed there was space for reflection on the use of the tool, as shown in the next section.

Results and Analyses

The following analyzes refer to the speeches of the interlocutors in relation to the tool, participation that were crucial for the planning of the changes that are punctual to reach the objective proposed in the creation of the Dictionary. We followed the literal transcription of the speeches based on the theories of Conversation Analysis (CA) from the model presented by Garcez (2008), who works with the analysis of interaction contexts, in terms of taking turns in interaction.

The transcripts presented refer to the moments of the video in which considerations about the application of the Dictionary were initiated by the speaker, the literal transcription of the speeches was adopted. To separate the selected shifts for the analysis, different CM will be used that will make it possible to understand the beginning and end of each excerpt and preserve the identity of the collaborators, as established by Gediel (2010) in his studies on deafness. The statements quoted below were given in response to questions about the possibility of using the Dictionary in the translation and interpretation process in the context of ES and in other learning processes for the deaf in which TILSP professionals are involved. Thus, below are the fragments considered for our analysis.

There has to be something in the Dictionary more for the people here, because if you think about it in general, it doesn't include it because here it is one way, São Paulo is another, Rio de Janeiro is another in the Northeast, so it seems that you are in another place. But that's in Portuguese too (TILSP 01).

Because, well, there are some deaf people who didn't learn Portuguese, sometimes they are having their first contact with Libras now. I'm not talking about a deaf person who is in university, no, I'm talking about a layperson. I'm learning Libras over there or sometimes I'm learning Portuguese too, then I read pineapple and see the sign too. Did you understand? You

can see that all printed Libras dictionaries have the drawing there. They are very visual (TILSP 02).

As stated by Lacerda, et al. (2004), for learning a second language to be really effective, teaching should not be mechanized, it should make sense for those who learn it and learners should be immersed in places where they can use the language, making it necessary to experience in contextualized situations that have meaning for those who experience them.

Faced with the need and, at the same time, the challenges posed by users regarding the incorporation or disaggregation of signals that have a large regional variation, I present below discussions that make this situation clearer. From this, we understand that the access and quality of Libras teaching in ES is linked to the ability to meet the different needs of the public that composes it. Therefore, we verified and evaluated that the feasibility of implementing different signs referring to a single word is a positive point for the deaf, but for one of the collaborators TILSP it can be an impasse to inclusion. However, in order to promote a more effective inclusion, the considerations of deaf students and TILSP will be implemented jointly in the Dictionary, where the regional signs will be displayed in the foreground, and the other cataloged signs will receive numerical indication according to their order of appearance. However, the most used sign in the context of the HEI is the one that will be used in the application sentence that aims to exemplify a context in which the sign can be used.

In the following fragment we see another speech by one of the TILSP the dissonance of opinions as pointed out above, the first speech is by the TILSP and the next two are by two of the participating deaf students:

> Just like that, I was looking at the question of the deaf, in this part of Biology, only part of the body and Biology is not that, it has to go much further. For a student who is studying Biology this is not Biology this is for a student who is starting to learn, who is enriching his vocabulary. We here at the university already have a good vocabulary, that's over here. (TILSP 02)

In order for the Dictionary to obtain permanent and official acceptance by users at the HEI through its use, it is necessary, according to the participating TILSP, that the dictionary has a larger framework because the institution can receive students from different areas of knowledge and thus learning would be possible. of specific terms. It was possible to perceive the emphasis in the speech of the participants referring to the regional variations and the signs of complex terms. As demonstrated, which makes us think of strategies to expand the system's content, taking into account that these aspects are also inherent in other languages. The realization of this note will enable its application as a didactic resource by future deaf students.

In the view of TILSP 02, the insertion of non-regional signs is productive, but it needs to be done with caution, since it needs to pay attention to the public that makes up the HEI, and beyond what is currently considered by them as the basic content of communication. The lack of knowledge of the TILSP that come from other regions regarding the signs used here makes the communicational learning process of the deaf student difficult, for this reason the Dictionary is a useful tool for the translation work from the moment that it offers the professional these signs that are used in the HEI region, and other signs that are used by deaf students from other regions who enter here.

A recurrent point was the request for specific signals so that the device could meet the difficulty that the deaf community at the HEI has been facing, these reports below give us directions for activities and new research that are being developed. Therefore, the Dictionary has as an innovation the incorporation of signs of a scientific nature, organized through a sign that initially covers some areas of knowledge and specific concepts, such as in the area of Literature, Biology and Mathematics. of paramount importance for the development of the tool. According to Perlin and Strobel (2006), it is necessary to understand the cultural difference between the deaf look and the listener look, and in terms of the production of didactic materials for teaching and learning Libras, the deaf are fundamental.

Conclusion

The research fulfilled the objective of building an accurate diagnosis on the use of the Dictionary from the interface tests with the deaf students of the HEI. Within the initial ambitions, based on the collaborative work between a technical team and a research team, it was possible to carry out the initial improvement of the Dictionary, which will facilitate the implementation of the tool in a pedagogical context at the HEI, where there is already the presence of students enrolled in different courses of graduation.

We consider that the software is accessible for the deaf, but that there is still a need to overlap Libras with Portuguese in the presentation of contents. The data support the assertion that the Dictionary is accessible and assimilable by the deaf and hearing people. That is, it was demonstrated that the Hand Configurations and the videos in Libras helped deaf people to understand by searching for certain words in Portuguese.

The observed results allowed the improvement of the Dictionary, the formulation of new interventions in the studied educational context, as well as contributing to the production of new knowledge. The improvement of the site demonstrates the need for improvements and the need for further research with the same, which is part of the next stages of development of the tool. We anticipate that the new interventions in the educational context studied will generate advances and meet the demands of the research participants. This is done by carrying out a work to encourage the use of technological tools in educational processes, believing that this process should encompass the various areas that make up the school curriculum (Carneiro; Passos, 2014, p. 103).

Due to the difficulty of finding bibliographies that present similar works on the development of ICTs for teaching and learning Libras, we realize the potential of this work and the development of new research that contribute to the good performance and implementation of the Online Dictionary of Libras/Portuguese Language. Another potential aspect of this study involving the tool is the possibility of maturation of the signal in specific areas through the contribution of the local deaf Community, and also from partnerships with other teaching and research institutions.

In the case of research with deaf individuals in which the researcher is a listener, as is the case of this research, it is noticeable the existence of the cultural difference that produces a delicate relationship of negotiation and adequacy to the reality of those who are the key pieces for the research and for the Dictionary development. That is why contact and participation in the deaf Community in the creation and evaluation of the tool is important so that it fulfills the objective of disseminating and teaching Libras, and so that there is no repetition of the historical framework of producing interventions “for” the deaf and not

“with” the deaf (Sassaki, 2007). Having the HEI's deaf Community participate is an act of recognition of the struggle for the right to speak and the leading role in decisions regarding their language.

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Building Social-Emotional Competencies and Resilience in Preservice Teacher Education: The Role of Yoga

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Abstract
This study scrutinises the effects of a yoga programme on the social-emotional competencies and resilience of 124 student teachers at a university in Turkey and investigates the viewpoints of the participants about the integration of holistic yoga practices. A Hatha yoga programme was implemented in the experimental group for 6 weeks. Data were obtained via Social-Emotional Competencies Questionnaire (SEC-Q), Brief Resilience Scale (BRS) and online open-ended questions. Between-group analyses displayed that self-awareness, self-management and resilience scores increased significantly in the experimental group after the implementation of the treatment. Within-group differences showed meaningful improvements in all social-emotional competencies and resilience levels for the experimental group. Delayed post-tests indicated that participants were able to sustain their improved social and emotional competencies and resilience. Qualitative findings indicated that participants found the programme as a feasible medium for mind-body awareness, emotion and stress regulation, and quality of life.

Keywords: Social-Emotional Competencies, Resilience, Preservice Teacher Education, Yoga

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Introduction

The current global escalation of mass exodus from the teaching career catalyses marked concerns in the field of teacher education (Molyneux, 2021). Several reports indicate that the present-day teaching climates trigger extreme levels of stress and impair psychophysiological welfare of teachers, giving rise to severe depression and anxiety, scepticism, low self-efficacy, and a lessened professional commitment (Hadar et al., 2020). Teachers' escalated attrition, absenteeism and alienation to their professional identity are now regarded as alarming problems (Amitai & Van Houette, 2022). Thus, addressing the demand to reinforce teachers' social and emotional competencies (SECs) and resilience has gained prominence across the globe, as early as possible at preservice teacher education programmes (Hadar et al., 2020).

These attempts are akin to the focal points of positive psychology, which entails the scrutiny of positive emotions, human virtues, and constructive institutions (Seligman, 2002). Yoga discipline manifests itself as a way of cultivating aspects of positive psychology and shares several similarities with its underlying principles (Singleton, 2010). Both positive psychology and yoga practices entail transforming the individuals to higher states of consciousness and well-being (Butzer et al., 2016) and by doing so, they promote SECs, resilience, and mindfulness (Ivtzan & Papantoniou, 2014).

SEC in Preservice Teacher Education

SECs are milestones in recognising and managing emotions, strengthening empathy, and displaying responsible decision-making according to the framework of Collaborative for Academic, Social and Emotional Learning (CASEL, 2020). Five domains within this framework are: self-awareness, self-management, social awareness, relationship management, and responsible decision-making. These competencies are reported to be linked with higher self- and teacher efficacy levels, better coping mechanisms, well-being, and motivation (Aldrup et al., 2020). The attainment of SECs is considered as essential and teachable for student teachers (STs) (Tonga & Erden, 2020). When provided with chances to enhance their SECs, STs are more inclined to reconstruct (a) their own emotions and coping mechanisms; (b) their future students' emotions and behaviours; and (c) how to create an encouraging learning atmosphere in their classes (Dolzhenko, 2017).

However, several studies indicate that social-emotional competencies of teachers have been neglected in many teacher education programmes (Hadar et al., 2020). An experimental study conducted by Garner and Kaplan (2018) in the USA, for example, revealed that STs have hardship in regulating and understanding their own emotions and well-being. In their qualitative inquiry, Mairitsch et al. (2021) found that Austrian and British STs went through a myriad of personal and contextual challenges and juggled between their ST roles, which negatively affected their abilities to maintain their well-being. Another recent study conducted by Özüdoğru (2021) revealed that Turkish STs' social and emotional needs are mostly unmet in teacher education programmes and STs feel anxious and isolated.

Resilience in Preservice Teacher Education

Despite its complex definitions, resilience can be described as the personal qualities enabling people to develop themselves when facing hardship (Connor & Davidson, 2003). Resilience is viewed as a critical capability of teachers in being resourceful, displaying agency and

setting positive management strategies in their profession (Arnup & Bowles, 2016). Reciprocal relationships nurturing growth, empowerment, and a sense of confidence and competence are critical for the advancement of effective teacher resilience (Le Cornu, 2013). Enhancing teacher resilience is found to be positively correlated with teaching effectiveness, job satisfaction and better coping mechanisms to adjust to erratic changes in education (Howard & Johnson, 2004).

STs are faced with rapidly altering educational environments which are affected by politically driven mandates, community driven expectations and professional driven standards (Ledger, 2021). They are challenged at navigating the complexity of the classroom environments and often end up cognitively overloaded (Moos & Pitton, 2013). This situation, in turn, creates a negative impact on their awareness and emotional regulation (Zimmerman, 2018). On the other hand, STs with cultivated resilience levels are reported to be building on their own support systems and persevering with the demands of their profession (McCormack et al., 2006). Accordingly, resilience is crucial to attain as early as possible in the teaching profession since it promotes teaching effectiveness, extends career satisfaction, and prepares teachers to adapt to complex educational conditions (Gu & Day, 2007).

Yoga Practices

A holistic yoga practice is associated with cultivating a comprehensive involvement of self-regulation, mind-body awareness, and physical fitness capabilities with an experiential sense (Butzer et al., 2016). Particularly, Hatha yoga is one-type of a holistic exercise combining the three vital components of a yogic practice: asana, pranayama, and meditation (Crowley, 2002). Asanas are characterised as the combination of physical postures that target at stabilizing the bodily functions and are particularly effective in the regulation of emotions and stress (Kathapillai, 2019). Pranayama discipline is concerned with aligning the mind with the present moment by involving correct postures, meditations and breathing patterns (de Manincor, 2017). Finally, yogic meditation is portrayed as the mastery of remaining peaceful and reaching happiness through alleviating discomfort that anxiety and stress generate (Kim-Onnia, 2010). To attain the holistic essence of yoga, these three elements were combined and employed in the current study.

There has been a dearth in the literature of holistic yoga practices for both pre-service and in-service teacher education. The extant studies in the context of yoga, SEC, and resilience in in-service teacher education largely tend to be descriptive work, conference papers or studies that have not gone through a peer-reviewed process (Bhavanani, 2006; Francesconi, 2017). However, one experimental study by Chen and Pauwels (2014) reports integrating yoga-based activities in a teacher education program in the USA. The results of the study revealed that yoga-based activities cultivated the perceived gains in mental well-being, social well-being, physical well-being, and daily behavior for in-service teachers. In addition, enhanced levels of resilience were reported by the teachers when overcoming with teaching barriers. A further qualitative study by Francesconi (2017) evaluated the effectiveness of a yoga program offered to high school teachers in Italy. The study results indicated that teachers lacked overall physical fitness and had a lot of stress at work, and therefore wished to practice yoga in order to increase their self-awareness, emotion regulation and overall fitness levels. Also, the teachers were able to witness several benefits of yogic activities. Herein, it is crucial to note that although encouraging results were observed for the SECs and resilience, the abovementioned studies were conducted in the context of in-service teacher education. In relation to pre-service teacher education and holistic yoga program integration, no studies

have been conducted yet. The abiding research, however, points out the fact that similar affordances could be observed for pre-service teacher education contexts.

It is evident that the volatile, uncertain, complex, and ambiguous state of our global world affects teachers' SECs, and resilience adversely. Correspondingly, increased teacher attrition, resignation, and absenteeism along with alienation to the professional identity are alarming consequences of sudden global changes (United Nations, 2020). STs are expected to provide their future students with skills and attitudes to manage swift changes (Gustems-Carnicer et al., 2019). Yet, there is enough proof that STs themselves are not equipped with enough SECs and coping mechanisms to handle the growing body of expectations on their own in today's world (Hadar et al., 2020). When unattained, the impaired SECs and resilience are expected to debilitate their cognitive functioning, overall well-being, and abilities to model and foster SECs and resilience in their own class environments.

This study aims at contributing to the literature by trying to understand the impact of a yoga programme called APM (Asana, Pranayama, Meditation) on enhancing the SECs and resilience of first year STs and learn whether they are able to sustain their SECs and resilience scores. Additionally, the study aims to find out STs' perceptions on the implementation of APM. Although SECs and resilience of teachers were previously investigated on a number of occasions (Aldrup et al., 2020; Jennings et al., 2017), the effect of a holistic yoga programme on these constructs has never been probed in the context of STs either in Turkey or around the world. In addition, a holistic Hatha yoga programme has never been implemented in online delivery settings with STs.

The current study seeks to answer the succeeding questions:
(1) Are there any significant differences between the yoga practice group and the nonyoga practice group STs in terms of their (a) self-awareness; (b) self-management and motivation; (c) social awareness and prosocial behaviour; and (d) decision-making?
(2) Are there any significant differences between the yoga practice group and the nonyoga practice group STs with regard to resilience?
(3) Does yoga practice lead to immediate and sustained improvements in SECs and resilience?
(4) What are the viewpoints of STs about the efficacy of the APM yoga programme?

The Present Study

Participants

The participants were all first-year students enrolled at the Faculty of Education at a private university in Istanbul, Turkey. Sixty-four participants volunteered to partake in the yoga implementation programme. The experimental group involved participants who majored in Early Childhood Teaching (n = 20), Special Education Teaching (n = 21) and Primary Mathematics Teaching (n = 23) departments and the control group participants were STs from the same departments (n = 60).

Participants' age ranged from 18 to 26 (M = 18.8, SD = 1.62). Overall, there were 94 female and 30 male participants. Several participants from the control (n = 3) and the experimental group (n = 4) had some health issues such as Crohn's disease, bronchitis, and diabetes. Eight experimental and ten control group participants were exercising regularly. None of the participants were familiar with Hatha yoga.

Procedure

Prior to the implementation, participants were supplied with the aims and procedures of the programme. After gaining informed consents and forming the groups, experimental group participants were provided with a guidebook to inform them about yoga practices and highlight several cautions when performing yoga. The yoga practices were at beginner level since none of the participants were familiar with yoga before. Before the implementation process, demographic information was obtained, and all participants were given SEC-Q and BRS as pretest. Each yoga session took 60 minutes, with 10-minute reflection sessions on the experience.

During the practices, participants were asked to be comfortable when standing up and sitting down, maintain correct postures and follow the demonstration of the instructor. Since the programme was carried out online, participants were requested to turn on their cameras throughout the sessions. The sessions started off with beginner asana practices to improve strength and balance and establish mind-body connection prior to upcoming exercises. Static and dynamic asana postures were both practiced throughout the sessions. The exercises involved moves to develop flexibility, improve posture, and adjust spinal alignment. Upon the completion of asanas, participants were asked to sit down and relax while keeping their spine erected. They were asked to observe their breathing patterns. Tailored versions of pranayama cycles were used depending on the observations and the readiness of the participants. Pranayama exercises included the practice of Nadi Shodhana pranayama and Bhramari pranayama employed interchangeably over the course of the practices. In the last step, Vipassana meditation was practised. The practice consisted of observing the thoughts and emotions and accepting them as they are without criticizing the self. Each session, the yoga instructor jotted down notes and monitored the behaviours of participants during the implementation.

In week 6, all participants were once again given SEC-Q and BRS as posttest. In addition, the experimental group participants were given the open-ended questions. The SEC-Q and BRS were administered to experimental group participants 6 weeks later as delayed post-tests. The whole data collection process and the implementation was conducted online.

Data Collection Instruments

Social-Emotional Competencies Questionnaire (SEC-Q)

To evaluate the effect of yogic practices on the SECs, SEC-Q, developed by Zych et al. (2018), was applied to both groups as pretest and posttest. The experimental group received the same instrument as the delayed posttest. SEC-Q includes 16 items based upon a 5-point Likert scale evaluating the participants' perceptions from 1 (Strongly Disagree) to 5 (Strongly Agree) and aims at assessing four SECs: self-awareness, self-management and motivation, social awareness and prosocial behaviour, and decision-making. Higher scores indicated better developed SECs and the scale had Cronbach's alpha value of .82.

Brief Resilience Scale (BRS)

BRS was employed to assess the ability of participants' bouncing back from stress and was applied to both groups as pretest and posttest. The same scale was applied to the experimental group as delayed posttest. The scale developed by Smith et al. (2008) included six items in

the form of a unitary construct. In the current study, negatively coded items were reverse coded. BRS was designed in a 5-point Likert Scale evaluating the participants' perceptions from 1 (Strongly Disagree) to 5 (Strongly Agree). Higher scores meant better enhanced resilience and the Cronbach's alpha value of the original scale ranged from .80 to 91.

Online Open-Ended Questions

To explore the effectiveness of the yoga programme, three questions were asked to experimental group participants at the end of the study: *What do you think about the yoga programme? Have you noticed any changes in your social and emotional life during & after the programme? To what extent was the yoga programme effective for you?* Participants were asked to reflect on the programme atmosphere, perceived effects, and their overall experience with yoga practices in a written way.

Data Analysis

Preliminary examinations were done to determine the assumptions of normality, linearity, homogeneity of regression slopes, homogeneity of variance and homogeneity of sphericity. The mean differences between the groups were analysed through a one-way analysis of covariance (ANCOVA). The differences within the experimental group across three time points were calculated via a one-way repeated measures ANOVA. The qualitative data were analysed through a thematic analysis process. Open, axial, and selective coding were utilised. Transcriptions were done by the researchers. Member-checking process was carried out to ensure credibility.

Results

SECs Results

To examine whether SECs mean scores differed between the groups while controlling for pretest scores, ANCOVA was computed. All ANCOVA assumptions were met in the data set.

The results revealed that there were statistically significant differences on the scores of self-awareness [$F(1, 121) = 8.22$, $p = .005$, $\eta p2 = .06$] and self-management and motivation [$F(1, 121) = 5.82$, $p = .017$, $\eta p2 = .04$] between the experimental and control groups ($p < .05$). Estimated marginal means indicated that self-awareness scores of the experimental group ($M = 14.4$, $SE = 0.18$) outperformed the control group ($M = 13.6$, $SE = 0.19$) on the posttest condition. Similarly, self-management and motivation estimated marginal means demonstrated that the experimental group ($M = 11.6$, $SE = 0.19$) gained higher scores than the control group ($M = 10.9$, $SE = 0.20$) (see Table 1).

Variable	Experimental	Control			
	M ± *SE*	*M* ± *SE*	*F*	*p*	ηp^2
SA	14.4 ± .18	13.6 ± .19	8.22	.005	.064
SMM	11.6 ± .19	10.9 ± .20	5.82	.017	.046
SAPB	21.3 ± .23	20.8 ± .24	2.59	.110*	.021
DM	11.4 ± .17	11.0 ± .18	3.54	.062*	.028

Note. Pretest scores were used as covariates; SA = self-awareness; SMM = self-management and motivation; SAPB= social awareness and prosocial behaviour; DM = decision-making; SE = standard error

Table 1: ANCOVA results for SECs

To determine the differences in the mean scores of the experimental group's SECs across three different time points, ANOVA was executed. Since sphericity was violated in the data set ($p < .05$), Greenhouse-Geisser corrected results were reported.

A repeated-measures ANOVA with Greenhouse-Geisser correction displayed that there were statistically significantly differences in the scores of self-awareness [$F(1.34, 84.21) = 62.6$, $p < .001$, ηp2 = .50], self-management and motivation [$F(1.36, 85.41) = 72.1$, $p < .001$, ηp2 = .53], social awareness and prosocial behaviour [$F(1.40, 88.55) = 103.5$, $p < .001$, ηp2 = .62] and decision-making [$F(1.50, 94.56) = 77.0$, $p < .001$, ηp2 = .55] across three different time points (see Table 2).

Variable	Time 1 Pretest	Time 2 Posttest	Time 3 Delayed Test			
	M ± *SD*	*M* ± *SD*	*M* ± *SD*	*F*	*p*	ηp^2
SA	12.2 ± .1.96	14.5 ± 1.96	14.3 ± 2.32	62.6	.001	.500
SMM	9.27 ± .1.94	11.6 ± 1.81	11.5 ± 2.15	72.1	.001	.534
SAPB	17.7 ± .2.67	21.3 ± .2.15	21.0 ± .2.57	103.5	.001	.622
DM	9.11 ± .1.65	11.4 ± .1.78	11.1 ± .2.07	77.0	.001	.550

Note. SA = self-awareness; SMM = self-management and motivation; SAPB= social awareness and prosocial behaviour; DM = decision-making

Table 2: One-way repeated measures ANOVA for SECs

A post hoc pairwise comparison using the Bonferroni correction exhibited a significant increase between self-awareness pretest ($M = 12.2$, $SD = 1.96$) and posttest ($M = 14.5$, $SD = 1.96$), self-management and motivation pretest ($M = 9.27$, $SD = 1.94$) and posttest ($M = 11.6$, $SD = 1.81$), social awareness and prosocial behaviour pretest ($M = 17.7$, $SD = 2.67$) and posttest ($M = 21.3$, $SD = 2.15$) and decision-making pretest ($M = 9.11$, $SD = 1.65$) and posttest ($M = 11.4$, $SD = 1.78$) conditions ($p < .001$). Put differently, the experimental group participants experienced statistically meaningful changes between the pretest and posttest conditions for all SECs.

According to further post hoc tests with Bonferroni correction, self-awareness posttest ($M = 14.5$, $SD = 1.96$) and delayed posttest ($M = 14.3$, $SD = 2.32$) conditions did not have a statistically significant difference ($p = .817$). Self-management and motivation posttest ($M = 11.6$, $SD = 1.81$) and delayed posttest ($M = 11.5$, $SD = 2.15$) conditions did not possess a statistically significant difference ($p = .918$). Social awareness and prosocial behaviour posttest ($M = 21.3$, $SD = 2.15$) and delayed posttest ($M = 21.0$, $SD = 2.57$) conditions did not differ statistically ($p = .479$). For decision-making, posttest ($M = 11.4$, $SD = 1.78$) and delayed posttest ($M = 11.1$, $SD = 2.07$) conditions did not display a significant difference ($p =$

.362). Consequently, it was seen that the experimental group participants retained their posttest scores after 6 weeks of recess ($p > .05$).

Resilience Results

To analyse whether resilience scores differed between the groups while accounting for pretest scores, ANCOVA was run. None of the ANCOVA assumptions were violated.

A statistically significant difference was observed in resilience scores between the groups [$F(1, 121) = 5.21$, $p = .024$], with a small effect size, ηp2 = .04 after controlling for pretest condition ($p < .05$). Estimated marginal means indicated that the experimental group ($M = 21.2$, $SE = 0.22$) outperformed the control group ($M = 20.4$, $SE = 0.24$) on the posttest condition ($p < .05$), (see Table 3).

Variable	Experimental	Control			
	$M \pm SE$	$M \pm SE$	F	p	ηp^2
Resilience	21.2 ± .22	20.4 ± .24	5.21	.024	.041

Note. Pretest was used as the covariate; SE = standard error

Table 3: ANCOVA results for resilience scores

In order to measure the mean scores of the experimental group across three different time points, ANOVA was executed. Sphericity assumption is violated in the data set ($p < .05$); therefore, Greenhouse-Geisser corrected results are reported.

A repeated-measures ANOVA with Greenhouse-Geisser correction displayed a statistically significant difference in the scores of resilience [$F(1.26, 79.86) = 58.4$, $p < .001$, ηp2 = .48] across three different time points (see Table 4).

Variable	Time 1 Pretest	Time 2 Posttest	Time 3 Delayed Test			
	$M \pm SD$	$M \pm SD$	$M \pm SD$	F	p	ηp^2
Resilience	18.6 ± 2.92	21.2 ± 2.14	21.1 ± 2.31	58.4	.001	.481

Table 4: One-way repeated measures ANOVA results for resilience

A post hoc pairwise comparison using the Bonferroni correction illustrated a significant increase between resilience pretest ($M = 18.6$, $SD = 2.92$) and posttest ($M = 21.2$, $SD = 2.14$) conditions ($p < .001$). Put differently, the experimental group participants experienced statistically meaningful changes between the pretest and posttest conditions. According to further post hoc tests with Bonferroni correction, resilience posttest ($M = 21.2$, $SD = 2.14$) and delayed posttest ($M = 21.1$, $SD = 2.31$) conditions did not have a statistically significant difference ($p = .782$). Consequently, it was seen that the experimental group participants retained their posttest scores after 6 weeks of delayed condition ($p > .05$).

Qualitative Results

Out of 64 experimental group participants, 45 replied to open-ended questions. The questions targeted exploring the viewpoints on the efficiency of the programme, general practice atmosphere and probable changes observed in participants' social and emotional life. Participants' answers were all provided in English. The qualitative data were analysed

through a thematic analysis process and three themes emerged: a) increased mind-body awareness, b) emotion and stress regulation, c) quality of life.

Increased Mind-Body Awareness

The first and the second open-ended questions asked the respondents to share their overall comments on the programme and any witnessed changes. One ST reported that "focusing on university courses" were better after the programme because her mind "does not drift away that much" anymore. Another stated, "The programme was useful because it helped me develop a better awareness and a better connection to myself". For participants, this observed change included focusing on the moment, developing a keen awareness and connection with their body, ruminating less, and gathering their attention at their academic and daily life activities. Specifically, one ST stated feeling "apprehensive before the beginning of the programme due to the pandemic outbreak and online education", and not feeling connected to her "mental and physical being". However, the participant began to notice changes with regards to the psychophysiological being after the programme, stating "I am feeling more aware of my senses and more connected to my school". Another participant commented on "losing attention in classes and feeling worried before". After being introduced to yoga practices, the participant "felt peaceful". Overall, no contradictory statements were stated.

Emotion and Stress Regulation

The second salient theme was enhanced stress management capabilities of the practitioners. Participants explicitly reported that their coping abilities with stress and positive attitudes towards anxiety-provoking environments changed as they engaged in holistic yoga activities. Specifically, one ST stated, "I noticed that I could go back to normal very quickly after having hard times. I feel like meditation has helped me a lot in handling my anxiety". Another participant added "I am very panicked about anything in my school. The exams and heavy course-loads really upset me, but I feel less stressed out because now I can control myself better". Participants particularly commented on the efficacy of pranayama and meditation observed on self-stress management. One participant mentioned that it was hard for him to "recover from stressful events" before. However, now he felt "less anxious" because "breathing techniques were especially helpful". Some participants mentioned using pranayama and meditation when they were under "heavy course-load and examination" settings.

Quality of Life

The last theme was the perceived change in the quality of life in general. Participants were asked to describe their routines and observing any changes after yoga. Respondents particularly commented on these changes by comparing them to their previous physical and emotional conditions, as in the following quote: "My posture is a lot better. I had a stooped posture before". Another commented on seeing yoga as "unnecessary" before. However, after indulging in the practices, the participant witnessed "positive changes" in his "energy levels". One ST mentioned "sleeping better" because of employing "pranayama and meditation techniques".

Overall, online open-ended questions indicated that the participants benefited from the programme as a useful and feasible medium for mind-body awareness, emotion and stress regulation, and quality of life.

Discussion and Conclusion

The goal of this study was to examine the effect of holistic yoga practices on SECs and resilience of STs and to explore their viewpoints regarding the implementation of holistic yoga practices. The results indicated that STs' SECs and resilience were improved after the programme; however, learners' social awareness and decision-making process did not differ between groups despite the observed rise in the mean scores of the experimental group. It was observed that the impact of yoga practice on SECs and resilience was sustained after 6 weeks of recess.

The differences in the levels of self-awareness, self-management and motivation after holistic yoga implementation could be attributed to increased mind-body awareness, and emotion and stress regulation. As previously stated, yoga as a positive psychology exercise is particularly utilitarian in orienting its practitioners to remain at the present moment and direct attention at their psychophysical being (Morgan, 2011). Higher levels of mind-body awareness, and emotion and stress regulation are linked to enriched SECs (Sahdra et al., 2011). In return, reinforced SECs are connected to a better mental welfare. Similar results regarding the effect of yoga on self-awareness, self-management and motivation are present in the study by Schussler et al. (2020), illustrating the increased levels of greater self-awareness, self-regulation, physical, and emotional health. Despite the setting, participants and applications of both studies differed from the present one, all indicating a positive impact of yoga through the meditation of mind-body awareness and self-regulation. Therefore, the current study findings are aligned with the evidence of yoga entailing the transformation of individuals to a higher consciousness and well-being (Butzer et al., 2016) and promoting self-management and self-awareness.

The statistically insignificant changes in social awareness and prosocial behaviour and decision-making competencies between groups after the implementation might be attributed to the duration and the setting of the study. Although yoga practices are associated with well-constructed prosocial behaviours and responsible decision-making, reconstruction of these two phenomena might be challenging in cross-sectional study designs. Previously, yoga practice time was reported to be significantly and positively correlated with the number of positive outcomes (Carmody & Baer, 2008). Additionally, many yoga-based programmes finding significant changes on social awareness and responsible decision-making tend to last longer than 6 weeks (Balkrishna et al., 2019). A further reason could also be linked to the complex nature of cultivating social awareness and behaviours since doing so requires being aware of one's own self, other parties in interaction and several other situational factors (Mueller-Hanson et al., 2007).

The refinement of resilience after the programme could be rooted in promoting self-regulation through emotion and stress regulation, and self-efficacy. Previously, resilience was reported to be correlated with constructs such as coping abilities, agency, positive management strategies, being resourceful and self-regulation (Mansfield & Beltman, 2019). On many occasions, mindfulness-based practices were reported to impact on the ways people withstand difficulties and control their stress levels (Zhou et al., 2017). Although quite divergent from the APM programme, Cultivating Awareness and Resilience in Education programme by Jennings et al. (2013) displayed that the programme helped supporting teachers by catering for their self-efficacy, stress management and well-being. Recent studies on the psychological beneficence of yoga practices revealed that physiological mechanisms calm the nervous system by regulating allostatic load and optimal homeostasis (Schmalzl et

al., 2015). Likewise, the increased levels of self-management and self-awareness competencies of the experimental group participants could be interpreted as mediators of resilience. Additionally, the present study results conform with the findings of other studies displaying that resilience and interrelated competencies could be developed during preservice teacher education (Peixoto et al., 2018).

The qualitative findings revealed that participants observed changes in their mind-body awareness, emotion and stress regulation, and overall quality of life. These changes could be attributed to ameliorated living standards and adaptive stress responses after yoga. Holistic yoga programmes are transformative at an intrinsic level and provide a bottom-up impetus for participants' well-being (Butzer et al., 2016). Prior studies unravelled that after yoga interventions, participants go through positive health behaviour changes almost spontaneously without the absence of external instruction and imposition of the specialists (Ross et al., 2012). In a study by Bryan et al. (2012), engaging in yoga practices in less than two months period of time enabled fundamental changes in regular exercise, self-efficacy, and mind-body awareness. In this study, participants were observed to practise yoga for enjoyment and personal choice in and outside the programme and wished to continue their practices when the programme ended. This bottom-up motivational mechanism and engagement are regarded as the core elements enabling the transformation of the mind and body, self-regulation, and overall quality of life. Additional nontarget findings such as sleep regulation, posture refinement and overall increase in energy levels might also suggest that yoga exceeds the expectations in SECs and resilience of teachers and provide a sustainable base to continue practices freely and willingly.

Ultimately, the results demonstrated that by centring the attention on mind-body connection, self-regulating themselves and improving strength psychophysically, STs could ameliorate and refine their SECs and resilience. The study also revealed that the effects of yoga practice on SECs and resilience could be sustained even after the end of implementation. Constituting central interests in positive psychology, constructs such as well-being and optimal self-actualization functions were fostered.

Implications

The present study contributes to the literature by unravelling the impact of yoga on ameliorating SECs and resilience of STs. Holistic yoga was found to be linked to mind-body connection, self-regulation, and psychophysiological strength; therefore, when the goal is to exploit its potential benefits, yoga should not be viewed as a discontinuous discipline. Those inclined to explore the benefits of yoga must appreciate the discipline's holistic essence, recognise their own capacities and boundaries, and consult professionals prior to any implementations.

Since there are no studies in the literature, yoga in student teacher education should be practised with caution. Individual researchers or institutions are recommended to seek professional guidance and feedback prior to, during and after implementing yoga. In this study, one of the researchers was an instructor in the Faculty of Education and a professional yoga practitioner, which facilitated the implementation process. However, future studies need to consider that the integration of yoga into student teachers' professional development requires a substantial amount of preparation time. In addition, collecting data such as the overall health condition and demographic information is essential to track down learners' progress and tailor the programme.

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Teacher's Needs Analysis on Content Knowledge in Science: Basis for a Comprehensive Learning and Development Plan

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Abstract
The Department of Education aimed to provide training that is both relevant and responsive to teachers' needs to enhance their effectiveness. This study was undertaken to assess the training needs of science teachers regarding content knowledge in science, serving as the foundation for a Comprehensive Learning and Development Plan. The respondents in this study comprised science teachers from both Elementary and Secondary levels within the Division of General Santos City, Philippines. The competencies tested were aligned with the grade levels the teachers instructed, adhering to the prescribed learning competencies for each grade level. The instrument underwent rigorous validation by Learning Resource Evaluators (LRE). The study's findings revealed a clear necessity to reinforce teachers' content knowledge in identified least mastered competencies within the four science domains: Matter, Living Things, Earth and Space, and Force and Energy, across all grade levels. As a result, it is recommended that these identified competencies serve as the foundation for the development of a Comprehensive Learning and Development Plan. This plan aims to equip teachers with the necessary knowledge and skills to enhance their instructional effectiveness and ultimately improve science education.

Keywords: Teacher Needs Assessment, Learning and Development Plan

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Introduction

Science holds significant importance due to its connections with technology and industry, areas often given high priority for development from a national perspective (DepEd Order No.24, s. 2022). Its mission extends beyond imparting scientific knowledge; it aims to broaden learners' understanding of science and knowledge construction, promoting scientific literacy and responsible citizenship. Science education seeks to equip learners with the skills needed to make informed, science-based judgments and decisions, potentially impacting social health and environmental factors.

Science educators serve as the guiding lights, facilitating the teaching and learning process by conveying science concepts, instilling problem-solving skills, and teaching how to gather evidence to support ideas and decisions. Given the ever-evolving nature of science education, continuous improvement and updates in science knowledge are vital for educators to meet the changing demands and challenges in this field.

The result of the Trends in International Mathematics and Science Study (TIMSS), published by and found shows that the Philippines ranked 41st in Math and 42nd in Science out of 47 countries. The Philippines scored 297 in math and 249 in science which is significantly lower than any other country. The country also scored the lowest among all 58 participating countries for both tests. This would mean that much should be employed to raise this rank which must start with the facilitator of learning through the learning and development of science teachers.

Research indicates that teachers significantly influence students' learning outcomes. To improve education, we must improve teacher effectiveness, considering factors such as academic preparation, teaching experience, and relevant professional development programs.

The Department of Education aims to develop not just efficient but effective teachers. Ongoing training plays a pivotal role in achieving this goal, enabling teachers to learn and perform their roles more proficiently. In-service training for teachers is both a legal requirement and an ethical imperative.

DepEd Order No. 32, s. 2011, defines Training and Development (T&D) as a process that enhances individuals' knowledge, skills, and attitudes to perform their functions effectively. This includes various activities such as training, seminars, workshops, conferences, scholarships, and job-embedded learning, all involving a systematic process from assessment to program delivery.

Furthermore, DepEd Memorandum No. 050, s. 2020, underscores the significance of T&D in upskilling and reskilling teachers and school leaders, ultimately improving learning outcomes. This underlines the importance of conducting a Comprehensive Learning and Development program for Science Teachers, aligning with the department's goals. As McKinsey aptly states, "The quality of an education system cannot exceed the quality of its teachers."

In the Division of General Santos City, the Curriculum Implementation Division, particularly the Science Department, conducts an Online Test on Content Knowledge in Science as the basis for developing a Comprehensive Learning and Development Plan. The results, especially regarding the least mastered competencies, guide the topics covered in training sessions. This approach aligns with DepEd Order No. 32, s. 2011, emphasizing the importance of competence assessment, planning, resource development, and program delivery. A competency-based

approach is employed in designing Comprehensive Learning and Development for Science Teachers, encompassing competency-based assessment and training methods to enhance the quality of science education in the region.

Statement of the Problem

The study aimed to surface the least mastered competencies of teachers teaching science in both elementary and secondary schools.

Specifically, the study seeks to answer the following questions:
1. What is the profile of Science Teachers in terms of their specialization?
2. What are the least mastered competencies of Science teachers in Grades 4 to 12?
3. Based on the result how may a Comprehensive Learning and Development Plan for Science Teachers be designed?

Methodology

This study utilized a descriptive-survey research method. This research design was deemed appropriate to identify the least mastered competencies among science teachers in Grades 4 to 12. A survey design is an approach that offers a quantitative or numeric portrayal of trends, attitudes, or opinions within a population by examining a sample from that population.

Subsequently, a Comprehensive Learning and Development Plan was created.

Participation and Data Sources

A. All science teachers from both elementary and secondary schools participated in the competency-based online content knowledge test with a total of 932 teachers.

Data Gathering Procedures

The instrument that was used to gather the needed data was a survey questionnaire. It consisted of a 40-item test that was utilized in the online test. These items were derived from the Most Essential Learning Competencies (MELCs) per grade level. Each test covered the 4 domains in Science, including Matter, Force and Energy, Living Things, and Earth Science. The developed test was in Google Form, and the items and choices were scrambled to prevent any leakage on the test. The said instrument underwent a thorough validation process by the Learning Resource Evaluators.

Before the test was conducted, an orientation was held through Division Memorandum CID No. 73, dated 2021, titled "Orientation on the Development and Utilization of the Electronic Profiling System (EPS) and the Conduct of Training Needs Assessment for Science Teachers." This orientation aimed to achieve 100% participation of science teachers in completing the Electronic Profiling System and to ensure 100% participation of Science Teachers in the online test to assess teachers' needs in content mastery in Science. Following this, Division Memorandum CID No. 85, dated 2022, was issued regarding the Conduct of the Electronic Profiling System and Training Needs Assessment for Science Teachers. Its goal was to provide accurate basic information to science teachers and determine the training needs of teachers in Content Knowledge.

Validity

After the questions were crafted, the identified Learning Resource Evaluator in each Grade level validated the test questions. The Instrument was validated using the following criteria: 1.) clarity of direction and indicators, 2.) presentation and organization, 3.) suitability of indicators, 4.) adequacy of indicators per category, 5.) congruency to the purpose, 6.) impartiality of the researcher, and, 7.) appropriateness of the options and evaluation rating system. Through their expertise, revisions and improvements were made. The instrument would obtain an overall mean that must be good or very good for the test to be valid.

Data Analysis

Each item of the test was subjected to detailed analysis. The "Least Mastered Competencies" were identified as those competencies scoring below 75%. This indicated that the items associated with these competencies had not achieved full proficiency among teachers.

The process of identifying the least mastered competencies for each grade level was aligned with the guidelines outlined in DepEd Order 8, issued in 2015, which pertained to the "Policy Guidelines on Classroom Assessment for K to 12 Basic Education Program," as demonstrated below.

Table 1: Descriptors, Grading Scale, and Remarks

Description	Grading Scale	Remarks
Outstanding	90-100	Passed
Very Satisfactory	85-89	Passed
Satisfactory	80-84	Passed
Fairly Satisfactory	75-79	Passed
Did Not Meet Expectation	Below 75	Failed

Competencies that scored below 75% and were accompanied by the descriptor "Did not Meet Expectations" were collectively classified as the least mastered competencies. Following this classification, the identified least mastered competencies formed the foundation for planning Learning and Development initiatives aimed at supporting teachers in their professional growth.

Data Gathering Methods

Request for Permission to Conduct the Study: The study sought permission for its execution. Once approval was granted by the Schools Division Superintendent, the researcher proceeded to issue a memorandum regarding the administration of online tests for teachers.

Administration of Online Test :As the tests were administered remotely, teachers from each grade level were allocated a one-hour time frame for the examination. The test link was closed as per the predetermined schedule, in accordance with the guidelines set forth in Division Memorandum CID No. 85, issued in 2022, which pertained to the "Conduct of the Electronic Profiling System (EPS) and Training Needs Assessment for Science Teachers."

Analysis of the Results:Following the completion of the test, the collected data underwent analysis utilizing mean percentages to pinpoint the least mastered competencies.

Development of the Learning and Development (L&D) Plan:After identifying the least mastered competencies, a comprehensive 3-year Learning and Development Plan was formulated. This plan was designed to address the critical content areas identified for each grade level.

Major Findings

The main source of data were the result of the Profiling of Science Teachers and the Online Test on Content Knowledge in Science. The findings were presemted sequentially vis-a-vis the statement of the problem.

Table 2: Specialization of Teachers Teaching Science

Specialization	No. of Teachers
Chemistry	9
Physics	7
Biology	237
Earth Science	3
General Science	171
Physical Science	17
General Education	238
Not Related to Science	250
Total	932

Table 2 presents data concerning the specialization of teachers responsible for teaching science subjects. The majority of science teachers, totaling 238, hold degrees in General Education. Interestingly, all of these General Education graduates are teaching Elementary Science. Additionally, there are 250 teachers whose academic backgrounds are not science-related. Among the various science-related specializations, Biological Science stands out with the highest number of teachers, reaching 273, while Physics has the lowest representation, with only 7 teachers specializing in the subject.

This data underscores the observation that a relatively small number of science major teachers are tasked with instructing science subjects in the context of basic education. As noted by Co (2021), this situation is a prevalent challenge within the educational system, where teachers frequently find themselves teaching subjects outside their areas of expertise, resulting in a mismatch between subject assignments and teacher qualifications across grade levels, from elementary to tertiary education. This phenomenon of teachers instructing subjects without the necessary educational background or training has often been overlooked.

This issue is of significant concern because even highly qualified teachers may become considerably less qualified when assigned to teach subjects for which they lack appropriate training or education. Such unqualified teaching assignments can potentially have a detrimental impact on student achievement and undermine the overall educational process. It highlights the importance of aligning teacher qualifications with their teaching assignments to ensure effective and meaningful learning experiences for students.

Table 3: Consolidated Mean Percentage Scores of Elementary Teachers per Grade Level

Grade Level	Matter	Descriptor	Force and Energy	Descriptor	Living Things	Descriptor	Earth Science	Descriptor
Grade 4	98.27	Outstanding	63.67	Did Not Meet Expectation	88.04	Very Satisfactory	72.72	Did Not Meet Expectation
Grade 5	81.92	Satisfactory	67.94	Did Not Meet Expectation	61.04	Did Not Meet Expectation	76.9	Did Not Meet Expectation
Grade 6	72.1	Fairly Satisfactory	73.13	Did Not Meet Expectation	57.95.	Did Not Meet Expectation	63.9	Did Not Meet Expectation
Mean	84.1	Satisfactory	68.25	Did Not Meet Expectation	69.13	Did Not Meet Expectation	71.17	Did Not Meet Expectation

Table 3 shows the Consolidated Mean percentage scores of Elementary Teachers per Grade Level. The data reveals varying levels of performance among teachers across different grade levels in four science domains: Matter, Force and Energy, Living Things, and Earth Science. Grade 4 teachers excelled in Matter and achieved a very satisfactory performance in Living Things, but they did not meet expectations in Force and Energy and Earth Science. Grade 5 teachers achieved a satisfactory performance only in Matter, while Grade 6 students had a fairly satisfactory performance in Matter but did not meet expectations in the other domains. Across all grade levels, students generally did not meet expectations in Force and Energy, Living Things, and Earth Science.

Table 4: Consolidated Mean Percentage Scores of Secondary Teachers per Grade Level

Grade Level	Matter	Descriptor	Force and Energy	Descriptor	Living Things	Descriptor	Earth Science	Descriptor
Grade 7	71.93	Did Not Meet Expectation	77.67	Faily Satisfactory	82.17	Satisfactory	73.31	Did Not Meet Expectation
Grade 8	80.32	Satisfactory	61.62	Did Not Meet Expectation	64.02	Did Not Meet Expectation	70.71	Did Not Meet Expectation
Grade 9	65.48	Did Not Meet Expectation	70.92	Did Not Meet Expectation	72.23	Did Not Meet Expectation	83.32	Satifactory
Grade 10	53.89	Did Not Meet Expectation	50.8	Did Not Meet Expectation	63.41	Did Not Meet Expectation	80.66	Satifactory
Senior High School	65.56	Did Not Meet Expectation	55.45	Did Not Meet Expectation	53.46	Did Not Meet Expectation	65.09	Did Not Meet Expectation
Mean	67.44	Did Not Meet Expectation	63.29	Did Not Meet Expectation	67.06	Did Not Meet Expectation	74.74	Did Not Meet Expectation

Table 4 shows the Consolidated Mean Percentage Score of Secondary Teachers per Grade Level. The data provided reveals the performance of teachers in various grade levels across four science domains: Matter, Force and Energy, Living Things, and Earth Science. Notably, Grade 7, Grade 8, Grade 9, Grade 10, and Senior High School teachers all received descriptors indicating that they "Did Not Meet Expectation" in most of these domains.

In Grade 7, teachers did not meet the expectation in Matter and Earth Science. Grade 8 teachers fell short of expectations in all four domains, while Grade 9 teachers also did not meet expectations across the board. Grade 10 teachers performed below expectations in Matter and Force and Energy, while Senior High School teachers struggled to meet expectations in all domains.

The overall mean scores for all grade levels and domains further emphasize that, on average, teachers did not meet the expected proficiency levels in these science domains. This data suggests a widespread need for targeted interventions and improvements in science education across these grade levels to help students achieve the desired level of competency.

Conclusions

The data collected through various data-gathering instruments, including Chemistry, Physics, and Biology assessments, have consistently highlighted specific domains that require immediate attention within the context of the Online test. This observation can be attributed to the specialization or expertise of science teachers who participated in the assessment.

Firstly, Chemistry emerges as an area that demands particular focus. The performance data across different assessments within this domain consistently indicate that teachers may be facing challenges or gaps in their understanding of chemical principles and concepts. Addressing these challenges is critical to ensuring a well-rounded science education.

Secondly, Physics appears as another domain where attention is warranted. The results from Physics assessments consistently indicate that teachers may be struggling to grasp fundamental physics concepts and principles. This underscores the importance of enhancing the teaching and learning processes within this domain to improve student comprehension and proficiency in Physics.

Lastly, Biology stands out as a domain that requires careful consideration. The data consistently point to potential shortcomings in students' understanding of biological science concepts and topics. Enhancing the teaching strategies and resources in Biology is essential to promote a more comprehensive grasp of biological principles among students.

In conclusion, the data gathered through the Online test underscore the need to prioritize Chemistry, Physics, and Biology within the science curriculum. These domains have emerged as areas where students may require additional support and resources to strengthen their understanding. By addressing these specific challenges through targeted educational strategies and professional development opportunities for science teachers, educational institutions can work towards providing a more well-rounded and effective science education for students.

Recommendations

Based on the result, It is recommended to come up with a Comprehensive Learning and Development Plan. The Proposed Comprehensive Learning and Development Plan is a multifaceted and thorough strategy designed to address various crucial aspects of education. Its primary goal is to bring about positive changes in the educational landscape by concentrating on several key areas.

First and foremost, the plan emphasizes the creation of an effective learning environment. This means fostering an atmosphere where students feel motivated, engaged, and supported in their learning journey. An effective learning environment goes beyond physical spaces; it encompasses the overall culture of the educational institution, including the relationships between students, teachers, and the school community.

Secondly, the plan focuses on improving teaching-learning situations. This involves enhancing the quality of instruction, curriculum development, and assessment methods. By investing in the professional development of teachers, the plan aims to equip educators with the knowledge and skills necessary to deliver high-quality education.

Additionally, the plan places a strong emphasis on staying updated with modern instructional devices and methods. In today's rapidly evolving technological landscape, it's crucial for educational institutions to keep pace with the latest tools and techniques. This ensures that students are exposed to innovative and effective teaching methods that align with the demands of the modern world.

Lastly, the plan seeks to inspire teachers. Teaching is not just a profession; it's a vocation that requires passion and dedication. By providing support, recognition, and opportunities for growth, the plan aims to motivate and empower educators. Inspired teachers are more likely to inspire their students, creating a positive ripple effect throughout the education system.

In summary, the Proposed Learning and Development Plan is a holistic approach to education that aims to improve the overall quality of education. It recognizes that a combination of factors, including the learning environment, teaching quality, technology integration, and teacher motivation, all play a vital role in preparing students to meet the challenges of the modern world.

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Professional Training Through Simulation: Presentation of a Model and a Tool for the Analysis of Trainers' Debriefing Practice

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Abstract
Although fundamental (Neill & Wotton, 2011; Policard, 2015, 2018), the debriefing activity of debriefing trainers (Bastiani, 2017) and the measurement of its mastery (Wazonis, 2015) are the subject of little research. Current approaches, based on recommendations and assessment grids, have limitations in terms of the overall understanding of the trainer's activity. To fill these gaps, our article presents an operationalised model of trainer debriefing activity in simulation: the Pyra Debriefing Model (PDM). This model is structured around five poles (learner, trainer, device, results and objectives) and four areas (objectification, cognition, didactics and psychopedagogy), thus providing a better understanding of the interactions between the trainer and the learners during the debriefing. In addition, an analysis grid, GD-12, was developed to structure the trainer's verbal interventions for each of the 4 areas. The GD-12 makes it possible to analyse verbal interventions at three levels: the function pursued by the trainer, the concrete ways in which they are implemented and the purpose of the intervention. At present, the model and the grid have been used in the initial training of future teachers and future pharmacists, during hot and cold debriefings. In conclusion, PDM and his GD-12 grid open new perspectives for a better understanding of the debriefing activity of trainers, thus promoting a more enriching educational practice in initial training.

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1. Introduction and Issue

The activity of trainers in debriefing is 'an emerging area of research, particularly in Francophone research' (Policard, 2018, p. 60), given the importance of the trainer's action for the overall quality of the training device and for the pedagogical effectiveness of the sessions. Indeed, few studies have looked specifically at the 'debriefing' (Simoneau & Pilote, 2017) of the trainer (Bastiani, 2017; Duvivier & Demeuse, 2023a; Policard, 2018). However, it is recognised that 'mastery of debriefing skills is crucial to facilitating student learning' (Neill & Wotton, 2011p.162) and that the way in which a trainer leads the debriefing is a determining factor (e.g. Krogh et al., 2016; Oriot & Alinier, 2018; Rall et al. 2010; Secheresse, 2020), both in terms of their commitment (Policard, 2018), attitude (Bastiani, 2017; Dubois, 2017) and mastery of skills (Wazonis, 2015; Bastiani, 2017).

The literature explores debriefing activities (Simonceau & Pilote, 2017) using three main approaches: the recommendation approach, the evaluation grid approach and the debriefing technique approach. The recommendation approach (e.g. Ross, 2021; Salas et al., 2008) suggests general principles for debriefing, but does not look at trainers' actual practice or how they actually guide learners. As Amigues (2009) points out "professional [training] activity cannot be limited to the prescriptions defined by any form of 'hierarchy'" (p.14).

Evaluation grids make it possible to assess the principles of debriefing, but they do not take into account the actual activity of the trainer or its effectiveness (Coggins et al., 2022; Van Malleghem, 2019). In addition, they are mainly derived from the health sector, which limits their applicability outside this field. Finally, the approach of debriefing techniques reflects the different debriefing methods such as DeltaPlus, advocacy inquiry or circular questions (Bauchat & Seropian, 2020). These techniques are seen as complementary tools that support the trainer's activity and interaction with the learners (Bauchat & Seropian, 2020). However, they require practical training to avoid mechanical and meaningless use (Abulebda et al., 2023).

This diversity of approaches highlights the importance of considering the debriefing activity in all its complexity and of adopting a nuanced approach in order to understand its different facets and practical implications. This difficulty is compounded by the fact that there is currently only one model that theorises the trainer's activity in post-simulation debriefing, called D-STAM (Debriefing Simulation Trainer Activity Model) (Duvivier et al., 2023). Based on the activity theories of Leplat and Cuny (1974), the D-STAM (Duvivier et al., 2023) provides a global understanding of trainer activity in post-simulation debriefing by considering input variables, process variables and effect variables. Despite its theoretical contributions, it presents difficulties in operational practice. Therefore, it seems important to develop tools and approaches to improve its operationalisation, taking into account the concrete realities in the field.

In this context, the aim of this paper is to present a) an operational model, the Pyra Debriefing Model (PDM) (Duvivier et al. 2023), for describing the debriefing activity of trainers and b) a grid tool, the GD-12, based on the said model, for analysing in detail the activity of the trainer during the post-simulation debriefing. The tool was used to analyse 19 'cold' post-simulation debriefings in the context of training future teachers and 52 'hot' post-simulation debriefings in the context of training future dispensing pharmacists.

The article is divided into three main parts. First, a theoretical framework is used to critically examine the trainer's activity during debriefing. Next, we develop the conceptual framework that guided our approach before describing the PDM and GD-12. Finally, the article concludes with a reflective discussion of the limitations of our approach and the prospects for further research.

2. Methodology

PDM and GD-12 grid were based on a literature search in 9 databases, including five French and four Anglo-Saxon databases (Springer, Cairn - Psychology and Education section, Open Edition, Eric, PubMed, Semantic Scholar Paper Corpus, Google Scholar, Pascal et Francis and ERUDIT). Searches were conducted using specific keywords such as 'debriefing', 'simulation', 'vocational training', excluding references to virtual simulation. The selected works focused on the field of vocational training, both initial and continuing, and were selected on the basis of the presence of at least one trainer in the debriefing context. There were three stages in the selection process: first, the titles and abstracts were read, then the full text articles were examined, and finally the works cited in the bibliography and in the connected papers were reviewed. In the end, 33 papers were selected to support the construction of the PDM and the GD-12 grid (Table 1).

Table 1: Database review of the trainer in post-simulation debriefing

Database	First round	Second round	Retained
Open Edition	18	3	1
PubMed	86	10	5
ERUDIT	23	6	1
CAIRN	475	7	3
Pascal & Francis	34	6	0
Google Scholar	371	12	6
Springer	861	2	2
ERIC	156	14	1
SCOPUS	765	22	4
Addition to the margin			9
TOTAL	3439	87	33

Once the PDM and the GD-12 grid had been developed, a practical test was carried out in two initial training fields at the University of Mons. The first field involved 19 debriefings of future teachers. The debriefings lasted on average 50 minutes and were conducted in a cold and individual way between a learner and a trainer. The trainers were two women (34 and 36 years old) with 8 and 5 years of experience in debriefing. The second field includes 52 post-simulation debriefings of future dispensing pharmacists, carried out on the spot in groups (between 15 and 18 learners). Two trainers were involved in this system. They are a man (26 years old) and a woman (45 years old) with an equivalent debriefing experience of 1,5 years.

There are several reasons for the very different contexts in which the model and the tool were tested. Firstly, testing the model and tool in a variety of contexts gives us a better

understanding of the scope and relevance of these two elements in different educational settings. Secondly, by confronting the model and the grid with heterogeneous contexts, we are looking for consistency in the results, which will attest to the effectiveness of the model regardless of the specifics of the training under consideration. Then, the use of deliberately different samples allows us to explore the factors that might influence the debriefing of the trainer (for example, the fact that some work individually while others work in groups). Finally, by exposing the model and the tool to a wide variety of situations, we assess their internal coherence, thus ensuring their adaptability and applicability in different educational contexts.

The approach adopted in this study is both deductive and inductive. It is deductive because it relies on a pre-existing theoretical framework to guide the analysis, as emphasised by Savoie-Zajc (2000, 2004 cited by Bocquillon, 2020). However, it is also inductive because the pre-established GD-12 is enriched by integrating other elements that emerge from the data itself (Mukamurera et al., p. 114 cited by (Kelsey & Hayes, 2015). This makes it possible to broaden the scope of the study and take into account aspects that may not be explicitly provided for in the initial theoretical framework.

3. Theoretical Background of Pyra Debriefing Model and GD-12

3.1. The Post-simulation Debriefing Trainer: Primarily a Facilitator Trainer

The definition of debriefing now seems to be established, resembling a reflective conversation with the learner at the centre (Kelsey & Hayes, 2015), able to support and trigger reflection (Tutticci et al., 2018) and aims to understand the underlying reasons for the results obtained during the simulation, while focusing on the quality of the processes and behaviours used during the simulated situation, with the aim of improving the learner's future performance (e.g.Bauchat & Seropian, 2020; Dubrous, 2020; Duvivier & Demeuse, 2023b; Policard, 2018; Secheresse, 2020). This debriefing phase is usually supervised by a trainer (Sawyer et al., 2016; Dubois, 2017; Bastiani, 2017), who may be referred to by various names such as 'teacher', 'mediator', 'instructor', 'mentor' and 'facilitator' (Jones et al., 2014, cited by Policard, 2018). Nevertheless, "facilitator" is the most commonly used term (Duvivier et al., 2023; Policard, 2018).

Despite the range of facilitation styles reported in the literature (Tuttici et al., 2018), the essence of a trainer-facilitator's (TF) debriefing activity can be characterised in three ways. First, the debriefing activity of a TF is first and foremost a pedagogical act. Indeed, the TF assumes the role of mediator between the learners, the knowledge to be acquired and himself/herself (Simoneau & Pilote, 2017), recalling Houssaye's concept of the pedagogical triangle (1998). This role of mediator aims to encourage learners to develop their understanding, analyse and synthesise their reasoning, emotions and actions during the simulation (Fanning & Gaba, 2007; Rudolph et al., 2008).

Secondly, the TF's debriefing activity focuses on the relationship and interactions with the learners. This stance of the facilitator, as described by Policard (2018), involves accompanying, questioning and guiding the learners (Simoneau & Pilote, 2017), fostering a fraternal or even co-learner approach, as evoked by Fanning and Gabba (2007). This orientation thus moves away from a more traditional transmissive or authoritarian role, as Horcik (2014) also points out. The importance of this stance is all the more evident given that the process of analysing learners' actions is reflexive in nature, going beyond simple

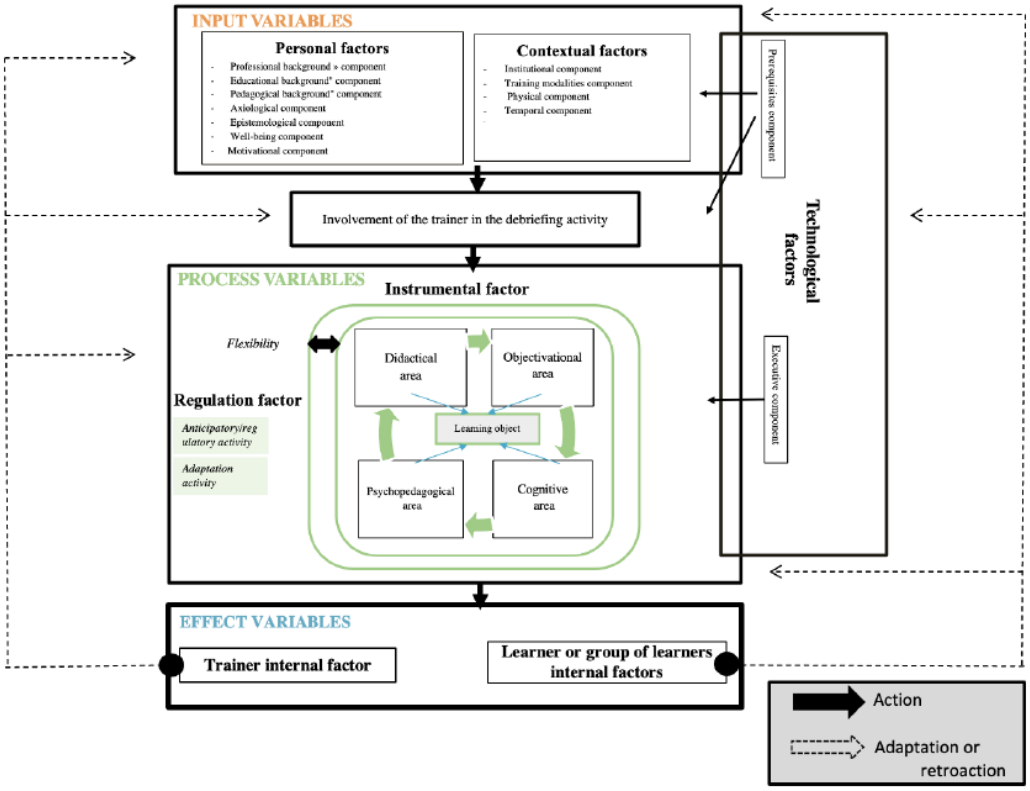
observation (Tuttici et al. 2018) and requiring a transformation of perspective (McDougall & Davis, 2011), through mechanisms of awareness, assimilation and accommodation, in a dual movement of putting the action back into context and distancing oneself from the action in order to give it a different meaning (Dubois, 2017). Furthermore, the trainer's activity is linked to his or her motivation and interest in the practice. According to Policard, (2018), the engagement profile influences the trainer's pedagogical stance and determines whether he or she adopts a controlling or an "empowering" approach towards the learner.

Finally, the debriefing activity of a TF is subject to double regulation by the trainer. The double regulation of the activity refers to the dynamic process by which the trainer adjusts and regulates his activity a) as a function of both the external factors of the work situation and the characteristics of the learners and b) as a function of internal factors, in particular his professional experience, his pedagogical skills and his ability to facilitate the learners' learning (cf. Duvivier et al., 2023). By ensuring this dual management, the trainer thus tends to regulate, on the one hand, his own role as facilitator in order to promote the co-learning approach and stimulate the learners' active engagement (Samurçay & Rogalski, 1998) and, on the other hand, the group dynamics and the progress of reflection in order to achieve the specific learning objectives (Simoneau & Pilote, 2017).

3.2. From D-STAM (Duvivier et al. 2023) to Pyra Debriefing Model

As we pointed out earlier, neither the recommendation nor the grid approach seems to me to provide access to a complete and nuanced record of a trainer's debriefing activity. The current situation can be attributed to the fact that there is currently only one model that theorises the trainer's activity in post-simulation debriefing, called D-STAM (Debriefing Simulation Trainer Activity Model) (Duvivier et al., 2023).

Figure 1: D-STAM (Debriefing. Simulation Trainer Activity Model) (Duvivier et al., 2023)

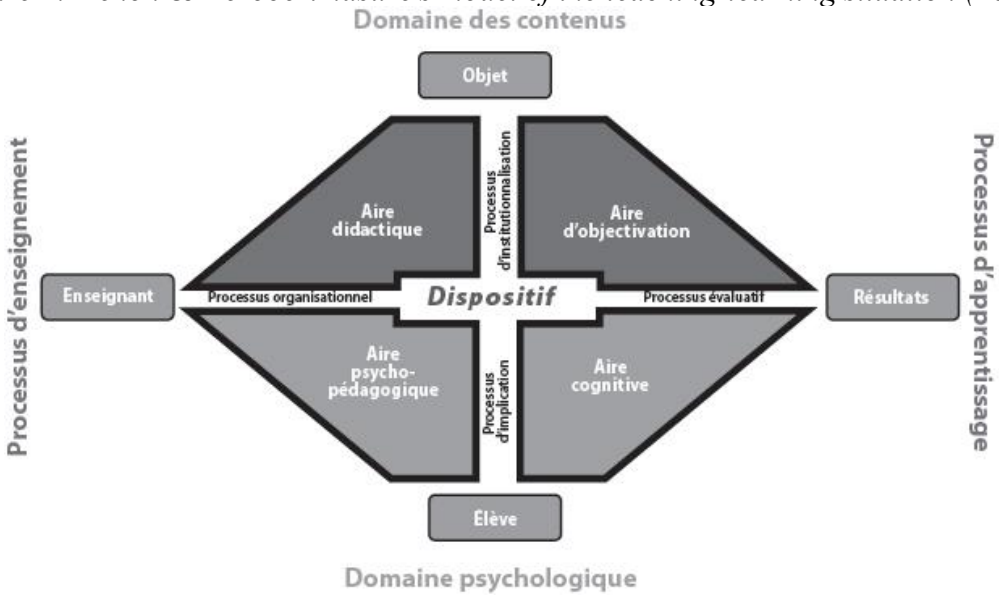


Based on the activity theories of Leplat and Cuny (1974), the D-STAM (Duvivier et al. 2023) provides a global understanding of the activity of trainers in post-simulation debriefing by considering input variables, process variables and effect variables (see Duvivier et al. 2023 for a summary). Despite its theoretical contributions, it poses difficulties in operational practice. It is therefore important to develop tools and approaches to improve its operationalisation, considering the concrete realities on the ground. The authors of the D-STAM (Duvivier et al. 2023) chose to focus on level 2 process variables, following the framework established by Dunkin and Biddle (1974) and emphasising instrumental factors. The result of their work is the PDM, which is presented below.

3.2.1. Presentation of the Theoretical Basis of the Pyra Debriefing Model (PDM)

The PDM is an activity model for debriefing trainers in a simulation-based training context. Debriefing is seen as a pedagogical activity that includes both teaching and learning. According to Hérold (2019), a teaching-learning situation involves trainers and learners who are brought together in the same space-time and are subject to specific constraints and resources, making the situation unique, event-driven and experiential (Pastré, 2011, cited by Herold, 2019). Although few studies have dealt with the modelling of teaching-learning situations, and even fewer with post-simulation debriefing, some proposals for models have been put forward, such as Dunkin and Biddle (1974), Gage (1978) or Hérold (2019) (cited by Hérold, 2019). We chose the teaching-learning model of Dehon & Derobertmasure (2015), which, based on Houssaye's (1993) pedagogical triangle, postulates that a pedagogical teaching-learning device is structured in four components: the didactic, psycho-pedagogical, cognitive and objectification domains (Dehon & Derobertmasure (2015).

Figure 2: Dehon & Derobertmasure's model of the teaching-learning situation (2015)



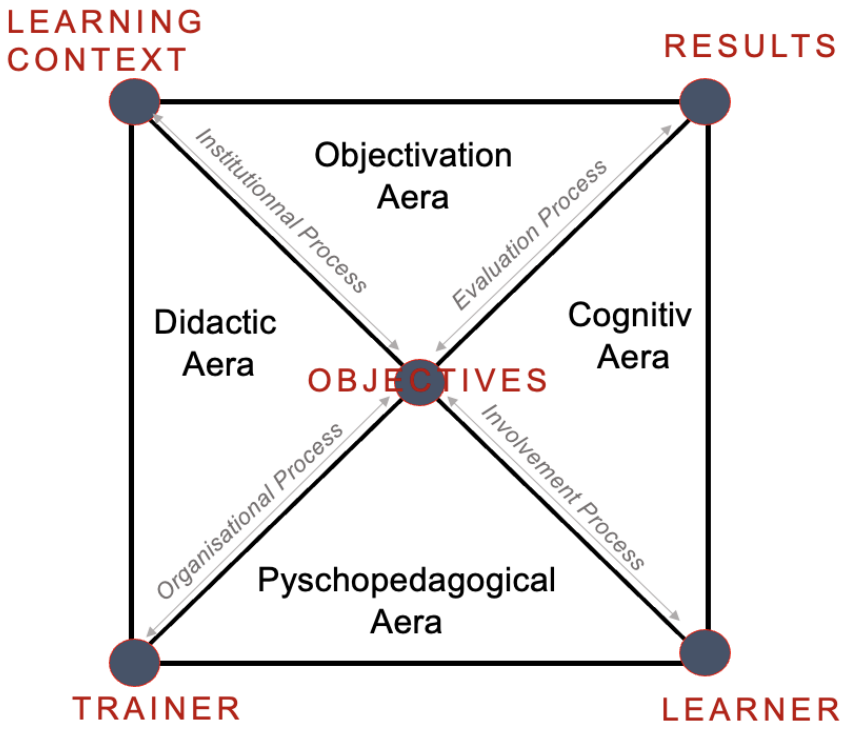
The teaching-learning model is justified in relation to the problem under consideration in several ways. Firstly, according to its designers, it allows us to focus on the trainer. Secondly, the model is developed and applied to debriefing after microteaching sessions, a form of simulation according to Chernikova et al. (2020). In addition, the model highlights the relationships and interactions between the trainer and the learners that are central to the debriefing process. Finally, the theoretical underpinnings of the model promote a pre-

reflective environment among learners (Derobertmasure, 2012), which is directly aligned with the aims of debriefing.

3.2.2. Presentation of the Pyra Debriefing Model (PDM)

As Dehon & Derobertmasure (2015) , the design of the PDM focuses on "what the trainer does" during the debriefing situation. This conception encompasses the specific and complex operational gestures and discourses that the trainer implements to facilitate student learning. This leads us to conceive the trainer's activity in debriefing as being at the intersection of several axes (or pole) characterised by actors, spaces, actions and interactions (Pastré, 2006). More specifically, the PDM (Figure 3) presents five equidistant poles, each of which is associated with key factors in post-simulation debriefing according to the scientific literature (giving the model a pyramidal structure).

Figure 3: Pyra Debriefing Model



The 'learning context' pole refers to the specific setting or circumstances in which an educational activity takes place. It encompasses the setting, conditions and elements that influence the learning experience (Cheng et al., 2015; Oriot and Alinier, 2018; Bauchat & Seropian, 2020; Secheresse, 2020; Arafeh et al., 2010; Peters & Vissers, 2004). This may include factors such as the physical environment of the debriefing room (e. g. Diaz-Navarro et al., 2021; Oriot & Alinier, 2018; Savoldelli & Boet, 2013).

The 'learner' pole concerns the trainee and his profile, including his level of expertise, his learning style, his place in the dynamics of the group of learners (Cheng et al., 2014; Sawyer et al., 2016; Dubois, 2017; Bauchat & Seropian, 2020), as well as the other individual factors of the D-STAM cited by Duvivier et al. (2023).

The "trainer" pole concerns the person who leads the debriefing, taking into account his or her personal factors (Duvivier et al. 2023), preferences (Secheresse, 2020; Bastiani, 2017; Dubois, 2017) and style (Policard, 2018).

Considering that the trainer is interested in the question of "results" (e.g.Chinara & Pellerin, 2014; Oriot & Alinier, 2018; Rudolph et al. 2008), in particular between what is expected and what is achieved by the learner (Rudolph et al. 2008; Oriot & Alinier, 2018, Vanpee, 2010), the "results pole" includes the behaviour implemented by the learner during the simulation and the reflections verbalised during the debriefing.

These four areas are related to the learning objectives of debriefing and, on a larger scale, simulation. They are considered central by many authors (e.g.Vanpee, 2010; Ross et al. 2021; Levin et al., 2019; Sawyer et al., 2016 ; Bastiani, 2017; Oriot & Alinier, 2018), including Secheresse (2020), who states that the ultimate aim of debriefing is to "make the link between the learning achieved during the training and a precise action plan" (p. 66). This link is part of an institutional, evaluative, organisational or participative logic (Figure 3), depending on the trainer's activity.

Furthermore, by cross-referencing the relationships between the five poles, four domains emerge (according to Derobertmasure, 2012; Dehon & Derobertamsure, 2015), which are presented in table 2.

Table 2: Description of the 4 domains of the Pyra Debriefing Model

Pyra Debriefing Model Area	Interrelation of aeras	Definition
Didactic	Device — Trainer — Objectives	Related to content and its transmission, this area encompasses the selection, organization of information, pedagogical methods, resources used, etc. Its aim is to make the training content clear, relevant, and accessible, thus fostering understanding and assimilation of knowledge by learners.
Objectification	Device — Result — Objective	Puts the simulation results (observed behaviors) and debriefing discussions into perspective with the learning environment. It encourages the analysis of learners' actions, identifies strengths and areas for improvement, and promotes critical reflection in line with learning objectives. Objectification aims to increase learners' awareness, facilitate knowledge integration, and encourage metacognitive reflection.
Cognitive	Learner — Result — Objective	Focusing on the underlying reasons for learners' behaviors during the simulation, this domain analyzes cognitive processes, decision-making, strategies used, and mental representations. It seeks to understand factors influencing learners' actions, such as their learning, reasoning, motivation, skill level, and learner profile.

Psycho-Pedagogical	Trainer — Learner — Objective	Centered on the interpersonal relationship between the trainer and the learner, this domain concerns how exchanges unfold and verbal interactions take place. It considers the level of facilitation, the degree of trainer involvement, support for understanding, and the creation of an atmosphere of trust and mutual respect. The psycho-pedagogical area fosters an environment conducive to learning, encourages active learner engagement, and supports their professional and personal development throughout the debriefing. It also encompasses the spatial organization and time management implemented by the trainer.

4. Introduction to the Verbal Intervention Analysis Grid for Trainer Debriefing (GD-12)

4.1. Key Words for Understanding How the GD-12 Grid Works

It is important to consider certain preliminary elements in order to fully understand how the GD-12 grid works: 1) verbal interventions, 2) notion of function, 3) definitions of implementation methods, 4) definition of object.

4.1.1. Verbal Intervention (Indicator to Consider)

There are many schemes for annotating and counting behaviours and thus minimising observer inference (Doabler et al., 2021). In GD-12 we are interested in the verbal debriefing interventions of the trainer. According to (Barrière-Boizumault, 2013), a verbal intervention refers to "all information that is exchanged verbally" (p.17).

4.1.2. Notion of Function (What?)

Verbal interventions in GD-12 are discussed according to their functions. Inspired by De Landsheere & Bayer (1974) and Beaugrand (1988, p. 285), cited by (Bocquillon et al., 2018), as well as Poggi (2003) (cited by Farouk et al. 2007) and Farouk et al. (2007), the notion of function refers to the presumed objective pursued by the trainer when he/she sets up a verbal intervention during the debriefing. This function-based approach highlights the intentional nature of the debriefing act, where the trainer's actions are categorised into well-defined functions and objectives (Maubant et al., 2005 cited by Bocquillon et al. 2018). In addition, analysis by function provides a better understanding of the interactions between trainers and learners during debriefing in simulation. Note that in GD-12, verbal debriefing interventions are not distinguished according to their preventive or restorative intent.

4.1.3. Methods of implementation (How?)

The intention to debrief can be expressed through a method of implementation. An implementation method refers to the way in which the trainer chooses to act or express himself in order to carry out a given intervention during the debriefing. We have favoured pre-reflective modalities, i.e. approaches that encourage in-depth reflection, especially in the context of debriefing, whenever possible.

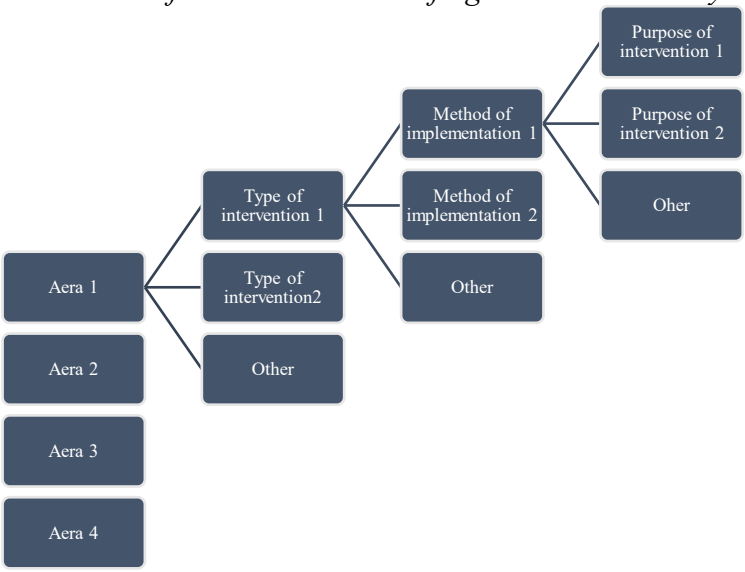
4.1.4. Object of Intervention (About What?)

The object of intervention refers to the specific areas to which the trainer's interventions during the debriefing refer. In other words, it is the subject or topic on which the trainer's intervention during the debriefing session is focused (Derobertmasure, 2012).

4.2. Structure of the GD-12

Figure 4 illustrates the overall structure of the GD-12. The grid is structured around the four poles of the PDM. It consists of 12 debriefing intervention functions (the "what"), which are subdivided into delivery methods (the "how") and the subject of the intervention (the "what"). Furthermore, in the process of coding verbal interventions, it is imperative that all semantic units are completely distinct and covered (principle of exclusivity) and that they are classified in a specific category (principle of exhaustiveness). In practice, this means that additional 'other' categories are included at each level[1].

Figure 4: Overall structure of the trainer's debriefing intervention analysis grid (GD-12)



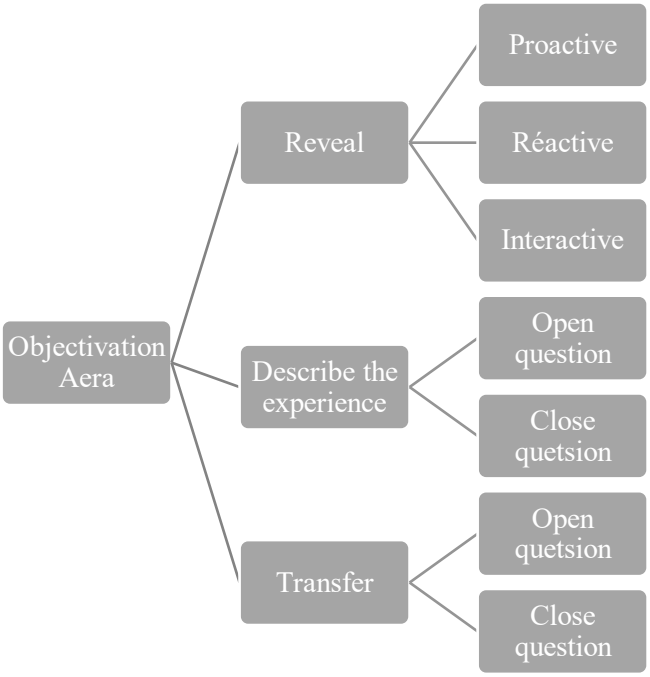
4.3. Presentation of the Types of Intervention and Their Implementation Methods by Aera

4.3.1. Objectification Aera

The objectification domain includes three types of intervention (Figure 5).

[1] For ease of reading, the "other" categories have not been included in the figures in 4.3.

Figure 5: Presentation of the types of intervention and their implementation methods for the objectification domain



In the '**reveal**' function, according to Dugal (2009)[2], the trainer plays an active role by revealing, pointing out and showing the learners something that they have not seen, heard or perceived that relates to either the simulation or the debriefing. The aim of the trainer's intervention is therefore to shed light on certain aspects of the simulation or debriefing activity that the learners may have missed during their experience. The trainer can highlight subtle elements, key interactions or significant behaviours that the learners may have missed. In GD-12, there are three types of strategies implemented for the 'Reveal' function that relate to the same object: proactive, reactive or interactive (adapted from Derobertmasure, 2012). A proactive intervention occurs when a teacher speaks alone. A reactive intervention occurs when a learner intervenes in response to the trainer's intervention. Interactive interventions include all other forms of intervention in which trainers and learners discuss and share.

In the "**describe the experience**" function, based on Guillemette (2012) and Stoloff et al. (2016), the trainer tries to create and share with all members of the debriefing, including himself, an accurate and factual mental representation of the situation experienced during the simulation (Secheresse, 2020). Interventions of the "describe the experience" type thus make it possible to ensure that all learners have a similar understanding of what happened during the simulation in terms of the tasks and functioning of the team (Klimoski & Mohammed, 1994). They are useful for debriefing as each learner may have a different perception of events depending on their focus on certain aspects of the scene and their base of prior knowledge and experience. The "describe the experience" function can be implemented using open and closed questions.

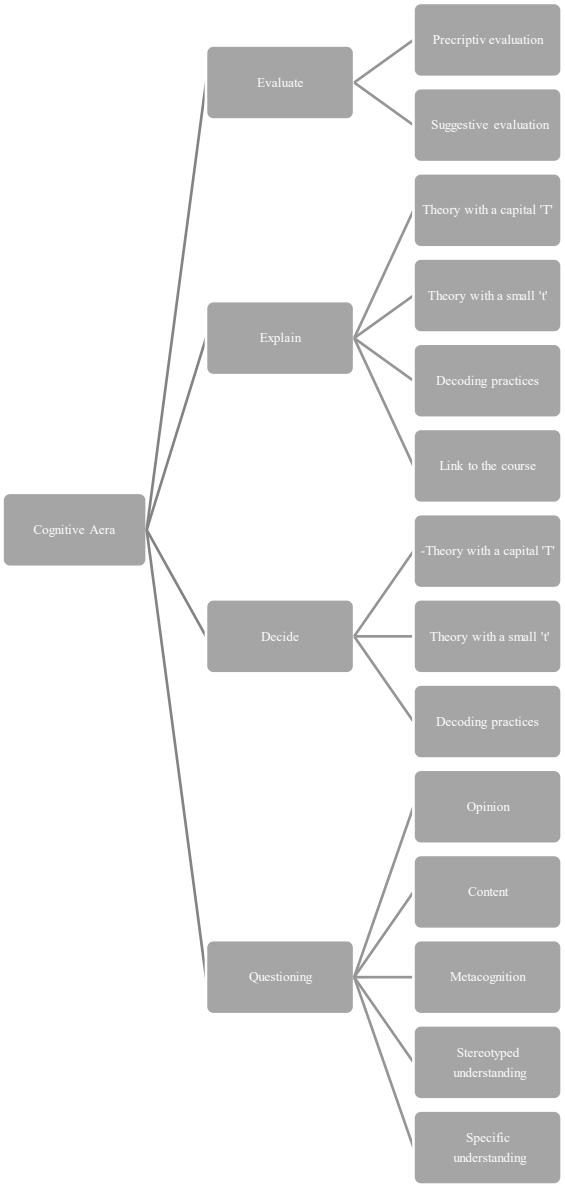
[2] Dugal's model (2009), developed for educational advisors, is used by Alonso Vilches et al., (2021) for debriefing, particularly post-event.

In the "**transfer**" function, the trainer's interventions aim to transfer the learning identified in the simulation and debriefing to the real work context (Oriot & Alinier, 2018). The aim is to get the learners to "make the link between the learning achieved during the training and a specific action plan in order to promote the transfer of learning (Tardif, 1999)" (Secheresse, 2020, p.66). Interventions of this kind are therefore forward-looking in the sense that they aim to change and improve future action by asking what could have been done and by making decisions aimed at planning future action. The 'describe experience' function can be implemented using open and closed questions. In line with Bastinai (2017), open questions offer greater freedom of response, while closed questions can be useful for eliciting specific information.

4.3.2. Cognitive Aera

The cognitive aera includes four types of intervention: assessing, explaining, deciding and questioning (Figure 6).

Figure 6: Representation of the types of interventions and their implementation for the cognitive domain



In the '**evaluate**' function, the trainer gives a judgement on the learner's actions or words, both during the simulation and during the debriefing. This evaluation can take different forms (Bastiani, 2017). With this approach, the trainer can make recommendations to improve the learner's performance (prescriptive evaluation) or offer advice or food for thought to raise the learner's awareness (suggestive evaluation).

According to Guillemette & Luckerhoff (2022), the '**explain**' function refers to the fact that the trainer establishes links between the simulated situation and theoretical knowledge by focusing on the logic underlying the sequence of actions (St-Arnaud, cited in (Guillemette & Luckerhoff, 2022). As described by Guillemette and Luckerhoff (2022), the trainer suggests "referring to previous learning that has played a more or less important role in the course and logic of the action (...) as well as to new knowledge, research findings and theoretical bases in order to compare ideas and theories with other knowledge, not with a view to evaluating the past but with a view to improving the future" (p.7). Table 3 shows the 4 methods used in this function (based on part of the Bocquillon et al. 2015 grid).

Table 3: Methods of implementation for the 'Explain' function

Methods of implementing the "Explain" function	Definition
Theory with a capital "T"	Expressing academic or theoretical knowledge, addressing a theoretical element, quoting an author, or establishing connections based on theoretical principles.
Theory with a lowercase "t"	Expressing in the form of practical advice or opinion without necessarily explicitly citing theoretical sources.
Decryption of practices	Expressing elements related to the analysis of practices and the situation.
Links to the course	Expressing a connection to the content of a course already given or upcoming.

According to Dugal (2009), the '**decide**' function refers to the trainer providing the answer to a problem. This approach aims to provide an immediate and clear solution to a given situation, giving the learner a definitive answer. When the trainer decides, he or she takes on the role of a directive guide, giving specific information or solutions to the learners. This type of intervention can be useful in certain situations where an immediate response is required, especially for novice learners (Secheresse, 2020). However, it can limit the opportunities for learners to explore and develop a reflective approach. The integration of the 'Decide' intervention into the GD-12 grid is all the more important as trainers tend to adopt a transmissive stance during debriefing (e.g. Bastiani, 2017; Policard, 2018; Savoldelli & Boet, 2013; Secheresse, 2020). Furthermore, the 'Decide' intervention is structured around three implementation modalities derived from the work of Bocquillon et al. (2017; 2019): theory with a capital 'T', theory with a small 't' and decoding practices (cf. Table 3).

According to Duval (2009), the '**questioning**' function implies that the teacher adopts an attitude of inquiry and curiosity by asking questions to deepen the understanding of what the learners are saying. This approach also allows the teacher to gather additional information about the learners' thinking and cognitive processes, which can be useful in identifying their strengths and weaknesses. Unlike Bastiani's (2017) approach, which assesses this dimension according to the type of question (open/closed), we have chosen a more specific approach

based on Bocquillon et al. (2019). According to the authors, the trainer can use five types of objectification (questions) to explore different aspects of learners' thinking and obtain additional information (Table 4).

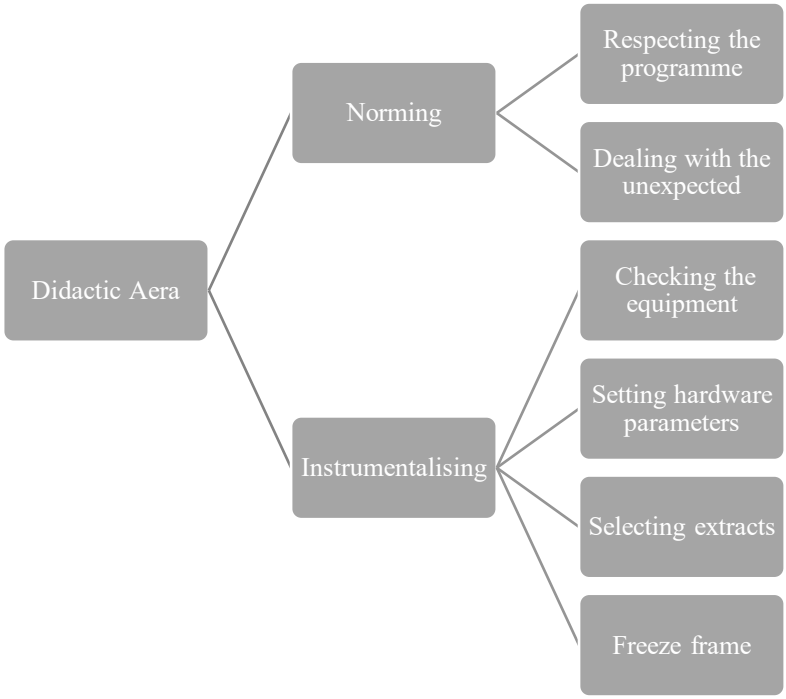
Table 4: Methods of implementing the "questioning" intervention

Methods of implementing the "Question" function	Definition
Stereotypical comprehension questions	These brief interventions ("Is that clear?", "Can we move on?") involve requests for comprehension that generally do not encourage learners to further express their level of understanding. They mainly aim to quickly verify if learners have understood without encouraging a real expression of their ideas or difficulties. In this sense, learners can respond positively even if they haven't fully grasped the content, limiting the accurate assessment of their true understanding.
Metacognition questions	These aim to encourage the manifestation of metacognition in learners. According to Bocquillon et al. (2019), metacognition can be defined as an awareness of one's own intellectual functioning (Raynal & Rieunier, 2012) or as the ability to reflect on one's own thinking (Gauthier, Bissonnette & Richard, 2013).
Specific comprehension questions	More elaborate, these questions require learners to develop their responses, allowing the trainer to obtain real information about what is understood ("Why did you choose this solution?").
Content-related questions	Content-related questions aim to "objectify the content. They mainly take the form of questions about the content (e.g., 'What is the capital of France?')" (Bocquillon et al. 2019, p.18).
Opinion questions	The trainer asks for the learners' opinions, particularly based on their personal or professional experiences ("How did you react to this emergency situation?").

4.3.3. Didactic Aera

The didactic area is structured around 2 intervention functions: normalising and instrumentalising (Figure 7).

Figure 7: Types of intervention and how they are implemented in the didactic area



The '**norming**' function has two objectives: a) to comply with the programme (Policard, 2018) and b) to deal with the unexpected and uncertainty. To achieve the first objective, the trainer implements interventions related to the parameters of space and environment, as well as interventions related to the parameters of time and rhythm (Delgoulet & Vidal-Gomel, 2013). To achieve the second objective, the trainer implements strategies to maintain a safe zone in the face of the unexpected and uncertainty, whether cognitive, behavioural, organisational (e.g. Policard, 2018 ; Krogh et al., 2016) or technological (Krogh et al. 2016).

In interventions with an "**instrumentalising**" function, according to Policard (2018), the trainer adopts a technicist logic. The "instrumental" function concerns the trainer's use of artefacts, i.e. training tools used to mediate between the learner and knowledge (Nijimbere, 2013; Rabardel, 1995a, 1995b). However, while Policard (2018) limits instrumental interventions to partial or high-fidelity simulators (e.g. mannequin), our research takes a broader view by considering any technological artefact, such as the use of video clips. Our choice makes sense in light of numerous authors who point to video debriefing as the 'gold standard' (e.g. Levett-Jones & Lapkin, 2014, p.62; Krogh et al. 2016; Sawyer et al. 2016). Based on our field observations and Krogh et al. (2016), instrumental interventions were grouped into four modalities of implementation (Table 5).

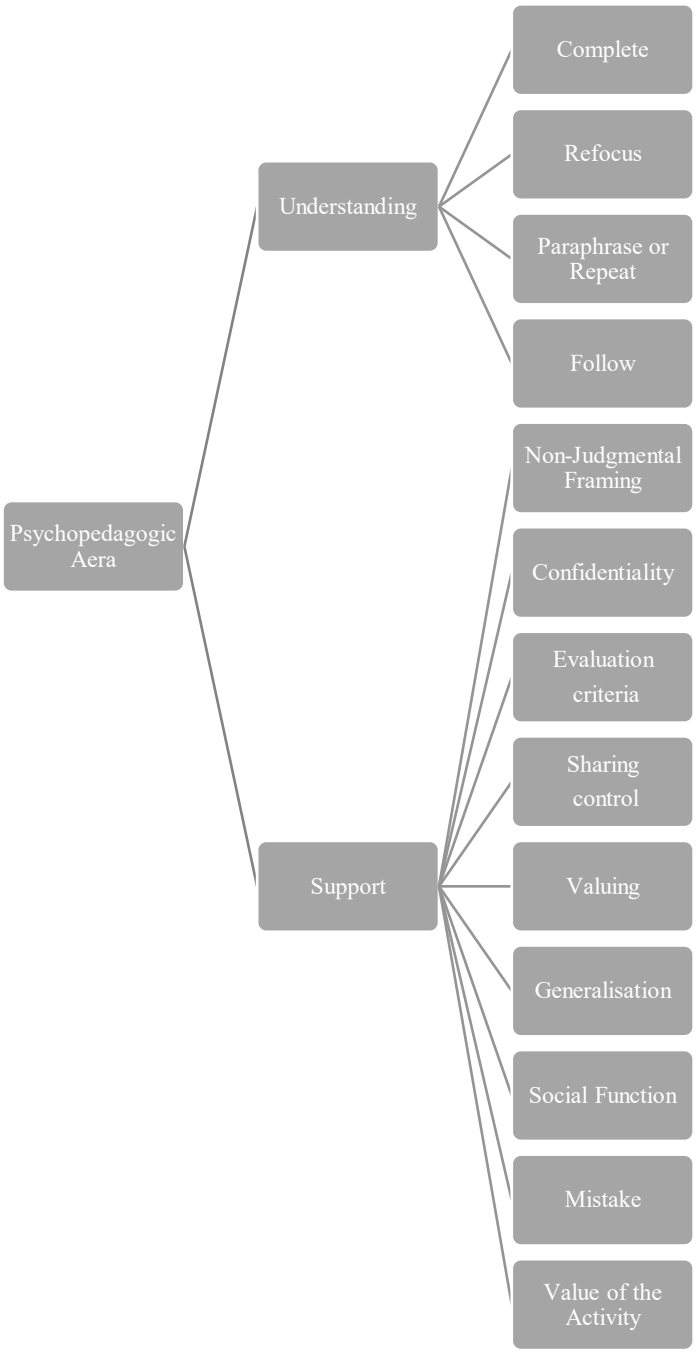
Table 5: Implementation modalities of the 'instrumentalise' function and definitions

Implementation Modalities of the "Instrumentalize" Function	Definition
Check Equipment	These interventions involve the trainer ensuring that all necessary simulation materials are ready and functioning properly. They may check technical equipment such as simulators, video recorders, audio devices, etc. This step aims to ensure that the simulation will proceed without technical issues.
Configure Equipment	In this modality, the trainer adjusts the settings of the equipment used during the simulation, such as sound, speed, brightness, etc. These adjustments can be made to replicate real conditions of the simulated situation or to adapt the environment to learners' needs.
Select Excerpts	The trainer may purposefully choose excerpts from video recordings captured during the simulation. These excerpts can be used to highlight specific moments of learners' activity or to illustrate certain key points to be debriefed later. This selection focuses learners' attention on crucial aspects of their performance.
Pause and Analyze	During the debriefing phase, the trainer can pause a specific video at a particular moment to analyze a situation or action in more detail. This approach allows for close examination of critical moments or specific interactions, providing opportunities for in-depth reflection and discussion with learners.

4.3.4. Psychopédagogic Aera

The psychoeducational area is made up of 2 types of intervention: understanding and support (Figure 8).

Figure 8: Types of intervention and how they are implemented in the psychopedagogical area



The "**Understanding**" function refers to interventions aimed at listening, reformulating or facilitating expression (based on Dugal, 2009). These interventions include listening attentively, reformulating what learners say and facilitating their expression (Dugal, 2009). Within GD-12, the "Understanding" function is broken down into four modalities (based on Bocquillon et al., 2015) (table 6).

Table 6: Implementation mode of the "Understand" function

Implementation Modality	Definition
Complete Learner's Statements	The trainer may complete learners' statements by finishing their sentences or inviting them to continue their reflection ("What do you mean?"). This strategy aims to encourage learners to develop their ideas and express their thoughts more comprehensively.
Refocus Learner's Statements	The trainer refocuses learner statements by revisiting essential elements of their input. This approach aims to clarify ideas addressed by learners and to keep the discussion centered on the debriefing objectives.
Paraphrase or Repeat Learner's Statements	The trainer paraphrases learners' statements by expressing them in their own words. This strategy verifies mutual understanding between the trainer and learners and promotes clear and precise communication within the group.
Follow the Conversation	The trainer uses interjections like "mmh," "ah," or "yes, that's right" to show attentiveness to the conversation and active engagement with learners' exchanges. This modality facilitates smooth transitions between topics discussed in the debriefing and encourages dynamic and interactive discussion

The '**supportive**' function refers to the trainer's actions to encourage and comfort learners (according to Dugal, 2009). This function has been highlighted as enabling an environment that is conducive to learner expression, giving learners the assurance that they can take risks and express their emotions safely (Spill & Gatin, 2019). We have identified several ways in which the support function can be implemented (Table 7).

Table 7: Ways of implementing the support function

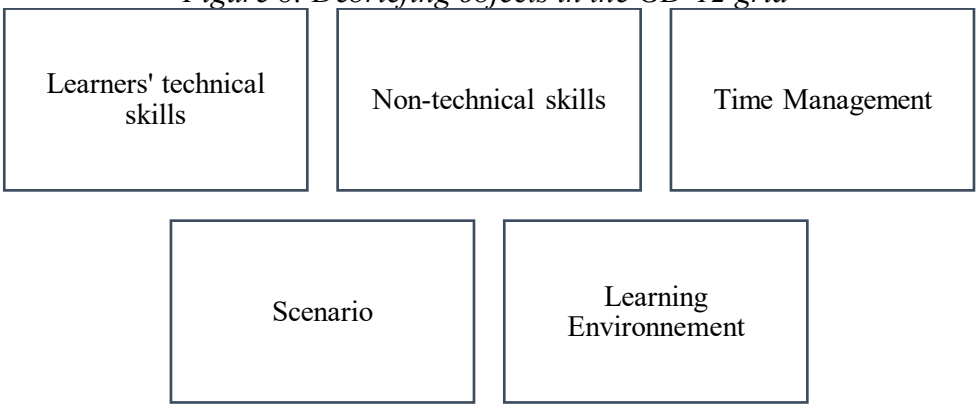
Method of Implementation and Reference Authors	Definition	References
Non-Judgmental Framing	Establishing a non-judgmental and non-critical environment that encourages learners to express themselves freely and feel safe.	Spill & Gatin, 2019; Rudolph et al. 2008; Oriot & Alinier, 2018
Confidentiality	Ensuring the confidentiality of exchanges and information shared during debriefing, creating a space of trust.	Rudolph et al. 2008; Savoldelli & Boet, 2013; Spill & Gatin, 2019; Horczik, 2014; Servotte et al., 2018
Transparency of Evaluation Criteria	Clearly communicating the evaluation criteria used during debriefing to assess learners' performance.	Viau & Louis, 1997 ; Oriot & Alinier, 2018
Sharing Control	Actively involving learners in the debriefing process and giving them a share of control over the content and conduct.	May et al., 2004

Valuing the Learner	Recognising and highlighting the efforts and progress made by learners during the simulation.	Spill & Gatin, 2019
Depersonalisation or Generalisation	Avoiding personalising individual errors or performances and generalising them to draw collective lessons.	Spill & Gatin, 2019
Social Function	Using reassuring and de-dramatising interventions to create a climate of trust and goodwill. Also using polite language and humour to create a friendly atmosphere.	Boquillon et al. 2015
Acknowledge Your Own Mistakes	Acknowledging and sharing your own mistakes as a trainer to create a learning climate that is open to questioning.	Spill & Gatin, 2019
Reinforce the Value of the Activity	Emphasising the educational value of the simulation activity and highlighting its limitations to optimise learning.	Spill & Gatin, 2019

4.4. Objects for Debriefing (About What?)

The trainer has a variety of objects on which to intervene in order to support learners in their reflection and learning process (Derobertmasure et al., 2016). These objects cover a wide range of skills and dimensions identified in our literature review. Importantly, the objects of intervention are not limited to what happened during the simulation but can also include the learning and reflections that emerge during the debriefing. We list 5 categories in the GD-12 grid (Figure 8).

Figure 8: Debriefing objects in the GD-12 grid



During the debriefing, the trainer intervenes in the different skills of the learners. Technical skills (or hard skills) "group together specific technical skills and gestures" (Couarraze, 2019, p.97). The trainer focuses on their level of mastery and execution. Soft skills are also important but difficult to capture (Bastiani, 2017; Couarraze, 2019). They include learners' interpersonal, attitudinal and communication skills (Courraze, 2019), such as communication, leadership, teamwork, stress management and certain cognitive skills, such as planning, decision making, task allocation and situational awareness (Chinara & Pellerin, 2014). The trainer can also debrief the learners on their time management during the simulation (e.g. Oriot & Alinier, 2018; Bastiani, 2017; Krogh et al. 2016). Another object of debriefing concerns the level of understanding of the simulation scenario (e.g. Oriot & Alinier, 2018; Sellberg, 2018), where the trainer checks the understanding of the contexts, the roles of the actors, the stakes and the specific objectives. Finally, the trainer pays particular attention to

the simulation environment, including the physical and contextual features that influence the learners' actions.

5. Conclusions, Limitations and Perspectives

The study of the trainer's activity in debriefing is a rapidly emerging area of research, which is crucial in the context of simulation-based training. Research, such as that of Wilhelm (1991), has highlighted the importance of the trainer's skills in determining the quality of the simulated experience perceived by the learner. Despite this recognition, the debriefing activity of trainers remains understudied (Bastiani, 2017; Policard, 2018). The PDM, which focuses on 'what the trainer does' during debriefing, offers an innovative perspective. It presents five equidistant poles associated with the key factors of debriefing according to the scientific literature. These poles define four different areas that characterise the trainer's activity. The GD-12 grid developed within this framework makes it possible to analyse the trainer's verbal interventions according to their function, the way they are carried out and the subject discussed. This approach opens up new avenues of study for understanding the specificities of trainers' activity in post-simulation debriefing, in particular by considering trainers with different field experiences and studying their impact on learners' level of reflexivity. However, this approach has its limitations. The model and grid were tested on specific devices and improvements could include other signals of trainer behaviour, such as communicative gestures.

In conclusion, studying the debriefing activity of trainers is a promising way of optimising debriefing sessions and improving learner learning in simulation. The PDM and the GD-12 grid are promising tools for this multidimensional research in educational science.

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Threats and Opportunities of Chat GPT in Online Learning With Elementary/Primary Students

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Abstract
This paper introduces the recently popularised computer AI (Artificial Intelligence) program called Chat GPT (Generative Pre-Trained Transformer) in an educational context. The paper then goes on to discuss the potential threats and opportunities that have and may still emerge for elementary/primary education. This is specifically discussed in the context of online learning. These opportunities and threats are largely collated from teacher surveys and teacher interviews. These surveys and interviews revealed that over 90% of elementary/primary teachers felt Chat GPT is more of an opportunity than a threat. Some of the key threats which emerged related to: academic dishonesty; ethical issues; assessment; and this platform being used to draw conclusions for students and feed them answers. Some of the key opportunities which emerged related to: saving time; differentiating; information accessibility; and enhancing the learning experience. Practical applications for the use of this technology in online learning with elementary/primary aged students are provided. Limitations of this paper are discussed.

Keywords: Online Education, Elementary, Online Learning, Chat GPT, Artificial Intelligence

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Introduction

Online learning has increased significantly over the last decade. This has been partly due to the Covid-19 epidemic, and partly due to technological improvements which improved this process. As this domain grows, the technologies which support this domain also grow, as such, teachers need to keep up to date with these developments in order to provide the best learning experience for students (Ko, & Rossen, 2017).

One of the biggest technological developments that has occurred recently, and that will have a significant impact on education both online and in class, is Chat GPT. This is an Artificial Intelligence program which allows a user to ask questions and then creates responses for them. It can create poetry, speeches and even essays and reports. With the introduction of Chat GPT, teachers globally have voiced concerns that students will no longer produce their own work, simply using Chat GPT to provide them with answers as opposed to thinking things through themselves (Yu, 2023; Maboloc, 2023). Equally, teachers have found this to be a key opportunity to develop their online teaching practice and integrate a new technology which has been found to be engaging for students. Technology and the engaging of students are two of four of the biggest problems that elementary teachers face when teaching online (Macur, 2022a), so the integration of this program may well tackle two of these key issues.

This paper seeks to produce some data on the online teachers' perspectives relating to this new technology, and to produce some professional practitioner suggestions on how to integrate it into online teaching practice.

Methodology

This paper collected data through a mixed methods approach. This was done to better inform data triangulation, as well as to validate the findings of the survey stage (Almalki, 2016). The first stage was a survey of 18 elementary teachers who teach predominantly in online settings. This data was collected through Microsoft Forms.

A total of four questions were asked, these were: Q1: "Is Chat GPT more of a threat or an opportunity in online education?"; Q2: "What Threats come to mind when you think Chat GPT and online learning?"; Q3: "What Opportunities come to mind when you think Chat GPT and online learning?"; Q4: "What practical methods of integrating Chat GPT in online teaching with Elementary students have you used or come across?" For Q1, the data was graphed in a pie chart to visually demonstrate the proportions of the teacher votes. For the other three questions, the most common responses were collected to formulate the key threats, key opportunities and practical application opportunities that teachers should be mindful of when incorporating this tool into their practice.

Once the data from the four questions was collated, the findings were reviewed with an experienced online teacher who works predominantly with elementary ages students. This stage added a final professional practitioner perspective in relation to how accurate the findings were when considered for classroom application.

Finally, the limitations of the study were discussed and a conclusion was created including some key takeaways for teachers who choose to incorporate this technology into their online practice.

Chat GPT in Education

Chat GPT can function as a lesson planner, activity generator, topic chooser, scheme of work creator and even an assessor of written work. Chat GPT cannot replace teachers, it must be integrated and teachers fully equipped to utilise it in an effective and efficient way (Ausat, et al. 2023). This is backed up by the concept that online teachers have a duty to keep up to date on latest technology which can support their teaching practice (Macur, 2022b).

There are a range of risks and concerns that are raised throughout the educational community around this new program. These concerns fundamentally have one thing in common, the acknowledgement that there is risk that students and educators become over reliant upon Chat GPT (Fuchs, 2023). Simultaneously, there are a range of positives, both predicted and already reported. It was found that Chat GPT can improve motivation and engagement in open education (Firat, 2023), two of the prime factors relating to educational success. Also, that two key opportunities for Chat GPT are improved learning efficiency and communication (Yu, 2023).

When thinking about the online context, it would be simple for students to have Chat GPT open during the lesson, funnelling any questions from the teacher into it, meaning they do not need to think or be challenged to create their own ideas and answers. As such, educators should be mindful of how lessons and courses are planned (Kasneci, et al, 2023).

The Findings

In this section, the responses to the questions were presented in the order of each question. Not every response is listed, rather, commonalities between answers were used to create categories of concern.

The first question: “Is Chat GPT more of a threat or an opportunity in online education?” was answered and found that 94% of teachers in this survey agreed that Chat GPT is more of an opportunity than a threat. The data is shown below in a pie chart.

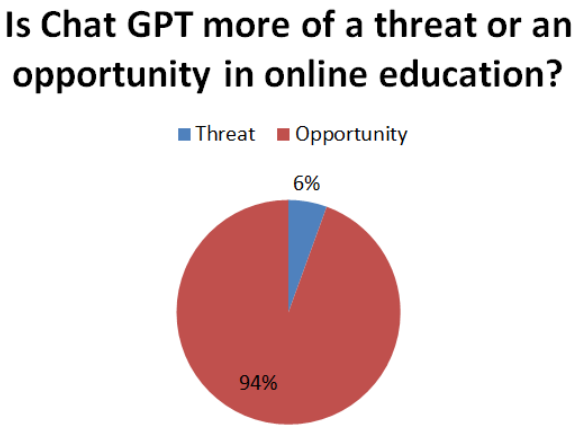

Figure 1: This is an image of a chart to show the percentage of teachers who felt Chat GPT is more of an opportunity than a threat

In response to the second question: “What Threats come to mind when you think Chat GPT and online learning?” the threats which emerged repeatedly were: Academic dishonesty, ethical issues, assessment and plagiarized conclusions. The general commentary from the

group of teachers centred around how students would use this platform to feed them the answers and complete any tasks as fast as possible.

In response to the third question: "What Opportunities come to mind when you think Chat GPT and online learning?" the opportunities which emerged repeatedly were: Saving time, differentiating, increased efficiency of information accessibility and enhancing of the learning experience. The general commentary from the group of teachers centred around how students would be able to access information rapidly, as well as teachers' planning and lesson creation workload reduced.

In response to the fourth question: "What practical methods of integrating Chat GPT in online teaching with Elementary students have you used or come across?" the four most common responses included: As a research tool, to support with lesson planning, for student self-assessment and to model tasks.

Reviewing of the Findings

The findings were then reviewed with an experienced online teacher who works predominantly with Elementary aged students. Where appropriate, the researcher questioned the teacher to dig deeper on their answer. Responses have been summarised and grouped into areas of agreement or disagreement.

The teacher agreed that: Chat GPT is an opportunity, much like the introduction of Google when that was developed; Chat GPT is an effective research support tool; Chat GPT can save time during planning. The teacher disagreed that; Chat GPT is an effective self-assessment tool. The teacher stated that self-assessment should be reflective of the student as opposed to provided by a platform; Chat GPT causes plagiarism issues, as teachers generally know their students well enough to tell if there has been use of an AI tool. Where unsure, teachers can use a plagiarism AI checker. When challenged by the researcher in relation to the self-assessment comment, to think if there were ways to use this platform for students to generate self-assessment tools, the teacher agreed this may be possible.

The interview with this experienced online teacher largely solidified the findings of the survey stage. This backs up the recommendations which can be pulled from these surveys.

Limitations

Some limitations of this study include: There was no practical in-class study incorporated into this paper; teacher perspectives can be very context specific; only 18 teachers were surveyed; only one teacher was used to review the findings.

Conclusion

This paper explored the threats, opportunities and practical application potential of Chat GPT with elementary students in an online learning context. This was firstly explored through a review of recent literature relating to Chat GPT in education. Following this, a survey of 18 educators who work predominantly in online contexts was complete. It was found that 94% of the teachers surveyed agreed that Chat GPT was more of an opportunity than a threat. This means that only 1 of the 18 teachers felt opposite. The four key threats which emerged from this survey were Academic dishonesty, ethical issues, assessment and plagiarized

conclusions. The four key opportunities were: Saving time, differentiating, increased efficiency of information accessibility and enhancing of the learning experience. The four practical applications which repeatedly came up were: As a research tool, to support with lesson planning, for student self-assessment and to model tasks. When reviewed with an experienced online teacher, these findings were largely agreed upon. It seems clear after reviewing the literature and gaining insight from this focus group of teaching professionals that Chat GPT is an opportunity for teachers to reduce workload and focus their efforts on working more directly with students. Beyond this, it is an opportunity for students to expand their research capability, streamlining their gathering of information. That said, it is important for educators to be mindful of how they create courses, this way, students have the best learning experience possible when integrating this new technology.

Further research on this topic is needed; practical in-class studies which explore the recommendations of this study and produce data around the implementation of Chat GPT when teaching online are the next steps the author of this paper recommends.

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Education Plan According to Age and Experience to Reduce Human Error of Construction Workers

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Abstract
In Korea, as construction projects become increasingly large and complex, many construction accidents are occurring. According to the Ministry of Employment and Labor, as of 2021, the number of accident victims in the construction industry is the second highest after other industries, and the number of accident deaths accounts for about 50%, ranking first in Korea. When analyzing accident victims in the Korean construction industry in 2021, those over the age of 60 or older account for 41% of the total. Also, based on experience, less than 6 months accounted for 91% of the total. Therefore, the purpose of this study is to find education plan according to age and experience to reduce the human errors of construction workers. As a result of this study, memory error and action error appeared in both analysis according to age and experience. So, education plan is needed to focus on training to comply with these safety work procedures and improving education methods to remember them for a long time.

Keywords: Safety Education, Human Error, Construction Accident

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Introduction

In Korea, as construction projects become increasingly large and complex, many construction accidents are occurring. According to the Ministry of Employment and Labor, as of 2021, the number of accident victims in the construction industry is the second highest after other industries, and the number of accident deaths accounts for about 50%, ranking first in Korea. Researches to prevent accidents in construction projects have been conducted in various areas, and recently, researches are being conducted to reduce accidents by reducing human errors in construction projects (Park, 2011).

When analyzing accident victims in the Korean construction industry in 2021(Ministry of Employment and Labor, 2021), those over the age of 60 or older account for 41% of the total. Also, based on experience, less than 6 months accounted for 91% of the total. So, in order to conduct education to reduce human errors of construction workers, it is necessary to find different ways according to age and experience.

Therefore, the purpose of this study is to find education plan according to age and experience to reduce the human errors of construction workers. The results of this study will be used as basic data on how education should be conducted according to the age and experience of construction workers.

Status of Accident Victims of Korean Construction Industry

As shown Table 1 and Table 2, the number of accident victims in the Korean construction industry shows a large difference according to age and experience (Ministry of Employment and Labor, 2021). By age, those under the age of 40 accounted for 9.7%, those aged between 40 and 50 accounted for 14.8%, and those aged between 50 and 60 accounted for 34.2%. In other words, in the Korean construction industry, the older the age, the higher the number of accident victims.

In terms of experience, less than 3 years accounted for 97.9%, followed by 3-10 years with 1.7% and 10 years or more with 0.4%. In the Korean construction industry, it can be seen that the shorter the experience, the higher the number of accident victims.

Total	Under 18 ages	18 ~ 24 ages	25 ~ 29 ages	30 ~ 34 ages	35~ 39 ages	40 ~ 44 ages	45 ~ 49 ages	50 ~ 54 ages	55 ~ 59 ages	60 ages more
26,888	1	169	588	800	1,060	1,577	2,406	4,080	5,121	11,086
100%	0.0%	0.6%	2.2%	3.0%	3.9%	5.9%	8.9%	15.2%	19.0%	41.2%

Table 1: Status of accident victims of Korean construction industry according to ages.

Total	Less than 6 months	6 months to less than 1 year	1 year to less than 2 years	2 year to less than 3 years	3 year to less than 4 years	4 year to less than 5 years	5 year to less than 10 years	More than 10 years
26,888	24,441	1,010	617	252	146	107	209	106
100%	90.9%	3.8%	2.3%	0.9%	0.5%	0.4%	0.8%	0.4%

Table 2: Status of accident victims of Korean construction industry according to experiences.

Human Error in Information Processing of Human

One of the most important causes of accidents in the accident occurrence mechanism can be said to be unsafe behavior of human (AIK, 2010). Human error is one of the fundamental causes of unsafe behavior by human (OSHRI, 2002). It is when humans fail to achieve a goal regardless of their will while cognizing, decision-making and acting to achieve a specific goal.

Human behavior is accomplished through a series of processes. When a stimulus is given, humans cognize it and determine which stimulus it is. In this process, when appropriate information is obtained through stimulation, information is processed based on the information and decision-making is made, and at this time, the human memory is used. When decision-making is complete, humans decide their own actions (Park, 2016).

In summary, it can be divided into four stages: (1) cognition of information or stimulation (2) information storage and memory (3) information processing and decision-making (4) action. In detail, it can be divided into cognitive checking errors (information delivery error, information checking error), thinking and memory errors (thinking error, decision-making error, memory error), and action operation errors (action error, operation error, operation checking error).

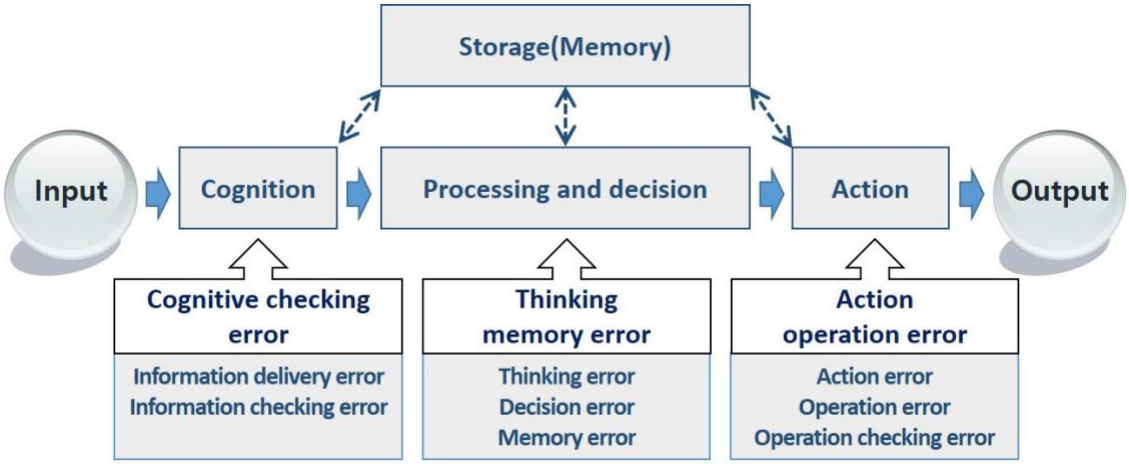

Figure 1: Type of human error in information processing of human.

Analysis of Human Error According to Age and Experience

Construction workers' human error according to age and experience was measured on a 5-point Likert scale using a questionnaire at construction sites of large construction companies in Korea. Excluding insincere respondents, a total of 142 survey results were used for analysis. The average age of the survey respondents was 50.5 years old, and the average experience was 15 years.

In this study, age was divided into less than 40 age, 40-49 ages, 50-59 ages, and 60 ages more. The reason is that the distribution of the number of accident victims in the construction industry showed an inflection point in which the number of victims increased slightly at the 40 age and 50 age, and it was found that it increased rapidly when the 60 ages more.

Although the distribution of the number of accident victims in the construction industry showed that the number of victims with less than 6 months of experience was overwhelmingly high, the experiences of construction workers were analyzed by dividing them into less than 3 years, 3 to 10 less than years and more than 10 years. The reason is there were actually very few (3 people) survey respondents who had less than 6 months of experience, and looking at the distribution of the number of victims in the construction industry, after 3 years, the number of victims tended to decrease gradually until 10 years.

Ages	Freq. (%)	information delivery error	information checking error	thinking error	decision-making error	memory error	action error	operation error	operation checking error
Under 40 ages	29 (20.4%)	2.04	***1.83***	2.14	***2***	2.09	***2***	2.12	1.9
40 ~ 49 ages	21 (14.8%)	2.06	***2.06***	2.11	***1.88***	2.11	***2.02***	2.04	2
50 ~ 59 ages	57 (40.1%)	1.79	***1.98***	1.95	***1.77***	1.93	***1.75***	1.88	1.79
60 ages more	35 (24.6%)	2.01	***2.06***	2.14	***2.1***	2.08	***2.07***	2.09	1.86

Table 3: Results of construction workers' human error according to ages.

Ages	Freq. (%)	information delivery error	information checking error	thinking error	decision-making error	memory error	action error	operation error	operation checking error
Less than 3 years	17 (12.0%)	1.91	1.69	2	***2.06***	2.01	***2***	***2.07***	1.71
3 to less than 10 years	27 (19.0%)	2.14	2.04	2.12	***1.98***	2.1	***1.98***	***2.02***	1.93
More than 10 years	98 (69.0%)	1.88	2.01	2.06	***1.87***	2.01	***1.89***	***1.99***	1.87

Table 4: Results of construction workers' human error according to experiences.

In Table 3, information checking error, memory error, and action error showed higher scores in those 60 ages more those under 40 ages. In other words, it can be seen that construction workers 60 ages more likely to cause information checking error, memory error, and action error than workers than under 40 ages. In addition, in Table 4, memory error, action error, and operation error showed higher scores as the experience was lower. In other words, it can be seen that those with less than 3 years of experience are more likely to cause memory error, action error, and operation error than those with more than 10 years of experience.

Conclusion

As a result of this study, memory error and action error appeared in both analysis according to age and analysis according to experience. Memory error is an error in forgetting or misremembering work contents, and action error is an error in habitually misbehaving during work or unconsciously working. Therefore, it is thought that accidents can be reduced by focusing on training to comply with these safety work procedures and improving education methods to remember them for a long time. The results of this study will be helpful as basic data on how education should be conducted according to the age and experience of construction workers.

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The Effects of the Flipping Classroom and Peer Instructional Models on Learning Mathematics

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Abstract
This study examines the impact of the flipped classroom and peer instruction teaching models on students' mathematics performance. More than one hundred students participate in a four-month study, and they are divided into three groups. A control group is being taught according to the traditional model. The first experimental group is being taught according to the flipped classroom model. A second experimental group is being taught using both a flipped classroom and a peer-instructional model. A quasi-experimental design is implemented, and three research tools are designed and used. These tools are YouTube channel, tests, and survey. We expect the results of this study to show that the performance of students in flipped classroom and a peer-instructional model class outperformed those in other two sections. This approach hopes to provide students with long-term learning as they are at the center of the learning process. In addition, this approach gives us the opportunity to know the math skills that each student needs. We hope to generalize this teaching model to other science majors. This educational model effectively contributes to quality education.

Keywords: Flipped Classroom, Peer-Instructional Model, Quasi-experimental Design, YouTube Channel

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Introduction

A flipped classroom is an instructional approach where students watch pre-recorded video lectures or complete readings before class, and then use class time to engage in hands-on activities, discussions, and problem-solving exercises. The goal is to shift the traditional lecture-based learning to a more interactive and engaging learning experience.

On the other hand, peer-instruction is a teaching method where students work in small groups to solve problems, answer questions, or discuss ideas. The instructor acts as a facilitator, providing guidance and feedback to the students as needed. Peer-instruction is designed to promote active learning, increase student engagement, and improve knowledge retention.

The flipped classroom and peer-instructional model can be used together to create a more effective learning experience. In a flipped classroom, students can watch the pre-recorded lectures or complete readings before class, and then use class time for peer-instructional activities. The instructor can assign small groups to work on a particular problem or topic, and then rotate among the groups to provide feedback and guidance. This approach encourages students to take responsibility for their own learning, promotes collaboration and teamwork, and creates a more engaging and interactive learning environment.

A number of studies have investigated the effectiveness of the flipped classroom and peer-instructional model in mathematics education. Several studies have found that the flipped classroom and peer-instructional model can lead to improved student achievement in mathematics. For example, a study by Lage et al. (2000) found that students in a flipped classroom model outperformed students in a traditional lecture-based model. Similarly, a study by Brame et al. (2013) found that students in a peer-instructional model had higher exam scores compared to students in a traditional lecture-based model. Also, the flipped classroom and peer-instructional model have been shown to increase student engagement in mathematics. For example, a study by Gannod et al. (2008) found that students in a flipped classroom model were more engaged and active during class. Similarly, a study by Lasry et al. (2014) found that students in a peer-instructional model reported higher levels of engagement and motivation. These models have been found to promote self-regulated learning in mathematics. For example, a study by Smith et al. (2016) found that students in a flipped classroom model were more likely to take responsibility for their own learning and engage in self-regulated learning strategies. On another side, the role of the teacher in the flipped classroom and peer-instructional model is important. Studies have found that effective implementation of these models requires a shift in the teacher's role from a lecturer to a facilitator of learning (Herreid & Schiller, 2013; Bergmann & Sams, 2012). A study by Strayer (2007) found that students in a flipped classroom model had higher learning outcomes compared to students in a traditional lecture-based model. The study found that students in the flipped classroom model had higher scores on a final exam, performed better on problem-solving tasks, and demonstrated better retention of material. In addition, these models have been found to improve critical thinking skills in mathematics. For example, a study by Limniou et al. (2019) found that students in a flipped classroom model demonstrated improved critical thinking skills compared to students in a traditional lecture-based model. From student attitudes point view, studies have found that the flipped classroom and peer-instructional model can lead to more positive student attitudes towards mathematics. For example, a study by Dooley et al. (2016) found that students in a flipped classroom model had more positive attitudes towards mathematics compared to students in a traditional lecture-based model. Also, these models often involve the use of technology such as online

videos, discussion forums, and interactive tools. A study by Gerstein et al. (2015) found that the use of technology in a flipped classroom model increased student engagement and motivation in mathematics. Finally, the effectiveness of the flipped classroom and peer-instructional model may depend on the specific implementation strategies used. For example, a study by Lai et al. (2017) found that the effectiveness of the flipped classroom model was influenced by the quality of the pre-recorded videos and the structure of the in-class activities.

Effect of Using YouTube Channels

Using YouTube channels can be a powerful tool for teaching and learning mathematics. Here are some potential benefits which we notice in our study of using YouTube channels in mathematics education. YouTube channels allow for the use of visual representation of mathematical concepts, which can help students to better understand difficult topics. Videos can be paused, rewound, and replayed, allowing students to work at their own pace and review key concepts as needed. Also, there are many high-quality YouTube channels available that offer mathematics lessons and tutorials. Teachers and students can find channels that align with their specific needs and learning styles. Moreover, YouTube channels can be used to promote active learning by encouraging students to engage with the material through comments, questions, and discussions. This can foster a sense of community and collaboration among students. Finally, YouTube channels allow for flexible learning, as students can access videos from anywhere and at any time. This can be particularly beneficial for students who may have difficulty attending traditional classroom lectures or who need additional support outside of class.

Samples and Assessments

Students participating in this study were enrolled in Calculus courses at leading UAE universities in Spring 2022/2023. Participants come from the Faculty of Science, Faculty of Education, and Faculty of Information Technology. 105 students will undergo pre-treatment and post-treatment testing. Those students were divided into three groups as follows:

- Experimental group 1(Flipping classroom): 30 students.
- Experimental group 2(Flipping classroom and Peer instructions): 36 students.
- Control group (Traditional teaching method): 36 students.

The tests were divided into three categories:

- Knowing: six multiple-choice questions.
- Applying: six multiple-choice questions.
- Knowing: six multiple-choice questions.
- Problem solving and reasoning: four essay questions. Two of them are open-end questions.
- Concepts: Three questions about the image of main concepts of calculus in the mind of the students such as integrals, derivative, and limits. Students will write all interpretation about these concepts in their minds.

It is worth mentioning that these questions cover the outcomes of the calculus book.

The Process

First, all participants consent to participate in this study. We use a quasi-experimental design of shape.

- Group 1: Pretest-treatment number 1-post test- survey.
- Group 2: Pretest-treatment number 2-post test- survey.
- Group 3: Pretest-traditional treatment-post test- survey.

We should note that treatment number 1 is the flipping class model with YouTube chancel while treatment number 2 is the flipping class with peer instructional model with YouTube chancel.

Types of Treatments

- Treatment number 1:

  It is divided into two stages.

  I. Before class:

  Recorded videos of lectures are posted on the in YouTube channel for students. In addition, all students are required to solve online pre-tasks prepared in blackboard. Then, the instructor will analyze student feedback from preliminary exercises. Also, prepare worksheets and mini-project for the next class. Also, prepare interactive PowerPoint presentations (short presentations).

  II. During the lecture:

  Students will solve the worksheet, mini-project (teamwork), do 1 minute test.

- Treatment number 2:

  In addition to treatment 1, we prepare one-step multiple-choice questions. This will help the instructor to know exactly where are the weak points in the students. Also, which type of help they need and in which concepts.

Conclusion

Both the Peer Instructional Model and Flipped Classroom Model have gained popularity in recent years as effective teaching approaches in different educational settings. Here is a brief discussion of each model and its results. The Peer Instructional Model is a teaching strategy that emphasizes collaborative learning and active student engagement. In this model, students work in small groups to discuss, debate, and solve problems related to the course material. The instructor facilitates the discussion and provides guidance to students. This approach has been shown to be effective in improving student learning outcomes and engagement in various educational settings. We reported the following results of the Peer Instructional Model:

- Increased student engagement and participation in classroom activities.
- Improved critical thinking and problem-solving skills.
- Enhanced student retention of course material.

- Increased student motivation and confidence in their learning abilities.
- Improved student attitudes towards learning and the course.

While the Flipped Classroom Model is an approach that involves the pre-recording of lectures or content delivery, which is then made available to students for review before class. This allows students to engage with the material at their own pace, freeing up class time for more interactive and collaborative activities. This approach has been shown to be effective in improving student engagement, motivation, and learning outcomes. We have reported the following results of the Flipped Classroom Model:

- Increased student engagement and participation in classroom activities.
- Improved student understanding and retention of course material.
- Enhanced critical thinking and problem-solving skills.
- Improved student attitudes towards learning and the course.
- Increased student satisfaction with the course and teaching approach.

Overall, both the Peer Instructional Model and Flipped Classroom Model have been shown to be effective in improving student engagement, motivation, and learning outcomes. The effectiveness of these models may vary depending on the educational setting, course content, and instructor's teaching style. Therefore, it is important to evaluate the effectiveness of these models in your specific context before implementing them in your teaching practice.

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A Study of Adaptive Learning in Large Class Sizes and the Enabling Conditions for Student Self-Regulated Learning in the UAE

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Abstract
In 2018, a 60 student program was piloted to explore the potential of using an adaptive learning system in larger class sizes to mitigate issues such as a lack of qualified teachers and high teacher turnover rates in the UAE. This study sought to understand the impact of this program on student engagement and academic performance, as well as the enabling conditions needed for student self-regulated learning. Using data from over 12,700 students' exam results, as well as surveys from teachers and students, we examined the impact of this program using a propensity score matching technique. Results of the study showed that increasing the teacher-student ratio had no significant negative impact on student academic performance, and in some cases increased student engagement. However, enabling conditions for student self-regulated learning and teacher feedback on this project provided key insights that guides a more in-depth digitization of the UAE K12 public education system, which has important policy and practice implications.

Keywords: Propensity Score Matching, Self-Regulated Learning, Adaptive Learning Systems, Teacher-Student Ratio, UAE K12 Public Schools

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Introduction and Literature Review

Within the education sector, some of the most pervasive issues in schools around the world are in regards to teachers: a shortage of qualified teachers (Ingersoll, 2003), teacher absenteeism (UNESCO IIEP, 2022), and high teacher turnover rates (Ingersoll, 2001; Kraft, Marinell, & Yee, 2016). United Arab Emirates (UAE) K12 public schools are not immune to these issues, as its large number of expatriate teachers leave it vulnerable to the high turnover rates seen in other expatriate-heavy industries in the country (Goe et al., 2020; Qasim, 2020). In addition, the pay and working conditions for teachers in the UAE are not always ideal, such as low salaries, lack of discretionary funding, and cultural and societal limitations in comparison to other fields, which can lead to a shortage of qualified and experienced educators willing to both work in the country and remain working here after they start (Alhumaid, 2021). A teacher shortage has been documented in the UAE as early as 2012, but the lack of qualified teachers has grown exponentially during the pandemic (Abdallah & Alriyami, 2022). Studies found that hundreds of teachers resign in the country every year, some even leaving before the end of their contract and the academic year (Murdock, 2022). Due to the teacher issues mentioned above and their related impact on student learning outcomes, researchers and education policy makers explore class size as a possible means to mitigating the problem.

Studying the effects of class size on student performance has been a popular topic of research to explore the optimum provision of instructional inputs (e.g. teacher-student ratio, digital learning tools) versus student learning gains in various contexts, and its cost-effectiveness. A key factor that drives this research effort is cost reduction, particularly teacher salaries. According to a Brookings study, increasing the pupil/teacher ratio in the U.S. by one student would save at least $12 billion per year in teacher salary costs alone (Whitehurst & Chingos, 2011). Depending on educational context, the results are quite mixed. According to the OECD PISA study (2018) on class size and student reading performance, B-S-J-Z China, is a typical example of larger class size (42 students per class on average) and higher average reading score, compared with the rest of the OECD PISA participating countries. Similar results found that different teaching practices reduce the importance of class size in East Asia (Stigler et al., 1982; Blatchford et al., 2016; as cited in Baker et. al., 2020). In Western Europe and North America, smaller class sizes are associated with better learning outcomes (Glass, 1982; Shin & Chung, 2009; as cited in Baker et. al., 2020). Altinok & Kingdom (2012) found that in the Middle East, North Africa, and sub-Saharan Africa smaller class size is associated with better learning outcomes (as cited in Baker et. al., 2020). Leuven and Oosterbeek compiled data from several class size studies and their findings determined that while research showed both positive and negative impacts on student performance from altering class sizes, most effects were quite small and not significantly different from zero (2018). Hence, it really depends on the specific educational context.

With educational technology making its way into classrooms, one such tool that has risen in prominence is adaptive learning systems (ALS). Through features like intelligent instructional design, personalized learning paths, adaptive testing, and real-time learning analytics, ALS provides students with educational materials and tasks in varying levels of difficulty, maximizing their chances of success (Zarkovic, 2020). OECD highlights the merits of adaptive learning systems and their ability to enhance student self-regulated learning (2021). However, they stress the importance of teachers when using ALS, emphasizing that "adaptive systems are not meant to replace teachers, but rather enhance their role," with well-trained teachers able to increase the impact of these systems on student academic

achievement (OECD, 2021). With the potential of adaptive learning systems to enhance teacher roles and to enhance student self-regulated learning, there are interests to explore how the provision of adaptive learning systems and teachers impact class size and student learning gains, potentially reducing teacher salary cost.

Research Context and the 60 Student Program

The Alef Platform is a student-centered adaptive learning system developed by Alef Education. In 2017, the platform was piloted in Abu Dhabi K12 public schools as part of the national initiative to digitize education systems and explore how digital learning can solve existing challenges in public education. Through bite-sized multimedia content, learning analytics, and student-centric features, the Alef Platform provides students with personalized, engaging learning experiences. By providing continuous feedback about what students are working on and how they are performing, teachers can support and intervene at the right point in a student's learning process. Learning analytics dashboards can be used by school leaders to monitor school performance, identify gaps for intervention, and support teachers' professional development. From Grade 5 to Grade 12, Alef Platform is used as the primary learning resource.

In the 2018-2019 academic year, a project called the 60 student program was piloted in a public all-girls school, by merging two Grade 7 classes into a single class of approximately 60 students. These students used the Alef Platform for English, Math, and Science, as it is assumed that the Alef Platform assists student self-regulated learning. The main objective is to investigate to what extent students could self-regulate their own learning using the Alef Platform in a larger class size, and how teachers could support effective teaching. Later on, the program was piloted in four other schools through both administrator introduction and school self-selection. There are a few criteria based on which schools piloted this program: 1) there are classrooms big enough to accommodate 60 students; 2) school leadership supports the program; 3) students are, on average, high achievers compared to same-aged peers at their school. Additionally, all pilot schools received implementation support on infrastructure and teacher professional development. Infrastructural support includes providing enough white boards for all students to see teacher instructions, seating arrangements, charging and laptop devices; teachers are provided with regular professional development on blended learning best practices using the Alef Platform, classroom management, and instructional strategies to work with larger class size.

Research Rationale

Finding the optimal teacher-student ratio within the Alef school context has significant implications for UAE K12 public schools, as it provides an opportunity to understand the efficacy of providing educational inputs efficiently (e.g. Alef Platform, teacher-student ratio) while maintaining student learning gains. The design of the adaptive learning system is built on the assumption that students work at their own pace, receive help and feedback from the system, and are therefore less dependent on the teacher; teachers, on the other hand, can focus on providing assistance to students who need intervention. Introducing the Alef adaptive learning system modifies student engagement with the learning task and with the teacher; as a result, teacher knowledge and skills must also be updated. Furthermore, an increase in student-teacher ratio in this context could create additional tasks for the teacher, such as ensuring accountability for learning and managing student behavior and engagement in a larger class size.

Research Goal and Questions

The purpose of this research is to examine the impact of teacher-student ratios on student engagement and academic performance, the enabling conditions for self-regulated learning, and to receive feedback from 60 student classroom teachers on their teaching practices within blended K12 classrooms in the UAE using the Alef Platform. This was formulated through the following research questions:

RQ 1: What is the impact of increasing teacher-student ratio on student engagement and academic performance on the Alef Platform?

RQ 2: In the 60-student classrooms, what are the enabling conditions for student self-regulated learning with the Alef Platform?

RQ 3: What are the 60 student project teachers' feedback on this project?

Methodology

Quasi-Experimental Evaluation: Propensity Score Matching

The 60 student program was conducted without any prior evaluation planning, and schools were assigned to the program through a combination of self-selection and administrator selection. As a result, students participating in the program and those not participating had significantly different background characteristics, which made assessing its impact and effectiveness challenging. This is very common in many educational systems, however, understanding what works and what does not work scientifically are still crucial for making policy and practice implications.

In order to understand the impact of increasing student-teacher ratio on student engagement and academic performance, we used a quasi-experimental evaluation design, propensity score matching (PSM) which is widely used for assessing a range of educational interventions and is among the most recommended (Morgan & Winship, 2007; Andrillon et. al., 2020). Additionally, PSM fits well with the context of this study since the Alef Platform provides a wealth of background characteristics on students that can be used to identify fitting counterfactuals.

This technique works by finding a counterfactual group of students (i.e., students who did not participate in the program) that is similar to the treatment group on a range of background characteristics. This similarity is measured by the propensity score, which corresponds to the probability that a given student would be assigned to the 60 student classroom program. Students in the treatment group are then matched to students in the control group with the closest propensity score. This allows for an apples-to-apples comparison of the impact of the program on two groups of students that are similar in all respects but for their participation in the 60 student classroom program.

Implementation of PSM

The analysis was conducted in Python using an implementation of PSM provided by IBM (Shimoni et al., 2019). First we created a set of features for each student and subject based on the background characteristics available from the Alef Platform.

We then trained a logistic regression model with participation in the 60 student program as the dependent variable and the set of student background characteristics as the independent variables. This resulted in a propensity score for each student, which corresponds to the probability that they would be assigned to the program based on their background characteristics.

We then applied PSM using nearest neighbor matching with a caliper width of 0.2. This means that treatment students were matched to the nearest control students with the closest propensity score, where the absolute difference in propensity scores was less than 0.2. This method has the advantage of being relatively simple to interpret while also providing a robustness check (i.e., one can see if results change if a different matching algorithm is used).

After applying PSM, we compared the distributions of treatment and control students on a range of background characteristics to check for balance between groups. The distribution of the propensity scores can be seen in Appendix 1.

The impact of the program was then measured by taking the difference in the outcomes metrics between the treatment and matched pseudo-control group. 95% confidence intervals were then calculated based on 100 bootstrap simulations.

Treatment and Pseudo-Control Groups

We looked at a total of 12,780 students from 97 UAE K-12 public schools. Among the 97 schools, 4 Abu Dhabi K12 public schools participated in the pilot with a total of 241 students. Table 1 shows the number of students in treatment and non-treatment groups.

Grade	Non-Treatment	Treatment
Grade 7	2909	52
Grade 8	2956	90
grade10	3378	50
Grade 11	3296	49
Total	12539	241

Table 1: Number of Students in the Treatment Group and Non-Treatment Group by Grade

To create a pseudo-control, 241 of the 12,539 non-treatment students were matched against the treatment group.

Student Quantitative Measurements

To ensure an unbiased analysis, our propensity model was trained using a variety of quantitative and qualitative measures to ensure pseudo-control was comparable to our treatment group. This is crucial in removing any confounding variables and ensuring our analysis is unbiased (Austin, 2011; Caliendo & Kopeinig, 2019).

Table 2 below shows the measures used, which were calculated using data from the Alef Platform as well as the exam data provided by the UAE Ministry of Education (MoE). They include both engagement and performance measures aligned with guidelines provided by the

MoE. Average time spent on the Alef Platform and number of MLO[1] completed are chosen as key indicators for student engagement. Summative assessment scores[2] per MLO and high-stakes end of term exams conducted by the local Ministry of Education are chosen as student academic performance indicators. The aforementioned data points were aggregated at the student, subject, and academic term levels. Aggregated features of the first term (academic year 2021-2022) were then fed into a logistic regression model to calculate the propensity scores, which were used to identify the pseudo-control group.

To answer RQ1, we measured the average effect of the treatment by comparing it to the outcomes of the pseudo-control on metrics from the second term (academic year 2021-2022).

Features Category	Features Sub Category	Features	Data Type	Description
Independent	Engagement	Average time spent in Term 1	Numerical (mins)	Average time spent on platform
		Completed lessons in Term 1	Numerical	Number of MLO (micro learning objective) completed on platform
	Performance	Summative Assessment Score in Term 1	Numerical	Assessment on platform
		Exam Score Term 1	Numerical	Final Exam
Dependent	Engagement	Average time spent in Term 2	Numerical (mins)	Average time spent on platform
		Completed lessons in Term 2	Numerical	Number of MLO (micro learning objective) completed on platform
	Performance	Summative Assessment Score in Term 2	Numerical	Assessment on platform
		Exam Score Term 2	Numerical	Final Exam
	Conditions for Student Self-Regulated Learning	Emotional regulation and task performance, Metacognition, Motivation, interest and enjoyment, self-efficacy reading, self-efficacy using Alef	Numerical	Self-system
		Teacher support classroom disciplinary environment, Teacher active engagement and support, Teacher support for differentiation, Teacher support for independent learning,	Numerical	Metacognitive strategies

[1] MLO, short for Mini Lesson Objectives, is the naming convention for each curriculum lesson on the Alef Platform. The Alef Platform provides Grade 5-Grade 12 UAE public school students with a primary curriculum for English, Math, Science, Arabic, Islamic Studies and Social Studies.
[2] Summative Assessments evaluate student learning at the end of each MLO.

	Gender	Categorical (Nominal)	Demographic
	Grade	Categorical (Ordinal)	Grade level of students

Table 2: Features for Student Engagement, Performance, and Conditions for Student Self-Regulated Learning

Student Qualitative Measurements

In order to answer RQ2 on the enabling conditions needed for students to exercise self-regulated learning with the Alef Platform, a student survey was developed and implemented. The survey was constructed based on literature on theories on self-regulated learning (SRL), our previous research findings, classroom observations, and teacher interviews.

The Zimmerman and Winnie models are the most cited frameworks on self-regulated learning (Panadero, 2017) and provide a framework for understanding cognitive, metacognitive, and emotional aspects of learning. In Zimmerman's cyclical phases model, students first analyze the task, set goals, develop motivational beliefs, plan task execution, and activate relevant learning strategies. Then, students exercise control strategies to monitor progress and keep themselves engaged. The final step of the process involves students self-reflection on progress, success, and failure. Winnie and Hadwin's theory has a strong metacognitive perspective that recognizes self-regulated students as active and managing their learning (Panadero, 2017). Our previous research in Abu Dhabi public schools indicates that student math academic performance is significantly influenced by metacognition, self-efficacy, and affective reactions to tasks (Miao et al., 2021).

Based on the above literature, previous findings, and school visits, we designed the survey to measure some key conditions to exercise SRL with the Alef Platform, including self-system factors (e.g. self-efficacy, motivation and interest, emotional regulation) and metacognition, in consideration of enlarged teacher student ratio and the use of adaptive learning systems (see conditions for student self-regulated learning in Table 2 above). For instance, self-efficacy using Alef and other digital tools (e.g. I feel comfortable using Alef and other digital tools to do learning tasks) and self-efficacy reading Alef lessons (e.g. I cannot completely understand the text in Alef lessons by just reading it once on my own) are designed to reflect student expectations and judgements about self and learning tasks with Alef and other digital tools offered. Five questions are designed to measure self-efficacy using Alef and other digital tools, five questions are designed to measure self-efficacy reading Alef lessons. Emotional regulation and task performance measure student capacity to regulate stress and the learning environment (e.g. I feel stressed when I have trouble understanding Alef lessons on my own), and six questions are designed. For metacognition, six items were designed to understand student perception of the usefulness of metacognitive strategies learning an Alef lesson (e.g. I use Alef assessments to monitor my progress.

In terms of teacher enabling support for self-regulated learning, survey measurements were constructed in consideration of literature on key roles that teachers assist students to become independent learners (Meyer et al., 2008), as well as field visit feedback. Therefore, the classroom disciplinary environment (e.g. the teacher has to wait a long time for students to quiet down) is designed to capture how often students feel their learning is hindered due to disciplinary problems, which could be worsened due to larger teacher-student ratios. Teacher

active engagement and support (e.g. the teacher asks questions that motivate students to participate actively in Alef classes) to understand how often their teachers have been actively engaged in guiding students to set learning goals, monitor learning, provide feedback and help when needed, and if students feel they have a very positive relationship with the teacher. Teacher support for differentiation and independent learning (e.g. the teacher assigns different tasks for different students) is designed to capture strategies that teachers use to scaffold, differentiate, and support independent learning. Five questions are designed to measure classroom disciplinary environment, six questions are designed to measure teacher active engagement and support, and six questions are designed to measure teacher support for differentiation and independent learning, using frequency scale items as "every lesson or almost every lesson, most lessons, some lessons, never or hardly ever."

The student survey was translated into Arabic and delivered bilingually through Survey Monkey. Approvals were obtained from school principals and local education governing agencies before implementation. 331 student responses were collected from both control and treatment groups across Grade 7, Grade 8, Grade 10, and Grade 11. All data collected follows the government student privacy protocol. Cronbach's alpha with item analysis was used to measure the reliability of all survey questions, which yields excellent internal consistency with a Cronbach alpha value of 0.88.

Teacher Feedback Survey

The teacher survey was designed to get pilot teacher feedback on best practices within the 60 student project, the main areas of difficulty and potential improvement within the project, how the use of the Alef Platform helps teachers manage larger class sizes, and teacher perception of self-regulated learning of students within the program. The survey was offered in English through Survey Monkey and anonymously completed by 24 teachers across all four schools participating in the 60 student program, with the responses obtained from teachers purely for the purpose of internal feedback.

Based on the objectives, survey items were designed to reflect four key areas of teacher practices: classroom management, lesson planning, instructional practices, and professional responsibility, taking into account Danielson's Framework for Teaching (1996, 2007, as cited in Isoré, 2009, p. 11) and UAE Ministry of Education Observation Framework (Emirates Schools Establishment, n.d.; UAE Ministry of Education, n.d.). These teacher practices were indicators of what teachers should know and do to exercise "good teaching," plus how enlarging teacher-student ratios and the use of adaptive learning systems potentially would have an impact on these practices. Additionally, survey items were also constructed to get teacher general feedback on the pilot program.

Classroom management pertains to teachers' ability to create a classroom environment and culture that is conducive for learning, clearly presenting tasks for learning, as well as their ability to successfully manage student behavior, all with the larger class size. An example of a classroom management question is "[To what extent do you] struggle to find time to work with students one-on-one during class." Lesson planning focuses on teachers' ability to effectively plan for lessons within the project setting, their knowledge of their content and their students, selecting appropriate instructional goals, designing and presenting coherent lessons, and assessing student learning. One lesson planning question is "[How often in your 60 student classroom did you use] Alef student data and learning analytics dashboard." Instructional practices is teachers' ability to clearly and effectively communicate lesson

objectives, both mastering the language of instruction and encouraging students to use it as well, the successful ability to differentiate for student needs, the use of assessments and being able to provide effective feedback to students on time, and ensuring student progress is aligned from curriculum standards. Instructional practices questions include "[How much do you agree that] Alef diagnostic assessments are helpful to gauge students' knowledge to allow them to be placed into level-appropriate instructional groupings." Professional responsibility includes self-reflection on their own teaching to determine areas in which professional development is needed, as well as the ability to successfully manage both in-person and online teaching, often concurrently. An example of a professional responsibility question is "[To what degree do you currently need professional development in] teaching cross-curricular skills (e.g. learning-to-learn)." Finally, general feedback asks after their own self-efficacy in regards to teaching, their ability to promote student use of ICT, and teachers' opinions on the success of the 60 student project. An example of a general feedback question is "[Do you agree that] the program has been successful in meeting its objectives."

Findings

Research Question One

Our study shows that class size has a statistically significant impact on student engagement, but not performance. Table 3 below shows the average treatment effect (ATE) on students across subjects across the 6 months of Term 2. In English, Islamic studies, and social science subjects, students in the treatment group were statistically significantly more engaged than those in the pseudo-control group. Students in the treatment group had a higher rate of successfully completing lessons and spent more time engaging with content on the Alef Platform. In math, treatment group students spent less time studying compared to control students, but the result was not significant.

On average, student performance in the treatment group was not significantly different from that of the control. In English, summative assessment and exam scores had average treatment effects of -0.38 and 0.94, but the p-values were above 0.05 and not significant. Islamic studies, math, and social studies showed similarly non-significant results. Science was the exception: the summative assessment score was significant (p-value 0.01), with an average treatment score of -5.6.

Subject	Features	Average Treatment Effect (ATE)	P-Value	Confidence Interval (0.025, 0.975)	
English	Exam Score Term 2	0.94	0.37	-1.12	3.00
English	Summative Assessment Score in Term 2	-0.38	0.67	-2.13	1.38
English	Completed lessons in Term 2	10.39	*0.0001	6.23	14.56
English	Average time spent in Term 2	232.82	*0.0001	186.09	279.56
Islamic Studies	Exam Score Term 2	1.11	0.19	-0.57	2.80
Islamic Studies	Summative Assessment Score in Term 2	0.29	0.84	-2.53	3.10
Islamic Studies	Completed lessons in Term 2	1.62	*0.01	0.39	2.85
Islamic Studies	Average time spent in Term 2	8.36	0.65	-27.79	44.51

Math	Exam Score Term 2	0.76	0.56	-1.81	3.33
Math	Summative Assessment Score in Term 2	0.21	0.89	-2.76	3.19
Math	Completed lessons in Term 2	9.41	*0.0001	4.43	14.40
Math	Average time spent in Term 2	-93.06	0.08	-198.75	12.64
Science	Exam Score Term 2	1.57	0.38	-1.95	5.09
Science	Summative Assessment Score in Term 2	-5.60	*0.01	-9.69	-1.52
Science	Completed lessons in Term 2	5.21	0.12	-1.36	11.78
Science	Average time spent in Term 2	319.82	*0.0001	180.51	459.13
Social Studies	Exam Score Term 2	-0.52	0.44	-1.84	0.79
Social Studies	Summative Assessment Score in Term 2	0.30	0.83	-2.39	2.99
Social Studies	Completed lessons in Term 2	3.77	*0.0001	2.19	5.35
Social Studies	Average time spent in Term 2	80.08	*0.0001	39.52	120.64

Note: * mark shows significant p-value (P-Value < 0.05)

Table 3: Average Treatment Effect of Intervention by Subject on Measured Features

Research Question Two

To understand how increasing teacher-student ratios affect student internal conditions and teacher external support needed for students to exercise self-regulated learning using the Alef Platform, we applied the same PSM to our survey responses. We took 82 treatment group students who had answered our survey, and matched them against 85 similar non-treatment group students to create a pseudo-control group.

The results in Table 4 below show that student-perceived usefulness of metacognitive strategies were statistically significantly higher for students participating the 60 student program. Students in the treatment group reported exercising metacognitive strategies as particularly useful, as metacognitive strategies are core self-regulated learning skills that learners benefit from even in an adaptive learning environment.

Students in the treatment group also reported more frequent need of teacher support for independent learning and teacher active engagement and support than students in the control group. These two enabling conditions are key for a successful self-regulated learning environment in a larger class size. This makes sense as by increasing the teacher-student ratio, teachers might assign more independent learning tasks for students. However, larger class sizes need more frequent teacher support to be successful.

Features Category	Features	Average Treatment Effect (ATE)	P-Value	Confidence Interval (0.025, 0.975)	
Student internal conditions	Emotional regulation and task performance	0.009	0.796	-0.06	0.08
	Perceived usefulness of metacognitive strategies	0.166	*0.032	0.01	0.32
	Motivation, interest and enjoyment	-0.084	0.007	-0.14	-0.02

	Self-efficacy in reading	0.122	0.071	-0.01	0.26
	Self-efficacy using Alef	-0.051	0.452	-0.18	0.08
Teacher external support	Teacher Support on classroom disciplinary environment	0.046	0.359	-0.05	0.14
	Teacher active engagement and support	0.233	*0.002	0.09	0.38
	Teacher support for differentiation	0.068	0.312	-0.06	0.20
	Teacher support for independent learning	0.220	*0.002	0.08	0.36

Note: * mark shows significant p-value (P-Value < 0.05)

Table 4: Average Treatment Effect of Intervention on Measured Survey Responses

Research Question Three

In the teacher feedback survey, we found three of the four key focus areas of the survey yielded positive findings. The majority of interviewed teachers frequently use Alef Platform tools for classroom management; the Team feature allows teachers to group students and the Star-awarding feature motivates students on good behavior and improved performance. It was also claimed that Alef lessons reduced teachers' lesson planning time and allowed them to spend more time gaining a deeper understanding of the lesson beforehand. The Alef learning analytics dashboard was highly cited as beneficial to teachers in the 60 student program, particularly with regards to differentiation and real-time updates on student learning. Additionally, the vast majority of interviewed teachers report they encourage students to practice self-regulated learning in every or almost every lesson, and about half of them say the feedback provided directly to students by the Alef Platform helps facilitate this practice.

On the other hand, a large percentage of surveyed teachers said they struggled to provide subjective real-time feedback to students due to the large class size, and teachers regularly supplement Alef products to fill gaps in the Alef Platform, such as Google Classroom and ClassKick for providing subjective feedback and teacher-student real-time interaction. In order to improve accountability for learning in larger class sizes, features that allow teachers to have real-time interaction and written feedback on assigned learning tasks could be considered for product development.

The professional development section of the survey brought forward several areas in which teachers identified they need assistance, including how to better utilize Alef data and platform tools. With hopefully further improvements to the Alef Platform forthcoming, providing training for teachers and students on effective interaction and accountability features on the platform can help boost teacher use in these areas. Additionally, teachers voiced a need for professional development in teaching cross-curricular skills, such as problem solving, learning-to-learn, and independent learning, in which improving teacher efficacy in this domain would benefit all learners, but especially those in the 60 student program. Finally, assistance was requested for UAE-context specific needs, such as second language teaching. In UAE K12 public schools, math and science are taught in English. With students speaking Arabic as their first language, this means that teachers whose first language is Arabic would require professional development for teaching in English to better support these students both

in and out of the 60 student program. Therefore, while results showcase numerous positive aspects of the 60 student program, the noted areas of improvement are not insignificant and highlight the need for further assistance for teachers and potentially updates to the Alef Platform to ensure success within the program.

Conclusion

This study set out to evaluate the efficacy of increasing class size with the Alef adaptive learning system in the UAE K12 public school context using propensity score matching. Understanding the program impact on student engagement, academic performance, and enabling conditions for SRL, as well as teacher feedback on the program, provides important education policy implications and product improvement insights.

We found that class size has a statistically significant impact on student engagement, but not academic performance. Given that academic performance is a key metric for scaling up the project and this evaluation only tracks performance changes over 6 months, further research needs to be conducted to track program impact on academic performance particularly.

Among conditions to enable students to practice SRL, student-perceived usefulness of metacognitive strategies was statistically significantly higher for students participating in the treatment group. This means that students in larger class sizes believe their learning benefits from being able to use metacognitive strategies while interacting with the Alef adaptive learning system. Additionally, students in the treatment group reported more frequent support received for independent learning and active engagement from teachers than students in the control group, among teacher external support factors. Hence, providing students with these conditional support is a key consideration for improving student learning experience in larger class sizes.

Lastly, teachers highlighted several areas for improvement, such as the need for real-time interaction and accountability for learning features that allow them to see how student groups have been proceeding with learning tasks and to provide written feedback. Teachers also showcased numerous positive experiences, with the majority of teachers finding the Alef product features helpful in their daily practices on lesson planning, classroom management, and instructions. Additionally, learning analytics has been highly cited as a beneficial instructional feature that automates assessment and feedback real-time.

Implications and Recommendations

The Alef adaptive learning system provides the possibility to mitigate teacher-related challenges in the UAE K12 public school context, only if certain conditions are met based on our study.

Firstly, the design and development of the technological inputs (i.e. Alef adaptive learning system) requires an iterative improvement process, taking into account evidence-based user feedback. For instance, in our study, SRL requires students to learn independently, but learning itself is also a social activity and requires accountability. The Alef Platform, when used in larger class sizes, instead of only providing independent adaptive learning support and features that group learners together, real-time interactive features need to be designed to allow teachers and learner peers to share inputs, feedback real-time, which in turn supports engagement and accountability of learning.

Second, the ability to exercise metacognitive skills is a key 21st century skill to be taught explicitly in the UAE public K12 context, which has been proven important consistently in this and past studies. Being able to exercise metacognitive skills is recommended as a national education policy to ensure efficiency of learning in the trend of digitizing education systems, and teachers should be aware of the importance of such skills and should be trained to cultivate learner metacognitive skills.

Lastly, from teacher knowledge and skill perspectives, apart from PD on learner metacognitive skill acquisition, training teachers to use adaptive learning systems has a learning curve, especially if teachers are to use technology to benefit flexible teaching and learning and to support various learning tasks. Education systems should be ready to have skilled trainers and capacity to deliver this service. Teacher hiring and in-service training should take into account the fact that math and science subjects require second language teaching. AI-powered adaptive learning systems won't be able to replace teachers, yet teacher practices, knowledge, and skills will be modified.

Limitations

Given that the pilot was implemented in all-girls schools in the Abu Dhabi emirate, the findings may not be generalizable to other contexts (e.g. gender, other emirates with a different learning context). In addition, since the impact of the program was measured only over six months, it is difficult to determine its long-term impact, especially when it comes to student academic performance.

Despite the use of propensity score matching to control for treatment bias, important confounding factors and contexts couldn't be controlled. Additionally, nearly all of the students in our sample had already used Alef before starting treatment; if the program were started from scratch, results may have been different.

In spite of these limitations, this study provides valuable insights to guide decision-makers on possibilities of scaling up the project, conditions needed from students and teachers to better work with adaptive learning systems in the local educational context. Most importantly, increasing class size is doable if teachers and students have the conditions met to work with adaptive learning systems in the UAE context, and teacher feedback should be always incorporated for product improvement; however, further research is still needed.

Acknowledgements

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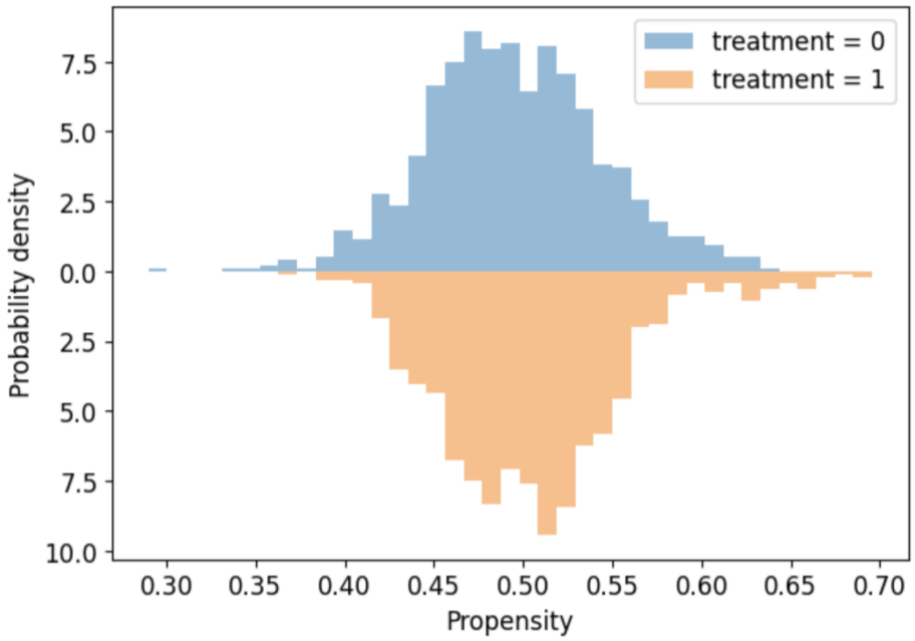
Appendix 1: Distribution of propensity score by treatment and pseudo-control group



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Passion-Based Learning Under COVID-19: Students' Perceptions for Implementation, Engagement and Passion in a Hong Kong Primary School

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Abstract
Passion-based learning (PBL), an education mindset to unleash students' potentials, is considered an innovative approach coherent to Education 3.0 as learning is mainly driven by learners. The existing studies, however, have neither drawn conclusive results towards the effectiveness of PBL, nor contextualized in Hong Kong primary school under COVID-19. The aims of this research with mixed-methods design are to explore students' perceptions towards the implementation of PBL, engagement level and passion scale of PBL. Three-phase PBL, namely Passion Discovery, Passion Pursuit and Passion Sharing, was first implemented in a class of total 14 primary 5 students. Semi-structured individual interviews involving 6 Hong Kong primary school learners were conducted. Questionnaires comprised of 10-item implementation, 17-item academic engagement and 14-item passion scale were administered to all participants. Two triangulation research methods have been adopted. Field note is made throughout the process of implementation while video analysis is conducted upon the completion of passion project. The overall results from major research methods, interviews and surveys, indicate a positive and encouraging perceptions towards the three variables. On the other hand, field note and video analysis demonstrate consistent results for triangulation. Passion-based learning, from this research, is explored into its feasibility in a local school, and is expected to be promoted in a greater context.

Keywords: Passion-Based Learning, Passion, Hong Kong, COVID-19, Self-Directed Learning

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Chapter 1: Introduction

1.1 Research Rationale

While Education 3.0, the future of education, awaits, our current education stays unchanged. According to Gerstein (2014), Education 3.0 is interest-based learning. It highly supports student-centered learning. Students learn by themselves and play roles as authors, drivers and assessors of their learning experience.

Passion-based learning, an alternative for Education 3.0, is a student-driven education approach introduced in late 2007 (Strickland, 2011). It is a more self-directed learning (Blaschke, 2012) defined as "a process in which individuals take the initiative, with or without the help of others, in diagnosing their learning needs, formulating learning goals, identifying human and material resources for learning, choosing and implementing appropriate learning strategies, and evaluating learning outcomes".

1.2 Research Background

Engagement level continues to erode in pandemic period. A study by Perets et al. (2020) measured the impact of the transition to emergency remote online teaching on student engagement in an education course. They found that students noted difficulties staying committed to the course after the transition, and that individual research projects were more effective at retaining engagement than synchronous lectures and student presentations.

Passion, defined as a strong inclination and desire toward an activity one likes, finds important, and invests time and energy (Vallerand et al., 2003; Vallerand et al., 2007), is usually viewed in a dualistic model. Scholars propose that there are two types of passion—obsessive and harmonious—that differ in terms of how passion is internalized into one's identity. In this paper, both harmonious and obsessive passions are to be concerned in the students' survey and field notes.

Pandemic impact on education is experienced globally. The level of academic performance of the students is likely to drop for the classes held for both year-end examination and internal examination due to reduced contact hour for learners and lack of consultation with teachers when facing difficulties in learning/understanding (Sintema, 2020).

1.3 Research Aims

This research is aimed at exploring and answering the following questions:

1. What are students' perceptions towards the implementation of PBL under pandemic?
2. What are students' perceptions towards the engagement level and passion scale on Passion-based learning?

Chapter 2: Passion-Based Learning

2.1 Definition

Passion-based learning (PBL) is an education mindset that believes every student has potential that must be unleashed (Maiers & Sandvold, 2018). Students are empowered to discover and consume, communicate and connect, and create and produce based on their deep

seated interests. Maiers & Sandvold (2018) said that passion-based learning is about finding a "hero" who can make him/her successful acquiring the practice of established practitioners in the chosen field. Teachers can act as facilitators and observers. They let students come up with something they are really passionate about that can be related to the curriculum and allow them to work within that space (Nussbaum-Beach, 2011). In passion-based learning, students learn and pick material they are passionate about in specific element of curriculum (Nussbaum-Beach, 2011).

2.2 9-step PBL Framework

The process of PBL implementation in this study follows the 9-step PBL framework below, which was developed from 3-phase framework (Maiers & Sandvold, 2018). In phase one, Passion Discovery is comprised of (1) "Exposure", to introduce PBL and expose students into various passions, (2) "Exploration", to allow students to explore their passions by asking a number of questions, and (3) "Discussion", to guide students to find the topic of their passion projects. The next phase, Passion Pursuit includes (4) "Assistance", to assist their projects by suggesting passion experts and ways to research, (5) "Realization", to set small steps and goals for students to accomplish their passion projects, and (6) "Evaluation", to evaluate their outcome from success and difficulties. Final phase, Passion Sharing, consists of (7) "Method", to share their project in different contexts, (8) "Outcome", to summarize the knowledge, skills and attitude learnt, and (9) "Extension", to extend students' learning by developing next round of PBL.

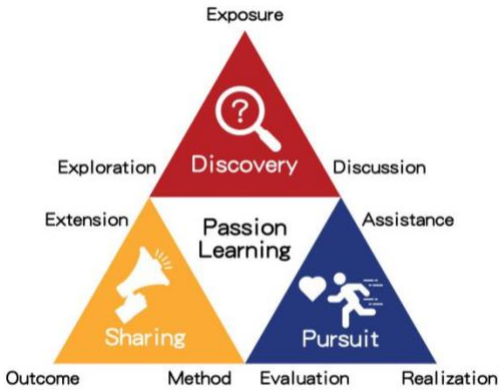

Diagram 1: 9-step PBL Framework

A formula is used (Maiers & Sandvold, 2018) to illustrate the connection among PBL, engagement and passion, in which the latter two indicators are the criteria in valuing students' perceptions in this study.

$$\text{PBL} = \text{What} + \text{Where} + \text{Who}$$
$$\text{PBL} = \text{Engagement (What} + \text{Where)} + \text{Passion (Who)}$$

Chapter 3: Methods

3.1 Theoretical Framework : Academic Engagement and Passion Scale

To measure academic engagement, I used the Utrecht Work Engagement ScaleStudent (Schaufeli, Salanova, et al., 2002), which comprises 17 items of which six measure vigour concerning behavioral engagement, five dedication about emotional engagement and six

absorption for cognitive aspect. Students responded to all items on a seven-point scale from 1 (strongly disagree) to 7 (strongly agree). The scales have been shown to report acceptable levels of internal consistency (.70 to .79), to show factorial validity, and to predict students' classroom behavior, such as learning behaviors during class (Mills, Culbertson, & Fullagar, 2012; Salanova et al., 2002; Schaufeli et al., 2002).

The Passion Scale (Vallerand et al., 2003) is a 16-item self-report questionnaire that is used to assess harmonious passion (6 items), obsessive passion (6 items), and the extent to which an activity coincides with the definition of passion (i.e., the "passion criteria"; 4 items). Items comprising the Passion Scale prompt respondents to indicate on a 7-point Likert scale the extent to which they agree or disagree with various statements about PBL.

In this research, the scale comprises 12 items of which six measure harmonious passion (e.g. 'Passion-based learning is in harmony with the other activities in my life') and six measure obsessive passion (e.g. 'I have almost an obsessive feeling for Passion-based learning'). Students responded to all items on a seven-point scale from 1 (strongly disagree) to 7 (strongly agree). The Passion Scale is a widely used measure of passion for various activities and has demonstrated reliability and validity in numerous studies (Vallerand et al., 2007; Vallerand et al., 2003)

3.2 Research Gap

As writing this essay, I still do not find many refereed article journals discussing this topic. The literature search was conducted in the ERIC, PsycINFO and Web of Science electronic databases because these databases contain the most publications regarding educational research. I used the term "Passion-based" & "Passion-driven" and a combination of educational terms ("learning", "teaching", "education", "academic engagement", "implementation", "intervention", "passion scale"). The search was limited to research articles in English.

Similarly, scholars confirmed that the ideas around this topic mainly discussed in professional education websites (Mas'ud,2019). What's more, no empirical study related to passion-based learning is found in the contexts of "Hong Kong", "Primary school" and "blended learning under pandemic". Therefore, huge research gap is yet to be filled in and gives rise to the driving force of this mixed-mode research.

3.3 Setting and Context

The study occurred in a P.5 academically less able class in a Hong Kong primary school. During online lessons, school time was cut to half-day schooling in which students ended their lessons at, normally, 1 p.m. In the first stage of passion-based learning, Passion Discovery was accomplished in both lesson time and online lessons. Students were to answer questions on an online platform to help identify their passions. After that, the second stage, Passion Pursuit, was carried out in both lesson time and extra spare time after school. Students spent some lesson time and mostly their after-school time to create their passion project collaboratively. Using electronic communication application, students share their opinions mainly after school. The last stage was done in the morning assembly time, which was the first 10 minutes of every school day.

3.4 Participants

In a P.5 class of 14 students, learners were separated into two sets of participants. The first set of students, 6 in total, involved in all the three stages of passion-based learning. The other set only participated in Passion Discovery. The involvement in the whole process was voluntary.

3.5 Instruments

Creswell (2012) defined the mixed-method approach as "an approach to inquiry that combines or associates both qualitative and quantitative forms" (p. 4). Moreover, Johnson and Onwuegbuzie (2007) believed that this approach allows researchers to "compensate for inherent method weaknesses, concentrate on inherent method strengths, and offset inevitable method biases" Greene (2007, p. 13).

Students' interviews and students' survey serve as the two primary sources of data informing the study. Researcher field notes and Document analysis were to confirm and/or question participants' academic engagement and passion scale about the intervention.

3.5.1 Students' Interviews

After the completion of three-step passion-based learning, 6 of the participants took part in an open-ended, participatory, semi-structured interview. Each interview lasts 15-20 minutes and occur during break time of school. Student interviews will be audio recorded and transcribed. The interview protocol and associated questions are designed to examine students' perceptions towards the implementation of passion-based learning step by step. The interview consists of three main phases: (a) The completion of Passion Discovery, (b) The accomplishment of Passion Pursuit, (c) The enjoyment of Passion Sharing.

3.5.2 Students' Survey

Students' survey relies on four areas of inquiry: (a) implementation of PBL , (b) academic engagement (c) passion scale, (d) open-ended questions to give participants an opportunity to explain their perceptions freely and to express their attitudes toward PBL. First three areas of inquiry are assessed in terms of a 7-point Likert scale the extent to which they agree or disagree with various statements.

3.5.3 Researcher Field Notes

I was immersed in the passion-based learning environment as a participant observer for the whole process. I took detailed field notes focused specifically on participants' engagement and passion during the intervention. The six main actors were typically involved in different stages of passion-based learning. My field notes included the context, activity, participants, length of observation, detailed descriptions , and any follow-ups. In the lessons, I looked for evidence concerning the measurements: implementation process, engagement and passion.

3.5.4 Document Analysis - Passion Project Video

According to Corbin & Strauss (2008), document analysis is a systematic procedure for reviewing or evaluating documents—both printed and electronic material. Like other analytical methods in qualitative research, document analysis requires that data be examined

and interpreted in order to elicit meaning, gain understanding, and develop empirical knowledge. Document analysis is used in combination with other qualitative research methods as a means of triangulation—'the combination of methodologies in the study of the same phenomenon' (Denzin, 1970, p. 291).

In my research, the significant document is the co-created Passion Project, the music video. It doesn't only represent the completion of three stages of PBL, but students' engagement and passion can also be found in their passion project, as non-technical literature, such as reports and internal correspondence, is a potential source of empirical data for case studies (Mills, Bonner, & Francis, 2006).

3.5.5 Interview Analysis

The research utilizes thematic analysis, a form of pattern recognition within the data, with emerging themes becoming the categories for analysis (Fereday & Muir-Cochrane, 2006). It takes a 4-phase analysis in the interview section.

3.5.6 Survey Analysis

The three variables are analyzed through SPSS and their corresponding measures such as mean, mode, median and standard deviation are generated. The results are correlated with central value of Likert-7 scale. Positive results are concluded for values higher than 4.429, the numeric representation of "Somewhat agree", "Agree" and "Strongly Agree".

3.5.7 Video Analysis

The current research, using the matrix style by Baldry and Thibault (2006), is a multimodal transcript modality that will combine still photos with descriptions of body movements and language used, by embedding digital images and film clips that can be opened and played. Analysis table will include time of clip, settings, speaker, utterance and other semiotic resources.

3.5.8 Field Notes Analysis

Assessment of field journals may be summative, where feedback is provided at the end of a course as an evaluation of learning and/or student performance, or formative, where feedback is provided throughout the course in support of student learning (Moss and Brookhart 2009). The present field notes were made right after the completion of each period, Passion Discovery, Passion Pursuit and Passion Sharing.

3.6 Triangulation

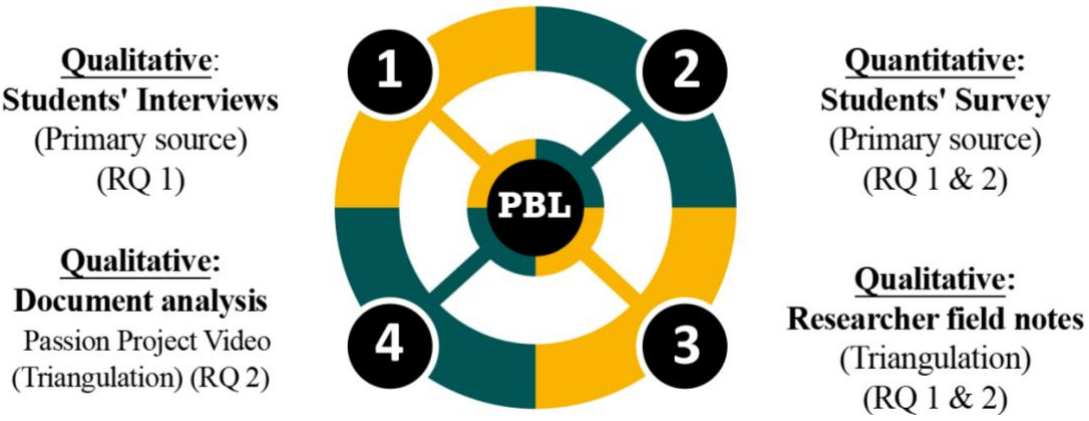

Diagram 2: Triangulation in this research

Chapter 4: Findings and Discussions

4.1 Research Question 1 - *What are Students' Perceptions Towards the Implementation of PBL Under Pandemic?*

4.1.1 Interview Data

In the first phase of PBL implementation, Passion Discovery, one of the themes from learners' perception is "Motivation for Discovery" which includes "Excitement", "Expecting future life" and "Passion promotion". The first type "Excitement" is related to "How do you feel about this phase?" Surprisingly, two of the most active and engaging participants passionately suggested a variety of exciting options about promoting PBL. Their inclination implies their passion in PBL as well as kindness to helping others to discover their passions. Not only the ideas were possible in future, but their passionate mindsets proved the success of the implementation. Possibility is limitless from class-based to school-based approaches. The researcher and corresponding school are assessing the feasibility of their suggestions, which might bring success to school-wide implementation.

In phase 2, Passion Pursuit, one of the two themes identified in this phase is "Team growth". In the process of Passion Pursuit, students emphasized the importance of "United as a team" and "Team building". A very motivating and inspiring view towards "How do you improve this phase?" was suggested. The current Passion Project served as a pioneer so only 6 out of 14 students participated. Yet a bigger team could be formed in future.

The third phase is called Passion Sharing. The first theme in this phase is "Self-growth" which covers "Confidence gained", "Peer relationship", "Appreciation" and "Expression". Boundless from fixed school curriculum, children could finally voice out their passions on a platform, the morning assembly time. The passion expression was perceived by both actors and the non-actor.

4.1.2 Field Note Data

The initial phase, Passion Discovery, aims at identifying students' passions. The data-driven codes are "Autonomy", "Passion", "Peer relationship" and "Expression of views". Theses codes can be categorized into two groups, "Motivation for Discovery" and "Methods of

Discovery", which are exactly the codes used for interviews. What's next, Passion Pursuit aims to practise and pursue their passions. The data-driven codes are comprised of "Peer-relationship" and "Skills". They are highly relevant to the interview code "Team growth" and "Skills absorbed". The resonance resembles a kind of learning from Passion Pursuit. Passion Sharing helps disseminate passion project. Data-driven codes are listed as "Confidence", "Enjoyment" and "Appreciation". Relevantly, codes can also be correlated into "Self-growth" and "Enjoyment". To conclude, the implementation of Passion-based learning is found to attain the goal of each phase. High correlation between data-driven codes and interview codes signifies the high reliability of the mixed-mode research.

4.1.3 Survey Data

The nature of the survey data belongs to "one-way", "ordinal" and "Likert scale data" (Clason and Dormody, 1994). Controversy has been drawn regarding the nature and analysis of Likert-scale questionnaire. Wu and Leung (2017) asserts that Likert scale is an ordinal scale but usually treated as an interval scale. Therefore, descriptive analysis including both ordinal and interval scale is to be done. In the following, survey data is analyzed regarding median, mode, frequency, in the view of ordinal data, and mean, arithmetic mean and standard deviation, in the view of interval data.

The first variable, "PBL Implementation", possesses a promising result. Given very limited time for implementation, "Passion expert" in phase one (Q3) and "Thinkbook" in phase two (Q4) have not been mentioned yet. Despite the absence of two elements, it doesn't affect the exploratory PBL implementation or the overall results. In phase one, majority of survey data goes towards good results significantly, especially for Q1. If Q3 is excluded, mean score 5.965 is calculated which relates much to "Agree" side. It implies that most participants perceived a successful implementation of Passion Discovery.

Similarly, negative result in Q4 implies the validity of the survey. As "Thinkbook" is a learning element requires much time to be implemented while the feasibility is in doubt, participants responded negatively. Except this, most data links to the positive side of Likert scale. Therefore, learners' perceptions towards Passion Pursuit are positive.

What's more, all indexes in Passion Sharing are correlated with the effective side. Positive values of median, mode, mean and arithmetic mean indicate the favourable result. Moreover, high validity is identified as the standard deviation of three questions exceeds 2. As only some learners involved in the passion project, many passions were not pursued or shared, echoes with the meaning of high standard deviation. To sum up, "PBL Implementation" is perceived successful in the eyes of learner survey.

4.2 Research Question 2A - *What are Students' Perceptions Towards the Engagement Level on Passion-Based Learning?*

4.2.1 Survey Data

The second variable "Academic engagement", even more favourably, generates nothing-bad results. First element "Vigour" takes a positive view. Except for Q3 "When I get up in the morning, I feel like doing PBL" which is understandable for too-early school time in Hong Kong, most results fall into a positive view. "Dedication" serves as the spotlight in this variable. Contributed by consistent mode of 7 point and relatively positive means &

arithmetic mean, all participants expressed their encouraging view. This noteworthy finding actually suggests that students truly dedicate much to both PBL implementation and passion project. It reaffirms the validity of the research methods as students engaged much in PBL.

Another element "Absorption" relates to neutral side comparatively. Yet, most promising result is related to Q4 "immersed with PBL" which resonates with the purpose of PBL. To conclude, all findings point to a very high engagement level by learners.

4.2.2 Field Note Data

Field note is made upon the three lessons on Passion-based learning. Codes are also drawn in terms of engagement level and correlated with survey codes. In Passion Discovery, data-driven codes concern with "Passion", "Autonomy" and "Expectation". With reference to academic engagement (Schaufeli, et al., 2002), the survey codes are listed as "Enthusiasm", "Joy", "Energy" and "Purpose" accordingly. Passion Pursuit's data-driven codes are about "Full engagement", "Passion", "Enjoyment", "Perseverance", "Teamwork", "Appreciation" and "Immersion". Consistently, academic engagement mentions "Enthusiasm", "Energy", "Persevere", "Meaning", "Proud", "Time flies" and "Immersed" respectively. The final phase Passion Sharing relates to "Appreciation", "Future engagement", "Enjoyment" and "Immersion". They fit the codes from academic engagement "Proud", "Meaning", "Joy", "Energy", "Enthusiasm" and "Immersed". To sum up, both observation and data-driven codes indicate a high level of engagement. Moreover, high correlation between survey codes and data-driven codes triangulates the data from survey and field note accordingly.

4.2.3 Video Analysis Data

The first engagement code "Enthusiasm" is specifically related to Student B, C and E. Looking into students' various semiotic resources, researcher realized students' enthusiasm was projected in different ways. Another code "Joy" is discovered in Student A,B,C,D and E. Apparently, actors enjoyed the video taking process. "Energy" that implies the vigour in engagement, is possessed in all the five actors too. Their energetic performance aroused audience's interests. The last engagement code relevant to the passion video is "Immersed". Particularly, this code implies a high level of engagement, thus only found in Student A and C. To sum up, video analysis shows that actors devoted much in the passion project and elicited a high level of engagement.

4.3 Research Question 2B - *What are Students' Perceptions Towards the Passion Scale on Passion-Based Learning?*

4.3.1 Survey Data

Regarding the final variable "Passion", the dualistic view (Vallerand et al., 2003) is comprised of "Harmonious Passion" and "Obsessive Passion". Preferable results encompassing "Agree" on "Harmonious Passion", and "Disagree" on "Obsessive Passion". Expectantly, most findings in "Harmonious Passion" are positively correlated to the success of PBL. Regarding both ordinal and interval views, the findings consistently fall towards "Agree" side. Specifically, "Obsessive Passion" has a tendency to fall onto "Neutral" side. Both Q3 "difficulty imagining my life without PBL" and Q7 "My mood depends on me being able to do PBL" do not generate a favourable result. Yet, the findings are close to "Neutral" and high standard deviation is located. All in all, most data is preferred in terms of

"Harmonious Passion" whereas it is noteworthy to concern "Obsessive Passion" in future researches.

4.3.2 Field Note Data

The first phase, Passion Discovery, concerns with codes "Passion", "Daily activity" and "Enjoyment". "Passion" and "Enjoyment" are identified from the observation, that are similar to "Attractive" in survey data. The last phase, Passion Sharing, correlates to "Enjoyment" and "Passion". For instance, Student E (Beatboxer) found a beatbox tutorial clip from Youtuber and included it in his clip. His "Passion to teach & share" beatboxing is one of the "Qualities he likes". The correlation between data-driven code and survey code shows a high level passion.

4.3.3 Video Analysis Data

In addition to semiotics resources, actors' utterances help identify passion level. The passion video is analyzed and compared with the codes in passion scale (Vallerand et al., 2003). Two of the codes are correlated namely "Qualities he/she likes" and "Daily activity". The first code "Qualities he/she likes" implies that passionate people love the qualities they possess. In the passion project, Student A,B and E possess the characteristics. Their utterances show passion and curiosity towards self-learning. The uncommon special talent is probably a quality they enjoy a lot. Another code "Daily activity" signifies the consonance between passion activity and his daily life. Students' passionate efforts in the passion project match with their daily activities Therefore, video analysis identifies actors' passion in the video and its correlation with passion scale is high.

Chapter 5: Conclusion

5.1 Summary of Findings & Implications

Current exploratory mixed-methods study, which draws upon data collected from six semi-structured interviews with Hong Kong primary five learners and a survey administered to 14 learners, is structured in a way that answers to the two guiding research questions. In the following, the answers to these two research questions are summarized and presented.

The first research question "What are students' perceptions towards the implementation of Passion-based learning under pandemic?" is investigated through interviews, field note and survey. A total of six themes that obtained from 9-step PBL constructs the framework for RQ1 investigation. Positive view from the interviewees on each theme indicates a flourishing PBL implementation. To empower the validity of the exploratory research, two-fold triangulation was enforced. Strong correlation was drawn between interview themes and field note codes. To conclude, students' perceptions towards PBL implementation were promising and encouraging.

The other question "What are students' perceptions towards the engagement level and passion scale on Passion-based learning?" is examined by survey, field note and video analysis. The uniqueness of sample size and sample profile in this exploratory research gives rise to the validity of quantitative analysis. Both field note and video analysis contribute much and have a strong correlation with engagement level and passion scale. The highly correlated findings imply a significant level of both academic engagement and passion. To sum up, students'

perceptions towards engagement level and passion scale were significantly assertive and favourable.

5.2 Limitations

A number of limitations have been encountered in the research. First, this class-based pioneer implementation is limited by its sample size and the uniqueness of sample profile. What's more, time was very limited for a primary five class who was facing Internal Assessment for Secondary School Places, especially under pandemic period. Most importantly, the scarcity of PBL researches, not to mention in the context of Hong Kong primary school under COVID-19, set the biggest obstacle to this pioneer research.

Nevertheless, the researcher has devoted much effort in the current research to alleviate the limitations. Correspondingly, both qualitative and quantitative methods are employed to investigate three variables, in order to generate a comprehensive picture of PBL. In the limited time, the researcher engaged as many students as possible in the process of interview, survey, field notes and video analysis. Most considerably, exploratory research questions and multiple methods with reference to relevant educational researches are employed through reading a variety of researches comprehensively.

5.3 Summary

This exploratory and visionary research on PBL is contextualized in a seem-to-be impractical Hong Kong primary school. It does not only impressed the school seniors and colleagues with the students' accomplishment and the possible future education, but it also draws attention to the feasibility of PBL in full-packed Hong Kong education system. The researcher sincerely hopes to contribute in the field of PBL by publicizing the research and sharing it with international researchers, in order to construct a sophisticated framework and guidelines for future PBL implementation. Future education should be individualized, student-driven, highly intrinsically motivated, full of creativity, curriculum co-constructed by both teachers and learners. In that way, Passion-based learning doubtless has a prominent place in future education.

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Multimedia-Enhanced English Presentation Training With the Audience in Mind

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Abstract
This study presents the initial findings from a comprehensive 16-week presentation skills training program designed for Taiwanese college students who possess intermediate to advanced English proficiency. The program utilized multimedia tutorials on infographics and various presentation tools, and provided one-on-one diagnostic sessions as well as workshops by field experts on modern presentation requirements which included communication proficiency and visual hierarchy. The study found that the training significantly improved the students' understanding of effective English presentations, resulting in increased cohesion of verbal-visual communication skills. The program also resulted in a growth of presenters' awareness of the audience. It strongly validates the effectiveness of a multimodal approach to training nonnative English speakers, highlighting the importance of including linguistic and visual components in presentation training for academic and professional success.

Keywords: English Presentation, Language Learners, Multimedia, Awareness of the Audience

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Introduction

Making successful English presentations nowadays is reckoned as an essential skill academically and professionally. Compared to native English speakers (NESs), due to plausible linguistic challenge in using English as a lingua franca, most nonnative counterparts may experience much higher cognitive load during oral presentations, when sharing complex knowledge in English-medium-instruction classrooms or international workplaces. According to Berman and Cheng, this advanced productive academic skill is considered arduous to most international students, to the extent that the high language demands strain grade point averages (GPA)—more so at the graduate than the undergraduate level. For graduate students and scientists, their lack of communication skills can lead to frustration when presenting at conferences. The damage could extend beyond educational settings if the quality of their oral presentations fails to meet expectations in the workplace.

Moreover, when envisioning a successful presentation, one does not only picture a brilliant monologue; the sole focus on improving verbal delivery in the past no longer suffices. Nowadays, verbal presentation training emphasizes that presentations should be visually pleasant, adopt clear information organization, and apply technology tools effectively-multimodal information delivery is highly valued and sought-after. In other words, for English learners, in comparison to NESs, the use of visuals (or other forms of multimedia) is more crucial when presenting their ideas. However, developing the crucial skill set requires deliberate and focused training: the skill mastery and practices are rarely included in school curriculum. Most students learn to present implicitly by mimicking their teachers or peers through observation and imitation. Therefore, the comprehensive design of presentation training in this study showcases how the 23 Taiwanese college students refine their English presentations through a strong combination of verbal and visual communications to elevate communication quality with the audience. This ongoing study has already yielded fruitful preliminary results, validating the effectiveness and necessity of the instructional design.

Mayer's (2020) Multimedia Learning Theory, lending a strong basis to guide the components of visualization in education, identifies three main principles for designing effective multimedia presentations: Multimedia Principle, Coherence Principle, and Signaling Principle. That is, people learn better when words are complimented with pictures rather than words alone, when extraneous material is excluded rather than included, and when cues are added to highlight the organization and structure of the essential material. In the context of multimedia presentation, his theory emphasizes on the necessity for presenters to apply visual hierarchy to guide the viewer's attention from vital to peripheral information using perceptual cues such as color, contrast, and size. In other words, presenters are responsible for facilitating their audience to process complex information more effectively. From this perspective, the creation of presentation materials necessitates an understanding and awareness of the audience's needs and preferences. Mayer's theory (2020) offers a framework for designing effective presentations by combining verbal and visual information to work around human's limited attention. In this paper, students' substantial progress will validate the application of these principles to complement the existing verbal training.

Methodology

The on-site training designed for the elective course titled "English Presentation with Multimedia and Communication Strategies" has a total duration of 16 weeks—with participants aged between 20 and 25, and with their English proficiencies ranging from

higher intermediate to advanced. All have given the consent to be included in this study. The multimedia tutorials target the production of infographics, advanced functions of *PowerPoint*, *Prezi* (www.prezi.com), *Powtoon* (www.powtoon.com), *Canva* (www.canva.com), as well as a well-known audience response system *Slido* (https://www.sli.do/). Many handy apps or online graphic editing tools which provide users with the ability to make simple graphic alterations without requiring extensive knowledge of complex design software. Refining visual materials, whether for aesthetic appeal or to illustrate concepts, aids student presenters in visually engaging their audience during verbal communication. Moreover, multiple field experts join the teaching to model qualities of presentation desired in the workplace. They respectively enrich the training in the form of workshops to familiarize students with the know-how in Visual Literacy, Infographic Design, and Public Speech. Collectively, considerable measures are taken to tailor the delivery of information to suit the target audience's preferences and presenters' objectives. In short, verbal skills, content visualization, and tool mastery form the comprehensive instructional design identifies the multimodal essence of modern English presentation training. Figure 1 shown below is the illustration of the instructional design.

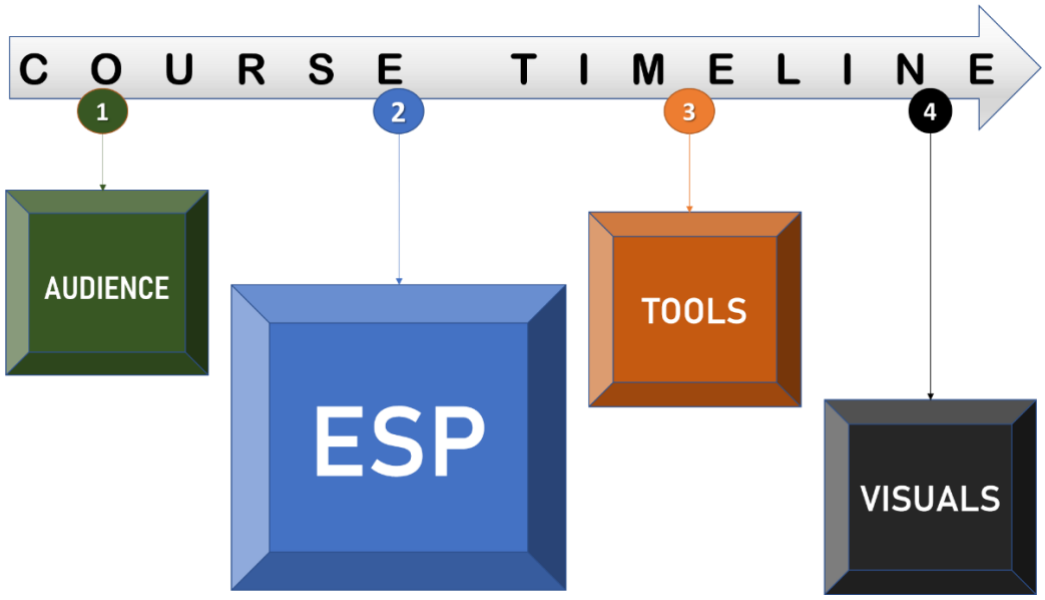

Figure 1: Instructional design
Note: The relative length of the modules is represented by the size of the color blocks

Module 1. Awareness of the Audience: This module aims to turn monologue to dialogue in a presentation with the purpose to turn silent audience to active learners. The prerequisite is the right mindset on the presenter's side: the awareness of the audience. To be more specific, a presentation ought to be participatory; remaining oblivious to audience engagement while unleashing nonstop PowerPoint (PPT) slides might suffice for a presentation in the past, but audiences today have higher expectations. Hence, the first module advocates the design of a presentation should revolve around the target audience: collective/individual background, interests, bias, existing knowledge on the topic…etc. The practice tackles the design of hooks, the ending, guiding/rhetorical questions, and "wow factors" (to impress the audience)—all included in the training from the outset and listed in the evaluation rubrics. Simultaneously, audience feedback is collected to enlighten student presenters about their performance, especially regarding the reception of their intended messages.

Module 2. Verbal Command (ESP): A series of learning tasks are designed to improve students' fluency and accuracy in oral presentation in response to students' learning needs (designed to address learners needs per the entry survey results):

- Learning from the expert: Analysis on Steve Job's presentation model (targeting formulaic expressions, content organization…etc.) and emulation of other successful public speaking models.
- Advertising for a brilliant idea: Contrastive intonation and proper pauses exercise and proper rehearsal.
- 30-second impersonation (from TED presentations): Incorporating facial expressions and body language into verbal communication, as well as awareness of audience's presence.
- Market analysis: Reporting statistics and extracting info from big data and communication strategies.

Through the above tasks, students pay attention to the rigorous organization and logic flow of content delivery to define, explain, support, and most important augment key information/messages/concepts. Lastly, designing and adapting presentations with the audience in mind is vital in this part of the training.

Module 3. Presentation Tools: advanced *PPT* functions, *Canva*, *Prezi* and *Powtoon* are included. Students proceed with skill transfer from the known to the unknown; they progressively extend their skills from familiar tools like PowerPoint to more novel platforms such as Canva, Prezi, and Powtoon, often integrating these various tools and adding narration and/or music. The capacities of these distinctive tools lead the students to rethink possible ways to construct presentations. Meanwhile, they manifest not only the skills to operate the mediums but also analytical knowledge of the pros and cons of each tool. From this point on, they can select the most appropriate tools and modes to best support various objectives and accommodate a specific audience of presentations.

Canva is a popular graphic design platform that allows users to create a variety of visual content such as social media graphics, presentations, posters, infographics, and more. It provides a wide range of customizable templates, graphics, AI-generated images, and fonts to help users design professional-looking visuals without the need for advanced design skills. See canva.com for more detail. Second, Prezi is a cloud-based presentation software that allows users to create dynamic and visually engaging presentations using a zoomable canvas. It offers a non-linear approach to presenting information, allowing users to create a path through their content and zoom in and out of different sections to emphasize key points. See prezi.com for more detail. Third, Powtoon is a cloud-based platform for creating animated videos and presentations. It offers a variety of customizable templates, characters, backgrounds, and soundtracks to help users create engaging and visually appealing content. See powtoon.com for more detail.

Module 4. Visuals: In this module, the quality and quantity of visuals are emphasized—enough to enhance impression but not so excessive as to distract the audience. Meanwhile, the strategic arrangement and selection of visuals to augment while accentuating the intended messages are vital to achieve persuasion. Most important, students become aware that the use of visuals should work in harmony with textual and verbal rhetoric (according to Mayer's Multimedia Learning Theory). A large quantity of brilliant samples and templates are introduced to the students with guidance. This way their inventory of useful resources expands, and their self-efficacy rises.

Field practitioners periodically join the learning modules in the form of consecutive workshops to demonstrate how to effectively create info-graphics, aesthetically organize visual elements, harmoniously animate verbal-visual communication, and confidently deliver an intriguing speech. They also review students' products in the previous modules to tackle individual problems and offer invaluable feedback. The team-teaching benefit not only the participants but also myself as an instructor: I am now able to upgrade my instruction to teach visual literacy in greater depth.

With video recording on individual presentations throughout the semester, students have the opportunity to examine their speaking habits and skills; such as how they paused, how they used fillers, if they could accurately describe statistical results and data, and more. To customize the instruction, each student would have one-on-one diagnostic sessions with the instructor to assess their personal performance. During which logs are taken as a qualitative data source. An entry survey is implemented to investigate students' learning needs. The progress of their mastery in content visualization is demonstrated through two rounds of presentations, conducted at the beginning and mid-point of the semester. With multiple sources of data collection, mixed-method data analysis techniques were used to unfold the induced effects of the multifaceted training. The back-to-back comparison between the beginning and the mid-point of the semester reveals students' growing understanding of the expected qualities in English presentations. Although the program is still ongoing, students have already made promising progress.

Results

The two major challenges, ***communication strategies*** and ***composition of visual elements***, stood out among 10 dimensions (listed below with corresponding percentages) in the entry survey (implemented before the training). These two indicators are respectively discussed, followed by a comparison between students' initial status and midterm presentation performances and visual production in this section.

Ten dimensions investigated through the entry surveys:

1. Content (the results of my research/experience/observation...): 21.7%
2. Info-organization (building logic, break down complexity/abstractness...): 34.8%
3. Script (proper discourse, word choice, transitional phrases...):13%
4. Rehearsal (on-stage performance, posture...): 39.1%
5. Visuals (image, infographics, aesthetics): 52.2 %
6. Tech tool application/operation: 21.7%
7. Language (fluency, intonation, pronunciation...): 47.8%
8. Communication strategies (skills to impress/persuade the audience): 60.9%
9. Target audience (knowing their expectations, background, questions they might ask...): 21.7%
10. Topic choice and key messages (objective met, call to action heard, impression made...): 30.4%

Communication Strategies (60.9%)

Among 10 various dimensions, communication strategies (skills to impress or persuade the audience) was considered the most difficult aspect among all (60.9%) in the beginning of the semester. Take S1 for example, in her first presentation, she failed to give audience some thinking time to process the information she shared. She kept talking nonstop and fast to

exhibit her strong familiarity and full preparation of the content. She focused on verbal fluency and confidence yet overlooked the interaction with the audience and refrained herself from gestures. The following QR code shows her 30-sec footage, and below is the verbatim transcription from it in the entry recording:

Hi my name is _____. Today I am going to introduce a task called Dictogloss. It is a writing activity that can help students improve and practice their writing skills. Ok so here is my table of content. First I will introduce the features and the procedure of this writing task. And then some reminders before going to the conclusions. Ok, so in a historical view, Dictogloss is a strategy which was introduced in 1990 as an alternative method to study grammar.

As anyone can see that she jumped right into the core content without showing an intention to connect with the audience and help them understand the significance of the topic. In other words, she did not attempt to build common ground with them, despite exhibiting perfect verbal fluency.

Fortunately, after completing the first half of the training, she has made great improvements by becoming aware of her audience in the midterm recording: she enticed the audience and patiently gave them time to think and respond. Below are the footage and verbatim transcription of her opening 30 seconds in the midterm recording when giving a simulated marketing analysis. Double slashes // indicate her deliberate design to invite the audience to engage in her talk. Her body language and audience responses are recorded in parentheses.

Good afternoon, everyone //. (with a big smile, eye contact, and open arms). Okay, let's try again, good afternoon, everyone // (her 2nd attempt with a bigger smile finally gets many returned greetings). Ok, very good! Thank you. // I am the store representative from the Gongguan branch which is in the south of Taipei. And today I am going to do a quick data analysis for the upcoming big sales event which everyone is looking forward to, aren't we all? // (with a big smile, eye contact, and wider arms again, and returned with many head-nodding and laughter).

Her deliberation of placing long pauses to appeal audience attention reinforced with her body language was obviously effective. Although the total word count is fewer, she stirred up the interests and participation from the audience already, while the fluency still sounded good. The verbal communication quality has drastically improved.

Composition of Visuals (52.2%)

Different visual elements, to sustain and direct audience attention, should be arranged and combined to facilitate audience's cognition, i.e., information processing. This know-how

encompasses the use of principles such as balance, contrast, proportion, and hierarchy to create an overall sense of visual harmony and effectiveness in conveying a message or idea—enjoyable to read/view and supportive to presenters' verbal communication. However, this know-how was a void in students' perpetual curriculum and past schooling experience. This gap also reflected in students' learning needs revealed through the entry survey: over half of them already sensed the deficiency. They often watched TED Talks and identified the successful models to pursue—yet did not how to embark on a change.

Taking S2 for example, in her first presentation, the first four slides below (Figure 2.) evidently unveiled her lack of know-how to properly compose visual elements: no respect of readers' eye flow, the competition among multiple focal points, the unaesthetic and unbalanced arrangement of images.

Figure 2: Students' PPT slides before the training

After the first half of the training, she has improved significantly (see Figure 3.). Her mastery of various techniques: creating layers (of shades) for contrast between foreground and background, visual impact with vibrant color and oversized font, cohesive color scheme across slides, respect of aesthetics and eye flow (Z-shape route), proper combination of images and texts, effective use of infographics, and balanced amount of content and focal points in one slide. Apparently, she refined the image for post-production to create the visual coding; her tool mastery has elevated as well. All in all, she respected the three principles Mayer (2020) has identified: *Multimedia Principle, Coherence Principle,* and *Signalling Principle*. The progress she has made endorses the necessity of interdisciplinary training by including effective visualization in English presentation curriculum.

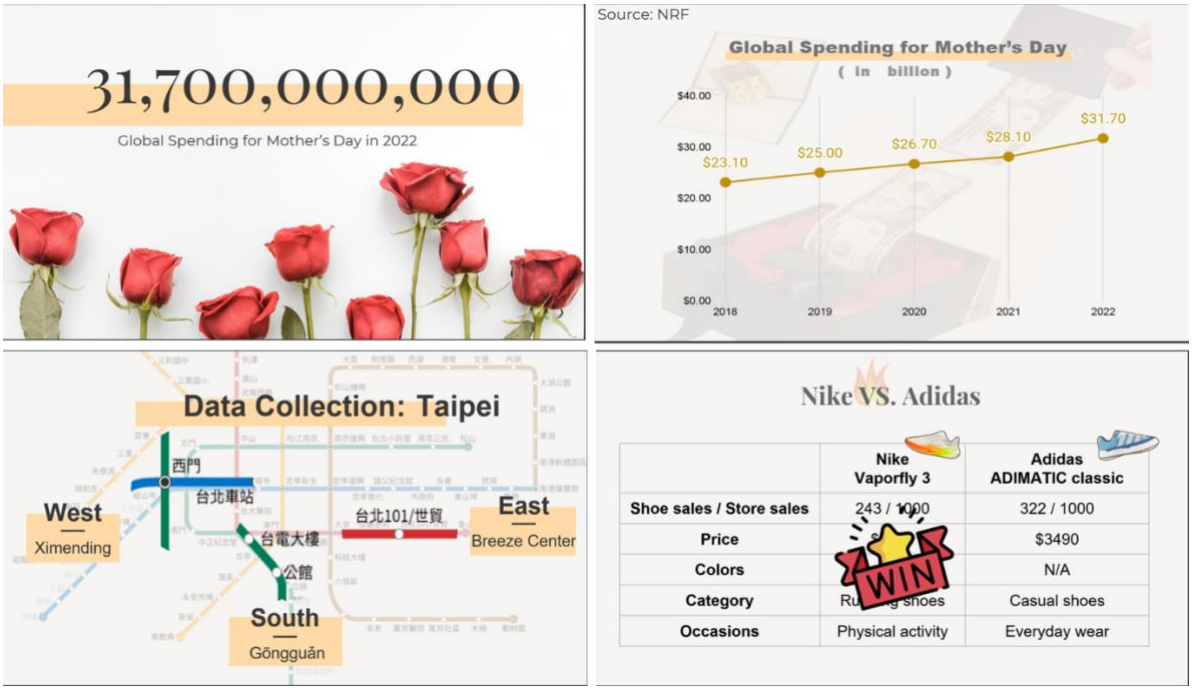

Figure 3. Slides after the first half of training

Conclusions

Fellow students' performances also drastically evolved: their creativity, aesthetics, awareness of audience, and imagery-expressions improved holistically along with their command of verbal communication. By familiarizing themselves with tech tools, they learned to select and combine based on presentation contents and objectives. Their applications of participative strategies to interact with audiences has become prominent. This research demonstrates the necessary inclusion of verbal-visual communication, multimedia tools, and communication strategies in English presentation training. Furthermore, the outcomes validate the effectiveness of the multimodal approach of innovative training for nonnative English speaking presenters, preferably early in their schooling experiences.

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Development of Building Construction Blended Curriculum for Korean Universities

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Abstract
The COVID-19 pandemic and the Fourth Industrial Revolution have brought about significant changes in education at Korean universities. Two typical examples are the expansion of online learning and the spread of innovative teaching methods. Online education has advantages in that it allows learners to repeat learning and learn freely, regardless of time and place. It is necessary to develop and operate the curriculum in ways that can utilize the advantages of online education and compensate for its disadvantages. Therefore, this study sought to develop an education method that combines online and offline education. The main contents of the convergence curriculum developed in this study are as follows. Basic theory education is conducted online, and intensive education is conducted offline. 3 hours of education per week consists of 1.5-2 hours of online education and 1-1.5 hours of offline education. Learners learn in advance using an online system (LMS). Deep learning is conducted in the classroom. Deep learning consists of quizzes, complex problem solving, and Q&A. The curriculum focused on weekly education procedures and the contents of education for each 15-week period. The curriculum proposed by this research could be applied flexibly according to the education goals of the instructor and the learning capabilities of the students.

Keywords: Building Construction, Team-Based Learning, Innovative Teaching Method, Convergence Curriculum

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Introduction

The COVID-19 pandemic and the Fourth Industrial Revolution have brought about significant changes in education at Korean universities. Two typical examples are the expansion of online learning and the spread of innovative teaching methods. It is time to address these changes and difficulties in the educational environment and discuss effective education methods for the future. Online education has advantages in that it allows learners to repeat learning and learn freely, regardless of time and place. However, learning from video lectures makes it difficult for learners to concentrate and interact with professors. Therefore, it is necessary to develop and operate the curriculum in ways that can utilize the advantages of online education and compensate for its disadvantages. Therefore, this study sought to develop an education method that combines online and offline education as one of the ways.

Development of Online-Offline Convergence Curriculum

Development Scope of Education Method

The blended education method to be developed in this study was aimed at a 4-year architectural engineering program at Korean universities. Specifically, the major course was assumed to be building construction in the third year. It was also assumed that the education period would be 15 weeks per semester, and three credits would be allocated to a theoretical course for three hours per week.

Development of Weekly Education Process

The education process with three hours per week was developed as shown in Table 1. The basic theory course is offered online, while the deep learning course is provided offline. It was suggested that the three-hour course program operates 1.5 – 2-hour online classes, and 1-1.5-hour offline classes. For online education, professors record video lectures and upload them to LMS, while learners use the video lecture on the LMS and learn at any time or place. For offline education, professors give deep learning lectures, while leaners take various types of deep learning according to the guidance of the professor. The contents of deep learning include quizzes, Q&As, problem-based learning, and field investigations. The content composition of deep learning varies depending on the educational objectives of each professor and university.

Methods	Online	Offline
Contents	Basic theory	Deep learning
Place	LMS	Classroom
Hours	1.5 – 2	1 – 1.5
Details	-Professor: lecture video production and upload -Student: individual study (lecture video, lecture note, textbooks use)	-Quiz (5-20questions multiple choice) (4-10times) -Q&A (every week) -Problem based learning (2-6times)

Table 1. Education process (3hours)

Development of Weekly Educational Content

In general, the curriculum at domestic universities consists of 15 weeks per semester. Table 2 shows the developed education content for 15 weeks in a semester. Exams are conducted twice (mid-term exam and final exam), and online and offline classes are carried out for the remaining 13 weeks. In online education, a basic theory course is offered via video lectures recorded in advance by the professor. In offline education, the deep learning course is provided along with quizzes, Q&As, problem-based learning and field investigations. The purpose of the quiz is to evaluate the level of mastery in a basic theory course offered online. In general, 5 to 20 multiple-choice questions are given in the quiz. Learners solve questions and submit their individual answers, and also work in teams to discuss and submit the answers, which induces peer learning and deepens basic theory learning.

Weeks	Online(basic theory, lecture video)	Offline(deep learning)
1	Chapter1 General theory of building construction	Mock quiz, Team composition (5-7per by team)
2	Chapter2 Temporary work	Problem based learning1 (team) : temporary work
3	Chapter3 Earth work	Quiz1 (individual, team) : chapter1, 2
4	Chapter4 Designated and Foundation work	Field survey1 (team) : plan presentation, plan submission
5	Chapter5 Form work	Quiz2 (individual, team) : chapter3, 4
6	Chapter6 Reinforcing bar work	Problem based learning2 (team) : earth work or foundation work
7	Chapter7 Concrete work1	Quiz3 (individual, team) : chapter5, 6
8	Exam(mid term)	
9	Chapter7 Concrete work2	Problem based learning1 (team) : form work or reinforcing bar work
10	Chapter8 Steel structure work	Quiz4 (individual, team) : chapter7
11	Chapter9 Masonry work	Field survey2 (team) : result presentation, result report submission
12	Chapter10 Waterproofing and damp proofing work	Quiz5 (individual, team) : chapter8, 9
13	Chapter13 Tile and stone work	Problem based learning1 (team) : concrete or steel structure work
14	Chapter19 Curtain wall work	Quiz6 (individual, team) : chapter10, 13, 19
15	Exam(final term)	

Table 2. Weekly education content

Problem-based learning is to work in teams to solve open-ended problems that arise from practical affairs at construction sites. In this way, learners can develop their practical

capabilities. The field investigation is to visit the construction site, conduct on-site surveys and then prepare the survey report for each team, through which learners can directly check the basic theories learned in advance at the construction site and study in depth through interviews with experts. The Q&A method is used in traditional theoretical education, but the Q&A session after learning about basic theories can be carried out more actively. It is also a good way to give additional points to encourage greater participation among students. The deep learning course conducted through team activities includes quizzes (solving in teams), problem-based learning, and field investigations. Participation in team activities can allow learners to develop collaboration skills.

Conclusion

The COVID-19 pandemic has brought about many changes in higher education. One of these changes is the expansion of online learning. In response to this change, this study investigated the development method of university education with the use of the rapidly growing online education programs and proposed a blended education method that combines online and offline education. The detailed contents of the proposed education method include the one-week education process and the education content of 15 weeks per semester. The education method proposed in this study is a general education process and content. Therefore, it is expected to be applied in accordance with different educational environments and conditions for each university.

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An Examination of Elementary Students' Reasoning Ability via Inquiry-Based Project Designed by STEAM Integration

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Abstract
This study describes inquiry-based methods, taught in elementary school setting, integrated with STEAM courses sessions that teacher candidates work with individual children. I examine fifty-six students' (4th and 5th graders) reasoning ability, especially on mathematics and scientific justification, on teacher candidates' STEAM lessons through the theory of inquiry-based methods. I employed a quantitatively descriptive and quasi-experiential mixed model ANOVA and a qualitatively coding process on open-ended questions and letter-writing analysis on the field. A pre/post-test design was employed to determine levels of students' development in reasoning ability. Instead of telling students what, why, and how climate change occurred, all participants' learning processes are guided by play-based pedagogy, based on students' needs in real classroom settings. Students thus needed to hypothesize reasonable responses via online resources. The STEAM lessons culminated in students writing a letter to the local mayor about potential damage to their municipality stemming from climate change. The lesson structure required young people to propose policy changes. Results indicated that prior to the inquiry-based model's implementation students were primarily given pencil-paper tests. Under the inquiry-based models, students begin exploring knowledge through scientific inquiry. Using the processes in this study, students significantly improved their ability to measure their reasoning and argumentation skills.

Keywords: Inquiry-Based Methods, Play-Based Pedagogy, STEAM Curriculum, Teacher Candidates

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Introduction

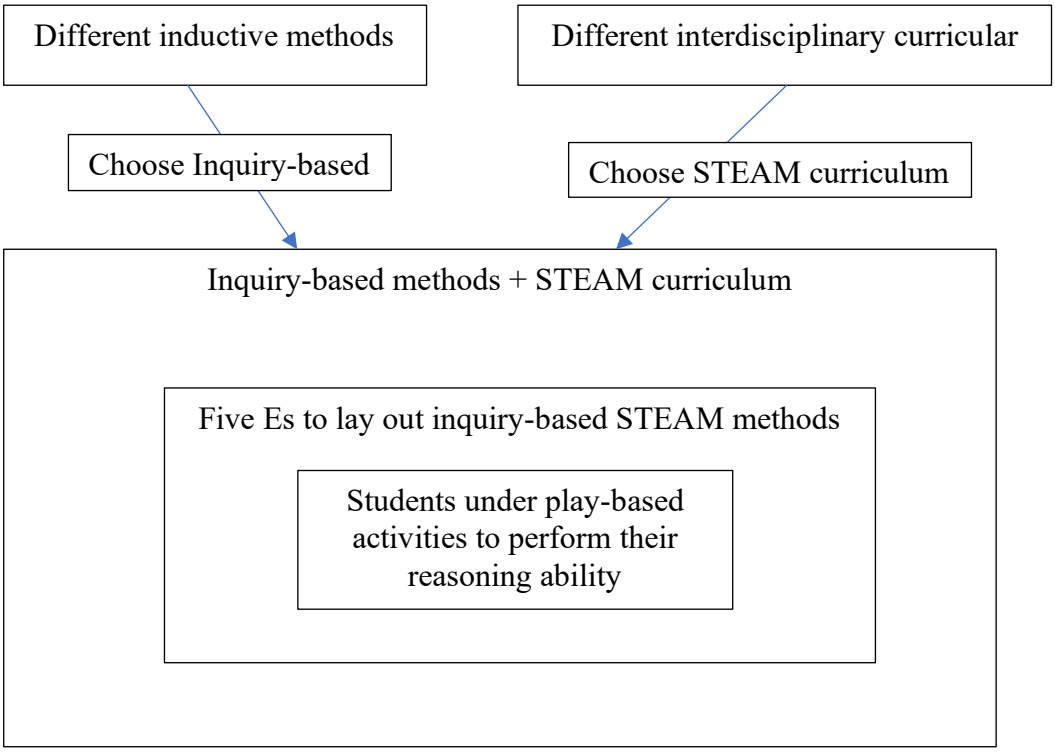
Four years ago, I began to introduce the theory of inquiry-based methods (Khalid & Mohammed, 2018) along with the play-based learning environment to my mathematics methods course. Teacher candidates implement the inquiry-based methods in the local elementary school at the same time so, as a method instructor and supervisor, I may observe and examine the practical performance of inquiry-based methods in real classroom settings. My intention to do this research, based on the pilot-observation in the four years, was to provide a scientific examination the validity of inquiry-based methods by elementary students' performance in the inquiry-based methods. Some research showed (Reinhardt, Robertson, & Johnson, 2021; Tan, 2019; Abramovich, Easton & Hayes, 2012) elementary teacher candidates may develop their signature pedagogy (Shulman, 2005) well when implementing inquiry-based methods in STEAM lessons. On the other hand, my pilot-observation showed that elementary students may develop their reasoning ability with STEAM-related activities under inquiry-based methods. This study is to examine if elementary students' reasoning ability can be developed well under inquiry-based STEAM methods.

To develop elementary students' reasoning ability in STEAM lessons, play-based pedagogy (Paterson, 2020), designed by teacher candidates, may be used to implement inquiry-based STEAM lessons for elementary students who have different learning needs. This means, based on elementary students' learning styles, levels of STEAM performance, and cultural background, teacher candidates may design meaningful games to develop their students' critical thinking skills. The focus of this study is students' reasoning ability in STEAM lessons, which may include elementary students' mathematical reasonings (Michael, Tammy, & Johna, 2010), scientific argument and reasonings (Zulkipi, et al., 2020; Berland & NcNeill, 2010). Through inquiry-based methods, used in STEAM interdisciplinary curriculum, I wonder how elementary students develop their reasoning ability through play-based pedagogy. The research question in this study is how elementary students develop their reasoning ability under play-based learning process through inquiry-based model.

Theoretical Framework

To aim at elementary students' reasoning ability, the content-related curriculum and pedagogy are discussed. First, I represent the difference between STEAM and STEM education, and why STEAM curriculum is the best lessons to examine and support students' ability. Secondly, I discuss students' reasoning ability performance in inquiry-based methods, and, thirdly, I explore how students use what, why and how to justify their reasoning in play-based learning pedagogy. Figure 1 may provide a picture of how pedagogy and content are considered together as Pedagogical Content Knowledge (Shulman, 1986) and how theoretical teaching models can be transformed to practical learning process.

Figure 1: Model of literature review



Students' Reasoning Ability in STEAM Curriculum

Students' reasoning ability can be developed by any creative activities in a disciplinary curriculum design like STEM education. Science education, under STEM curriculum, normally provides rich creative activities for students to observe facts, explore evidence, justifying the prediction based on their reasoning ability (Cabello et al., 2021). Researchers (Aguilera & Ortiz-Revilla, 2021) are aware that the component of "Arts" may need to be included in STEM curriculum in order to approach the essential meaning of education, not just for job preparation. Furthermore, standing on teaching through understanding, students can develop their critical thinking better when STEM curriculum adds art components than STEM only (Conradty & Bogner, 2018). By adding art into STEM curriculum design, students can show their critical thinking skills in reasoning ability (e.g., finding reasons, justifying the reasons, choosing meaningful reasons to conclude the hypotheses etc.) presented by the "art" activities (e.g., writing a letter to the city mayor, drawing pictures to share in the schools, or doing activities for community service. In this study, students are under STEAM education to develop their reasoning ability.

When focusing on students' reasoning ability performance, one concern is how students can develop their reasoning ability under inquiry-based STEAM lessons with wide different students' abilities and have different cultural backgrounds (Huo et al., 2020). Excellent STEAM lessons require teachers to be knowledgeable in domain-content subject with consideration of cultural or environmental differences. Students must feel that their teachers recognize their cultural strengths so they will feel worthwhile when representing their reasoning abilities (Zulkipi, et al., 2020). The research (Zulkipi, et al., 2020; Berland & NcNeill, 2010) showed it is easier to connect all students by environment-related art activities because these activities can be built together in the classroom which will provide a

foundation that all students can relate to. In this study, under STEAM curriculum, students can represent their reasoning ability by writing a letter to their city mayor. This activity provided common ground for all students.

Students' Reasoning Ability Under Inquiry-Based Models

Within several inquiry models (Gunter, et al., 2011), STEAM curriculum can be designed under problem-based inquiry methods, based on the situation learning theory (Shulman, 2005; Putnam & Borko, 2000) as theoretical framework. Problem-based inquiry STEAM lessons provide students to examine the problem situation, so students need to ask themselves, what, why and how questions to learn new knowledge by themselves. The teachers' roles under problem-based inquiry STEAM lessons are to facilitate students' needs, not give answers, so students use their reasoning ability to guess, predict, and confirm new knowledge. In addition, Thunberg et al., (2018) showed that cognitive learning in inquiry-based STEAM methods can help students make a positive attitude to explore new knowledge by reasoning ability, and Vlassi and Karaliota (2013) studies in behavior science perspectives showed inquiry-based STEAM methods help students believe in their own capabilities to explore new knowledge.

Inquiry-based models can be represented by the five Es' (Engage, Explore, Explain, Elaborate, and Evaluate) in lesson processes (Duran & Duran, 2004) in STEAM curriculum. The Five Es may systematically support different kind of scientific activities for students to demonstrate their reasoning ability (Karpudewan et al., 2015). The goal of this study is to explore how students can use the questions of what, why, and how by themselves and answer their own questions by reasoning under situatedness inquiry-based learning in STEAM lessons.

Practical Play-Based Pedagogy/Activities for Students' Reasoning Ability

As Figure 1 represented above, inquiry-based methods provide a theoretical concept, and the play-based pedagogy may provide a practical concept for teachers to design meaningful STAEM learning activities for their elementary students to play. Here the play-based pedagogy is not based on free play-based curriculum (Pyle, 2017) for kindergarten and first grade. The play-based pedagogy, as Putnam and Borko (2000) states, is systematically designed for students as a group to choose STEAM activities to explore new knowledge. The formation can be different. For example, station teaching can be used so students play different STEAM games, but all aligned with the same learning objectives. It also can be under three prepared STEAM games; students can choose one of them to play individually or as a small group.

The goal of play-based pedagogy practically creates a game-based environment for students to explore new knowledge through the essential questions, what, what, and how to explore new knowledge by themselves. The games may come from technology (e.g., website like IXL, iPad apps, google exploration, etc.) integrating to the STEAM lesson objectives. The research (Lo & Hoover, 2022) showed through playing the games/activities with an "inquiry" or "unknown knowledge" in their mind, students represent that they have responsibility to find out the knowledge and they feel belonging in their learning process.

Method

Participants

Fifty-six students are qualified to participate in this study. These students are all in four classrooms in 4th and 5th grade at Lincoln Elementary School in the St. Clous School District, located in the central Minnesota. All of the teacher candidates in this study are well-trained and have proven their abilities in previous clinical settings. The school has 84% of students on free lunch and students' scores are consistently below the state average in standards test. The school principal and math coach are very supportive of this study because they are looking for different instructional models to implement their STEAM curriculum. Based on their observation, they found the play-based pedagogy in the real life under the theory of inquiry-based method helps students with different cultural background, students with limited English ability, and students with below average performance in STEAM lessons very well. Both would like to know the results of this inquiry-based method as it is implemented in the existing STEAM interdisciplinary curriculum.

Two of four teacher candidates are assigned to the 4th grade classrooms and the other two are assigned to the 5th grade classrooms. All four teacher candidates understand inquiry-based STEAM method concept, play-based pedagogy, and five Es lesson procedure very well. There are totally 98 students in the four classrooms, but the study eliminates students who are under special education plan (called IEP in the U.S.), who have extremely social emotional disabilities, and whose STEAM performance only reach to 2nd grade standards. To the end, only 56 students in these four classrooms are qualified to be participants in this study.

Instruments and Data Collection

The 5-likert-scale survey (see appendix A) with 5 items and three open-ended questions is designed as instruments for this study. This same survey is used twice as pretest (the 5 items) and posttest (the 5 items with three open-ended questions) in this study. Multiple data collections are implemented in this study. For the quantitative data, a quasi-experiential design with pre- and posttest survey to the 4th and 5th graders was collected to determine the levels of students' performance in their reasoning ability. The qualitative data is collected from the three open-ended questions in the posttest survey and students' performance in their persuasive letter writing project.

Procedure of This Study

The unit of climate changes was chosen to be an indicator of this study under inquiry-based methods because it is the unit covered in 4th and 5th grade science curriculum. Before the climate changes unit, all students took the pre-test survey. During the unit, students are required to write down their answers related to what, why, and how in their learning tasks. Most of time, the answers of these questions are represented in the "Explore", "Explain" and "Elaborate" steps in the five Es lesson process. The final project of this climate change unit is students wrote a persuasive letter to the local mayor. In the letter writing project, students are required to report their findings through math reasoning(what), cause/effect through scientific reasoning(why), and their reasoning of how to effectively do recycling in this city (how). After the unit, students take the posttest survey and teacher candidates collect students' persuaded letter.

Data Analysis

I analyzed quantitatively pre- and post-test survey by using mixed model ANOVA. Within 4 classrooms, one 4th grade and one 5th grade classroom are treatment group, in which students' reasoning performance is developed with the inquiry-based STEAM methods and plan-based pedagogy following five Es lesson process. The other two classrooms, one 4th grade and one 5th grade, acted as the control group in this study. Students in the control groups are under regular textbook-driven curriculum to complete their climates change unit. The mixed model ANOVA analysis is to compare the pre- and posttest results to see if students' reasoning ability performance shows a statistically significant difference.

I analyzed qualitatively students' answers to their open-ended questions and letter writing data by coding process (Elliott, 2018). I develop meaningful codes to categorize five criteria of reasoning abilities. The qualitative data may represent how play-based pedagogy through inquiry-based STEAM methods can facilitate students' reasoning ability in STEAM curriculum.

Research Question

How can 4th-5th grade students develop their reasoning ability under play-based learning process through inquiry-based STEAM methods?

Findings

Fifty-six students are qualified to represent their reasoning ability in this study. The following quantitative data report from the Mixed model ANOVA model is used to report if students' reasoning ability performance has statistically significant difference.

Reliability Indication

I relied on internal consistency statistics to interpret the reliability of the scales generated for the investigation, In the U.S, I designate grades 4-5 as "intermediate [elementary] level" (ages approximately 8-11). I intend to continue the development of an instrument that practitioners may find useful for tapping elementary students' attitudes toward their ability to engage in critical thinking. I have entered the pertinent results in Table 1.

Based on the Table 1, it showed that the five items sufficiently intercorrelated to produce Cronbach alphas (all are greater than 0.6) appropriate to the research effort and to justify combining the items to form a more reliable composite score.

Table 1: Reliability estimates

Scale	N Items	Description	α
A. Pre-Assessment	5	Initial Assessment of ability (of fourth and fifth graders) to think critically	**.73**
B. Post-Assessment	5	Same as above except collected ***following*** the treatment experience	**.79**
C. Pre-post taken as one tool	10	The alpha score across two administrations of the same items	**.66**

Descriptive and Inferential Results

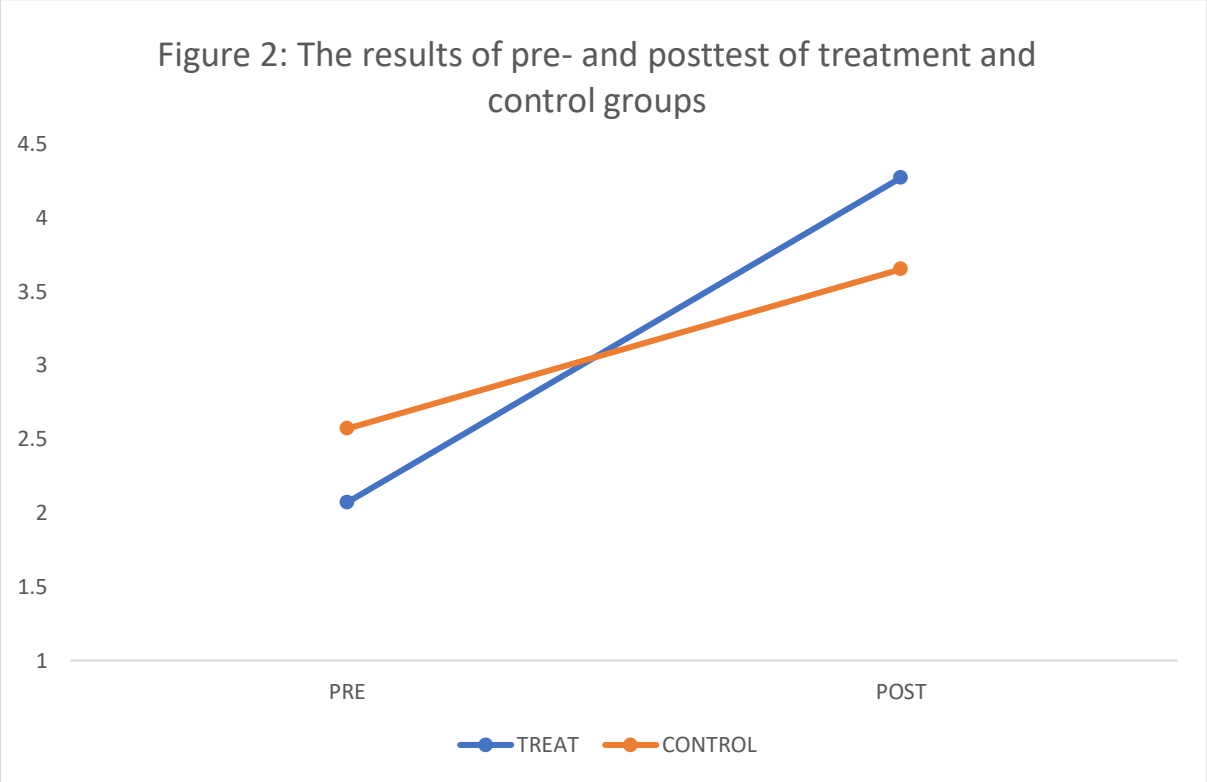
Descriptive Analysis. Based on the positive internal consistency metrics, I next constructed a composite score by averaging the pretest survey scores and, of course, the post treatment test survey values. As a starting point of the analysis, the mean values by pre- and posttest treatment levels are provided in Table 2 and transferred the Table 2 numbers into the Figure 2.

Table 2. Pre and post values across groups.

Pre vs. Post/ group	N	Mean	SD	d (Post-Pre)[1]	Effect Size[2]
Pre/ Treatment Group	30	2.07	.45	----	----
Post/ Treatment Group	30	4.27	.45	2.20	4.9
Pre/ Untreated Group	26	2.57	.41	----	----
Post/ Untreated Group	26	3.65	.27	1.08	3.1

[1]d = difference, post treatment mean – (minus) pretreatment mean.
[2]Rough estimate of pre-to-post effect size for each group (d/pooled SD's). Inferential results found below.

Figure 2 showed ordinal effect that before the units, the students in the treatment groups do performance reasoning ability lower than the control group. After using inquiry-based methods, the treatment group students perform higher reasoning ability than the control group in this unit.



Inferential Analysis. A mixed model ANOVA was developed. Via this model, I sorted variability of the dependent measures into three interacting independent variables, TRIAL (two levels Pre vs. Post, repeated measures) and GROUP (two levels, treated vs. controlled). The potential independent variable GRADE (between grades within classes) was ignored as no a priori reason existed to assume that the fourth-grade class would perform differently from the fifth-grade class. In fact, in a preliminary study, this proved to be the case, GRADE

did not interact with TRIAL, nor did it interact with GROUP. I treated the TRIAL effect and TRIAL * GROUP interaction as within-subjects effects with inter-subject variability designated as the error term. GROUP served as a between-subjects factor, with within-group variability serving as the error term. The resulting mixed model ANOVA table is shown below in Table 3.

Table 3. Mixed model ANOVA inferential results

Variability Source	Pillai's Trace	F	df	*p*	Partial Eta[2]
PRE-POST Assessment (Within Subjects)	.94	779.2	1	<.001	.94
PRE-POST X Group (Treated vs. Controlled, Within Subjects) Trial by Group	**.62**	**89.8**	**1**	**< .001**	**.63**
GROUP[1] (Between Subjects	----	.451	1	.51	----

[1]Between-Groups SS = .106, 1 df yields a MS of .106. Error = 12.73 df = 54 = MS_{error} =.236 (.45, see above)
[2]Eta-squared indicates the strength of an effect—roughly in SD units. For example, the pre-post by GROUP effect here is about 2/3 of an sd.

The most central effect related to the questions posed for the study's is the PRE-POST X GROUP interaction effect. I chose to emphasize this result because it best answers the research question about whether the treatment worked as planned. In other words, one might pose the following query: Did the treatment group improve more than did members of the untreated group? The answer is a resounding yes. Not only was the GROUP X PRE-POST effect significant, but it produced a reasonably strong effect, $F(1, 56) = 89.8$, $p < 0.001$, the effect size (η^2) = 0.63.

Oddly, both the treated and controlled group changed significantly as a function of time, e.g., TRIAL, evincing a sizeable effect size of .94 (partial eta[2]). This probably occurred because of subjects' prior exposure to items, e.g., during the pre-treatment phase of the study. Perhaps exposure to the topic of critical thinking produced contemplation of the topic that impacted post test results. In my view, this is a form of difficult-to-manage error variance that probably undermined the interaction effect by some degree. In other words, this is a measurement issue that needs to be addressed in future studies, perhaps via analysis of covariance.

Table 4 contains results (treatment group only) by item (pre vs. post). This allows for an examination of which items produced the largest pre-to-post differences.

Table 4. Mean values by item/ treated group only (descending order by gain: post-pre)

Item (short title)/ Arranged in descending order by size of pre-post change (difference)	Mean	SD	Mean	SD	Post-Pre Difference	Rank By Gain[1]
1. I can use my own words to describe what global warming is and how greenhouse gases (HCFs) trap the sun's heat.	2.23	.63	3.87	.63	1.64	5
2. I can justify evidence to explain global warming under natural factors or human factors.	2.23	.86	4.30	.65	2.07	4
3. I can examine the city data report and decide which parts need to reduce their HCFs emission.	2.10	.61	4.57	.63	2.47	2
4. I can explore effective strategies through information online to reduce HCFs emission in the city.	**1.87**	**.57**	**4.57**	**.57**	**2.70**	**1**
5. I can write a persuasive letter to our mayor persuade him by using scientific reasoning.	1.93	.74	4.07	.58	2.14	3

[1]Item #4 produced the largest gain (pre-to-post), followed by, in order, items 3, 5, 2, and 1.

Based on the table 4 report, it obviously showed students in the treatment groups can explore effective strategies by themselves online and produce new knowledge "to reduce HCFs emission in the city" by self-learning process. The findings showed students can use their own reasoning ability to build their new knowledge.

The Qualitative Findings

The following qualitative data from students' answers to open-ended questions and their persuasive writing project is used to report how play-based pedagogy through inquiry-based STEAM methods can facilitate students' reasoning ability in STEAM curriculum.

Theme one: Students prefer to have more time to do self-learning under inquiry-based STEAM method.

From the open-ended question number 2, it showed students would like learning lessons by themselves under inquiry-based methods. Instead of a lecturing process in science lessons, they prefer to play related-scientific games online to explore new knowledge. They feel confident to ask themselves what, why, and how questions. Here are two quotations from a student.

> "Our group choose to play an online game under global warming lessons on the website of IXL. After the greenhouse video clip, we have a plenty of time to explore what greenhouse gases are, why carbon dioxide trapped the heat from the sunlight. I feel so proud that I learn new knowledge by myself." (4th grader, Reid)

> "I like the inquiry-based learning environment because I have more time to explore meaningful information about why climate change cause global warming." (5th grader, Mohammad)

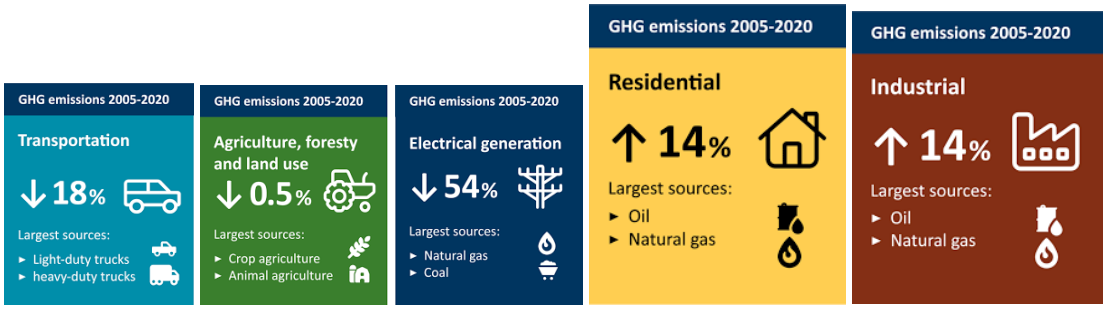
It showed students enjoy having enough time to work together. In the beginning, they might start with divergent perspectives to answer questions or make a hypothesis. Students will use their critical thinking skills to examine information, examine evidence, justify their reasoning, and keep asking meaningful questions to approach convergent perspectives.

> "Our group evaluates information and make a reasoning justification for our conclusion. So, we know better how to write a letter to our city major." (4th grader, Ayan)

Theme two: The "Arts" in STEAM showed students' reasoning ability better

The findings are based on the coding analysis from writing a letter. Through students' persuasive letter performance, it showed students do a better job to combine STEAM reasoning ability with their language art performance. The final task in the climate change unit, the writing task, students use the online resource (https://www.pca.state.mn.us/sites/default/files/lraq-2sy23.pdf) to find the data (see Figure 3) and use the data to write a persuasive letter to their city mayor. The coding on the letter writing is to explore students' use the questions of what, why, and how, as scientific reasoning, to compose their letter. It showed students can develop their reasoning ability from STEAM requirement to apply in the real-life situation. The project helped students begin to learn how to appropriately represent their scientific reasons and argument to other persons.

Figure 3: Data for writing a persuasive letter



Resources are from the website: https://www.pca.state.mn.us/sites/default/files/lraq-2sy23.pdf

The following is the quotation from students' persuasive writing project.

> "…because residential and industrial GHG are still increase 14% from 2005 to 2020, we suggest you increasing solar energy for houseowner and manufacture to reduce the use of oil and natural gas." (4th grader, Abdi)

> "After we explore global warming, dear Mr. Kleis, I think you need to make a recycling policy in each school and show recyclable materials as explicit as possible." (4th grader, Sara)

Writing a letter in a group can be one of play-based activities. After that, each group may present their letter and explain what they write, why they represent this way, and how better they think your performance as self-evaluation under the last step of five Es process.

Conclusions

Inquiry-Based Methods in Diversity Classrooms

Students' reasoning ability is current K-12 education focus, especially in schools with complicated social environments. There is a constant debate about what kind of education models and training models can help our students the best. Several studies (Mark, et al., 2021; Kang & Kim, 2014) showed the inquiry-based methods perform well for gifted and talented students. After implementing the study in the elementary school, where 89% of students remain eligible for free/reduced lunch and 45% are designated as students of color, the study represented the opposite result of the previous studies that students of color in the multi-cultural background classrooms actually can also perform well. Survey question number 4 "I can explore effective strategies through information online to reduce HCFs emission in the city." The difference between post and pretest means have the largest gain. It means students of color have the ability and students who come from poverty have the ability to do critical effective learning under inquiry-based STEAM method. They showed they can provide self-learning attitude in each learning task.

Play-Based Pedagogy and Five Es

One conclusion of this study is about students' motivation and their attitude to each learning tasks in the STEAM lessons. Obviously, the play-based pedagogy plays a practical role effectively to motivate students' learning attitude without worrying about their possible STEAM content deficiency. Play-based pedagogy are required to use scaffolding to lay out the STEAM games. In addition, teacher candidates must be well trained to change easy games to be more challenge, to change competitive games to be cooperative games, or change individual games to be group-playing games.

Play-based pedagogy motivate students to participate in the science unit on climate change, so they enhanced their reasoning ability and other critical thinking. This means that under educative models, inquiry-based methods, students can practice how to use their own words to ask meaningful question, to justify meaningful evidence (for example global warming in this study), to examine their justification of their reasoning, and to explore the best strategies to report all reasoning they made to others.

Five Es play a big role in making a regulation for students to play STEAM games in each lesson. Under play-based pedagogy, students, individually or in a small group, are easy to lose the direction during their own playing time. When teacher candidates use five Es lesson process in each single STEAM lesson, it may help students to create an environment-awareness schema (Thunberg et al., 2018) in their mind. Normally under inquiry-based methods, teacher candidates act as a facilitator in STEAM lessons to go around the classroom to help different kinds of students' learning needs. During the "Explore" time, students know the next step is "Explain" section so they will do meaningful exploration to aim at their explanation in the next step of each lesson.

Technology Roles in the STEAM Curriculum

Technology in this study plays a big role to establish the inquiry-based STEAM methods so even though in the diversity classrooms, students still can develop their reasoning abilities corresponded with different kinds of learning styles (Darmayanti, et al., 2022). The traditional textbook-driven through lecturing teaching process may need to be used to integrate some benefits from technology application. Technology also provides effective STEAM games online or iPads for students to play with each other. Multiple STEAM games online, representing the same learning objectives, may fit into different students' needs. Technology can be a huge resource under play-based pedagogy. Students can choose online games to play for making some math procedure fluency or choose other online games for understanding (for example to google what HCF, why greenhouse gases trap the sun's heat, or to reduce HCF emission). Students with access to technology can feel a great sense of belonging in their learning environment.

Limitation and Further Research

This study presented the research question that the theoretical inquiry-based methods can develop elementary students' reasoning ability. During the whole STEAM curriculum, students frequently use what, why, and how questions to explore knowledge as their reasoning ability evidence. Students' critical thinking skills and performance in this study is limited by the four indicators and three open-ended questions (see Appendix A). Further research may develop students' reasoning ability performance based on different critical thinking skills in STEAM curriculum.

Inquiry-based methods play as a theoretical framework to implement in STEAM curriculum. The play-based pedagogy performed very well to motivate students' self-learning attitude in the real-life learning environment. It showed the transformation from theorical to practical methods works very well, especially under clinical teacher preparation program. The study also showed teacher candidates receive benefits from implement what they learn in the program, and they can implement what they learn into other methods. For the further research, the inquiry-based methods may be implemented in different subject matters designed by student-centered curriculum.

Appendix A

Consideration of Students' Reasoning Ability

A. **Response Format/ Disagree-Agree**: Please read each item carefully and record your degree of agreement or disagreement with the statement. Do this by circling either 1, 2, 3, 4, or 5 in the space provided, as follows:

1=Disagree; 2=Tend to Disagree; 3=Neutral; 4=Tend to Agree; 5=Strongly Agree
(Leave items blank if you have no opinion.)

B. **Response Format/ Written**: At the end of the survey, you will find a few short-answer items. It will be a great help to the project if you write a short paragraph in response [to them], without consulting outside sources. We want to know about your thinking right now.

C. **Circle**: Please circle the order of this questionnaire administration

FIRST TIME SECOND TIME

D. **Agree-disagree items.**

No.	Survey questions	Disagree-Agree Choices 1 Disagree, 2 Tend to Disagree, 3 Neutral, 4 Tend to Agree 5 Strongly Agree				
1	I can use my own words to describe what global warming is and how greenhouse gases (HCFs) trap the sun's heat.	1	2	3	4	5
2	I can justify evidence to explain global warming under natural factors or human factors.	1	2	3	4	5
3	I can examine the city data report and decide which parts need to reduce their HCFs emission.	1	2	3	4	5
4	I can explore effective strategies through information online to reduce HCFs emission in the city.	1	2	3	4	5
5	I can write a persuasive letter to our mayor persuade him by using scientific reasoning.	1	2	3	4	5

E. Very Short Answer Items.

1. Please share an example of how you justify a scientific reasonings to agree with a hypothesis you made in any science lessons—especially in terms of making a hypothesis and how you accept or deny the hypothesis (e.g., a statement like "Climate change is affected by human beings releasing to much carbon dioxide" and you may share your reasoning by writing "I agree with this statement because …").

2. You may know we use five Es in our STEAM lessons. Please provide a short paragraph about how you use "*what*", "*why*", and "*how*", in your critical thinking section to make a justification of your reasonings in your science lessons.
3. Please provide a short description of how **you** feel about the inquiry-based learning environment and integrate STEAM subjects together in your science lessons.

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Enhancing Inclusion and Critical Thinking With Station Rotation Model: A Research Proposal

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Abstract
New pedagogies are quickly entering the educational landscape as educators scramble to provide students with the 21st century skills. Station Rotation Model, a type of Blended Learning is a student-centred method that creates more engaging, productive, and goal-oriented learning environments by leveraging technology. At the same time, teachers need more than one framework to meet the needs of diverse students and turn their classrooms into flexible learning environments by following a Universal Design for Learning. This is a research proposal with the purpose to explore the implementation of the Station Rotation Model in a Primary School Classroom in Greece. Such a model will be designed based on other models found in literature and on the ADDIE method for the designing of a blended learning approach. Moreover, the model will follow the Greek curriculum, whilst in order to provide an inclusive and differentiated instruction, the guidelines of Universal Design for Learning will be taken into consideration at the time of creation and implementation of the activities/ stations. With action research, the investigator and practitioner will document and reflect on the use of such a model on a differentiated instruction and its effect on students' engagement, active participation and academic achievement. Last, the development of students' critical thinking skills will be explored as it is a crucial part of the transferable skills. The expected results point to the fact that the implemented Station Rotation Model will create an inclusive environment and have positive effects on students' engagement, academic achievement and critical thinking.

Keywords: Station Rotation Model, Blended Learning, Primary Education, Research Proposal

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Introduction

The swift advancement of digital technology will continue to alter the ways in which knowledge is produced, comprehended, and conveyed, opening the door for new instructional strategies and resources. Digital innovation has the potential to revolutionise education and change how universal access to education is delivered (UNESCO, 2023). Meanwhile, new pedagogies and models are quickly entering the educational landscape as educators scramble to provide students with the knowledge and skills necessary for the 21st century (Kim, 2021; Yang & Newman, 2019).

Online and blended learning attracted the attention of many educators and researchers worldwide after the COVID-19 pandemic (Lonigro, 2021). Blended learning is a student-centred method, where there are involved features of student-teacher, student-student and student-content collaboration (Ogude & Chukweggu, 2019). It places the student at the centre of the learning process by leveraging technology to create more engaging, productive, and goal-oriented learning environments (Powell et al., 2015).

The Station Rotation Model (SRM) is one of the four rotation models that according to Horn and Staker (2015) are included in the broader term of blended learning. It includes a set of educational activities (stations) that students rotate among during class time, depending on the subject or course. The students can rotate in groups at the stations that the teacher has set up in one classroom or several classrooms (Staker & Horn, 2012). SRM could be used to connect a previous topic to a new one, review a unit, or introduce a new one (Hite et al., 2022). A teacher-led station, small group work, and at least one station for online learning is typically included. There might be other stations like individual tutoring, pencil-and-paper assignments, small group instruction, manipulatives and group projects (Hover & Wise, 2020; Novak & Tucker, 2021; Staker & Horn, 2012; Walne, 2012).

SRM appears to be a promising strategy with several advantages for both the teachers and the students. The utilisation of project-based learning as a station to go along with the online learning station is also made easier by this concept. The learners can construct the knowledge individually by doing problem analysis or collaboratively building the understanding together with their peers, something that could be an important factor for the development of critical thinking (Othman et al., 2016; Prasetya, 2016). Critical thinking is an imperative transferable skill for students, because it enables them to analyse and compare information as well as construct arguments (Basri et al., 2019).

On the other hand, teachers need more than one framework to meet the needs of diverse students and turn their classrooms into flexible learning environments. Therefore, they can achieve this by connecting Blended Learning Models with the Universal Design for Learning (UDL) (Novak & Tucker, 2021). It is important to offer an inclusive environment to all students, bearing in mind not only the emerging number of learners with special educational needs (UNICEF, 2021), but also that each and every student will benefit from a differentiated instruction (Hite et al., 2022).

The rapid growth of the implementation of blended learning has created a gap in research in primary education. The majority of studies of SRM are focused on secondary settings, on higher education and/ or vocational training, even though it seems to be a quite popular and common approach in primary education (Fazal & Bryant, 2019; Fulbeck et al., 2020; Lonigro, 2021). Therefore, there is a need for more evidence-based research on a primary

setting. Moreover, literature shows that there are more studies focusing on the blended learning approach of flipped classroom, rather than the Station Rotation Model (Lonigro, 2021; Truitt, 2018; Yang & Newman, 2019). In the study proposed, a primary school setting was chosen for the implementation of the SRM, firstly due to the gap on research, and secondly to ensure equity related to access to technological devices with an in-class implementation. In addition, the Greek educational setting was chosen because of the familiarity and personal interest of the researcher-practitioner and because no similar research has been conducted till now in Greece. Last, studies in varying context and population could bring value to other investigations carried out so far, as technology and pedagogy constantly evolves (Ioannou et al., 2020).

The originality of this research lays also on the fact that a combination of a blended learning approach and UDL guidelines will be done. Inclusion of all students with an opportunity to differentiate instruction is imperative as it can help them develop the transferable skills needed for the 21st century carriers (Kim, 2021). As Fulbeck et al. (2020) highlighted, there is still more to learn about the SRM as an approach for differentiation and personalised learning, so future studies could be carried out on understanding student engagement through this approach. In addition to the above, according to Lonigro (2021), SRM could be used as a model to address some of the problems generated from the Emergency Remote Teaching during the pandemic, like for example students' low engagement, the need for more collaborative and inclusive practices and thereafter the need for the teacher to work with smaller groups of students.

The purpose of this study is to explore the implementation of the Station Rotation Model in a Primary School Classroom in Greece. An SRM will be designed based on other models found in literature and on the ADDIE method for the designing of a blended learning approach (Branch, 2009). Moreover, the model will follow the Greek educational system and curriculum, whilst in order to provide an inclusive and differentiated instruction, the guidelines of Universal Design for Learning (CAST, 2018) will be taken into consideration at the time of creation and implementation of the activities/ stations. With action research, the investigator and practitioner will document and reflect on the use of such a model on a differentiated inclusive instruction and its effect on the engagement of students and their academic achievement. Last, the development of students' critical thinking skills will be explored as it is a crucial part of the transferable skills (Basri et al., 2019) and at the same time because the research about critical thinking in Greece is still at early stages according to the literature review of Fountzoulas et al. (2019).

Objectives and Research Questions

The project objectives are considered as an important part of the research design. Research should not simply embark on an investigation without stating the reasons for it (Thomas, 2013). It is about stating what the project is supposed to achieve. In particular, this study has the following objectives:

General Objective

To design, implement and evaluate the Station Rotation Model in a Primary School classroom in Greece.

Specific Objectives

- To design and implement an SRM on a primary school classroom in Greece based on existing models in literature and utilising the ADDIE model for blended learning design.
- To adapt the SRM to the educational program of a primary school classroom that follows the Greek educational system and curriculum.
- To incorporate the UDL guidelines into the creation and implementation of the activities/ stations to provide inclusive and differentiated instruction.
- To explore students' and teacher's perceptions and experiences on the implementation of the SRM as well as the perceptions of the implicated families.
- To evaluate the effectiveness of the SRM in promoting students' engagement and academic achievement.
- To investigate the impact of SRM on the development of students' critical thinking skills.
- To determine the effectiveness of the Station Rotation Model in enabling inclusive and personalised teaching that caters to the needs of all learners, including those with the most learning difficulties.
- To provide recommendations for further improving the implementation of the adapted SRM in Primary School classrooms in Greece.

Research Questions

Having established the topic to be investigated and the nature of the objective to be fulfilled, the ideas should take the form of a more specific question or questions that will form the basis of the research (Thomas, 2013). The central questions of the project are:

- How effective is the Station Rotation Model, adapted to the Greek Curriculum and incorporating UDL's guidelines, in promoting students' engagement, their academic achievement and lastly their critical thinking skills?

- Does the Station Rotation Model allow for inclusive and personalised teaching appropriate to the development of the abilities of all learners, including those with the most difficulties?

Methodology

At a first stage, for the exploration of the theoretical background, a Systematic Literature Review (SLR) will be conducted with specific inclusion, exclusion and quality criteria the relevant studies around the word regarding the state of the research question (García-Peñalvo, 2022) following the guidelines of PRISMA (Page et al., 2021). At a second stage, a preliminary study will be conducted. The research methodology to be used is the action research with a mixed method approach. Action research is "research that is undertaken by practitioners for the purpose of helping to develop their practice and it is usually done at the same time as performing that practice" (Thomas, 2013, p.249). Action research is very typical in educational contexts, as the researcher and practitioner could be the same person and it could be used as a process to improve the educational practice, implement a new instructional method, improve the curriculum, solve issues among students or school members (Hine, 2013; Lufungulo et al., 2021). In the case of this study, I will be the researcher and teacher to implement the new instructional approach and reflect on the use of

the Station Rotation Model in my classroom. One cycle of the action research will be documented.

Regarding the sample of the study, this will be a classroom of a public Primary School in West Attiki, in Greece. As it will be an action research, the sample is a convenience sample and closely related to the researcher and practitioner, who will implement the new method and try to enhance the engagement of students as well as their critical skills.

The literature has long explored the benefits of the mixed method approach. It employs both qualitative and quantitative methodologies, either simultaneously or sequentially, resulting in data triangulation that improves the results' validity (Thomas, 2013; Yilmaz, 2013). For this study, more than one method will be used to collect data. For the data collection will be used: questionnaires, participatory observation, rubrics, research journal, focus group and interviews.

For the analysis of data, thematic analysis will be used for all the qualitative data following Braun and Clark (2006) guidelines and with the use of ATLAS.ti 9. On the other hand, statistical analysis will be used for the quantitative data (Miller & Brewer, 2003) and it will be facilitated with the use of SPPS v27 tool. All the ethical considerations will be taken into account throughout the study following the guidelines for educational research of the British Educational Research Association [BERA] (2018).

Apart from the above, it is important to mention that the instructional design method to be used for the designing of the blended learning approach is the ADDIE, which stands for Analyse, Design, Develop, Implement, and Evaluate. “It is a product development paradigm and not a model per se”. ADDIE is a systematic development of a course/ product with the educational philosophy of a student-centred intentional learning (Branch, 2009. p.1). Even though it is usually used in Higher Education, the basic steps of this approach could be taken into consideration in this study as SRM is a type of blended learning approach with the same purpose to create an effective and inclusive learning environment.

Conclusion

As educators strive to give students the skills they need for the 21st century, new pedagogies are swiftly making their way into the educational environment. Blended learning places the student at the centre of the learning process by leveraging technology to create more engaging, productive, and goal-oriented learning environments (Powell et al., 2015). According to Horn and Staker (2015), Station Rotation Model is considered part of Blended Learning. Students rotate in groups around a set of educational activities; and it typically includes: A Teacher-led station, Group work and at least an Online station (Staker & Horn, 2012). On the other hand, teachers need to create flexible learning environments in order to meet the diverse needs of students. Novak and Tucker (2021) suggest that this could be accomplished by fusing the Universal Design for Learning (UDL) and Blended Learning Models.

This paper aims to present a research proposal as part of a PhD programme. It intends to design, implement and evaluate the Station Rotation Model in a Primary School classroom in Greece, following the UDL principles. With action research, the investigator and practitioner will document and reflect on the use of such a model on a differentiated inclusive instruction and its effect on the engagement, academic achievement and critical thinking of students.

As it is an action research method a continuous reflective process will be made which might slightly change the research questions. According to literature findings it is expected to observe positive effects on student engagement and academic achievement and their critical thinking skills. It will be also important to explore how this educational methodology will affect the inclusion of all students.

Finally, it is important to mention that the progress of the study, the changes made and the results will be published in the portal of the PhD programme as well as in other conferences.

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TIC - TAC and Digital Competences in Military Higher Education

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Abstract
In the digital age, education with excellence must be supported by teachers with advanced levels in digital competencies, therefore, the research identifies the competency areas and their available levels by the different actors in military higher education, applying the scientific method and its progress is descriptive; through a survey to 124 people among Management staff, Administrative staff, Teachers and Military Instructors of the Escuela de Formación de Soldados del Ejército "Vencedores del Cenepa." According to the most relevant results, basic and medium levels in security competence are evidenced in 52,42% of respondents, considering that the career of Higher Technology in Military Sciences belongs to the department of Security and Defense of the University of the Armed Forces - ESPE, which is responsible for the training of soldiers in the field of security and defense, reason why it is essential to improve the digital skills on its personnel through specialized training processes. It is concluded that the effects of the application of TIC-TAC dynamize the classes, facilitate the teaching-learning process, contributing to have a training in didactics and methodological innovation of military and civilian teachers, improving skills and abilities.

Keywords: Digital Competences, Military Education, TAC, TIC

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Introduction

Worldwide education has had to adapt to numerous changes caused by various aspects, among which is the introduction of Information and Communication Technologies (ICT in spanish TIC). Unfortunately, it has primarily focused on the use of technological tools without exploring the benefits they bring to learning. Technology provides a new approach to educational research, which doesn't imply that ICT improves education per se, but rather how teaching and learning are approached. This gives rise to Technologies for Learning and Knowledge (TLK in spanish TAC), which allow organizing students into collaborative work groups to plan and solve problems, tasks, or projects together.

In the military environment, there has been a need to include ICT in education, but without fully assessing their importance in teaching and learning. At the Escuela de Formación de Soldados del Ejército "Vencedores del Cenepa" (ESFORSE), the application of technology has been evident, including virtual classrooms, MI ESPE (the computer platform of the Escuela de Formación de Soldados del Ejército), digital bibliographic repositories, among others. However, in some cases, the teacher or military instructor uses ICT out of obligation rather than allowing technology to generate joint learning and knowledge between the teacher, students, and technology. Therefore, it is essential to explore the digital skills of the different stakeholders and the benefits in the educational field. To achieve this, it is necessary to introduce TLK in military education to evaluate the performance of ICT in teaching and learning.

This study aims to answer the research question: What are the levels of digital competencies among the academic staff at ESFORSE? The paper begins by providing a detailed literature review, followed by a description of the methodology employed. It then presents the analysis and discussion of the results obtained and concludes with the findings of the current research study.

Literature Review

Education at all levels is the main pillar of socio-economic development, and in order to promote continuous improvement in the teaching-learning process, various actions have been developed worldwide, such as the establishment of legal norms and reports.

Currently, communicative, ethical, or intellectual competencies, to name just a few, are no longer sufficient to ensure effective teaching performance, which faces several challenges similarly with the new educational environments (Rangel, 2015). Knowledge has become the main source of wealth, and Information and Communication Technologies (ICT) are the most effective tools for its production and dissemination (Cabero, Barroso, Rodriguez, & Palacios, 2020).

The Organic Law on Intercultural Education in Ecuador, in its Article 6, section j, regarding the obligations of the state, states that it should: "guarantee digital literacy and the use of information and communication technologies in the educational process and promote the connection between teaching and productive and social activities" (LOEI, 2012).

Digital Teaching Competencies

In 2008, UNESCO developed a curriculum report with standards on competencies to integrate ICT with new pedagogies and promote dynamic social classrooms, cooperative interaction, collaborative learning, and group work, stimulated in teachers. This plan is based on three main components: basic technology concepts, deepening knowledge, and knowledge creation, which establish objectives and competencies that teachers should achieve (UNESCO - a Organización de las Naciones Unidas para la Educación, la Ciencia y la Cultura, 2008).

The development of digital competencies in teacher training has become an essential educational need, not just a trend. According to Morales (2013), this impact is reflected through the following aspects: expanding the coverage of education services, strengthening the educational system, promoting the use of ICT, and meeting the demand for services, see figure 1.

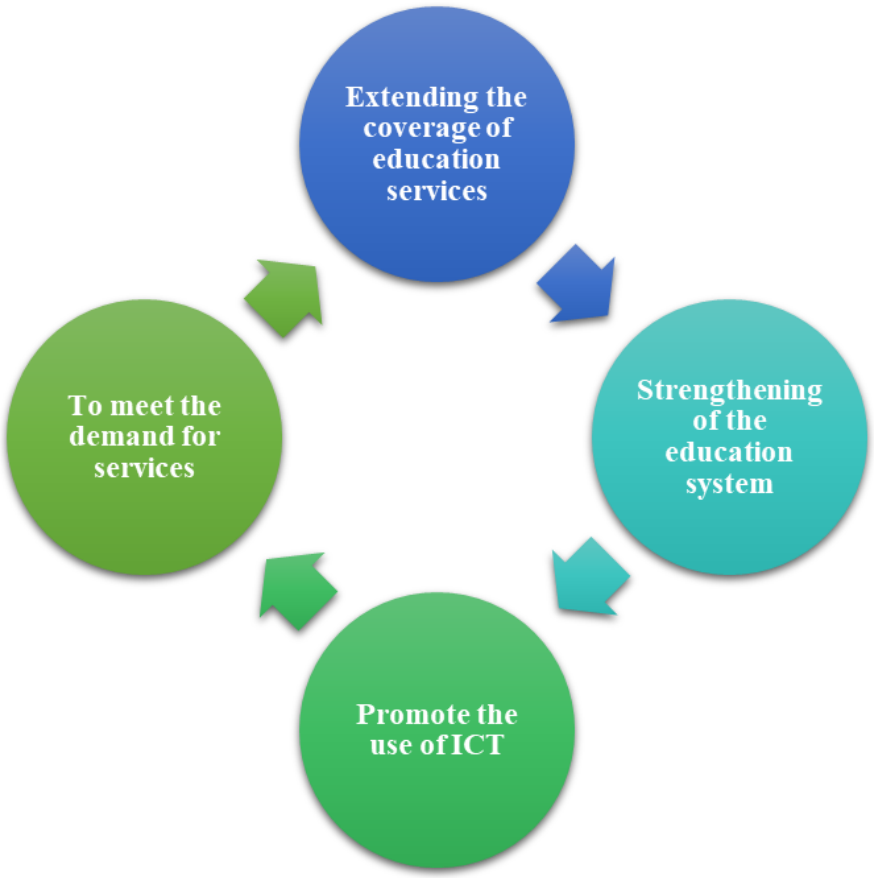

Figure 1: Aspects of digital competencies
Source. Morales (2013)

In recent studies conducted by Rangel (2015), the new role of the 21st-century teacher and their skills in using a set of resources are described:

Those that enable interaction with information, intellectually managing different systems and codes, reading and decoding not only in a linear manner but also in a hypertextual and hypermedia way, and evaluating information by discriminating valid and useful information for their educational, communicative, and action projects.

Similarly, we can say that teachers need to develop technical and pedagogical competencies to know, use, and integrate ICT in teaching practice, with the aim of making effective use in the teaching and learning process (Vera Noriega, Torres Moran, & Martínez García, 2014).

Considering the competencies that teachers of the 21st century need to develop for the improvement of their educational practice and continuous professional development, the Common Framework for Digital Teaching Competence establishes 5 competency areas and 21 competencies structured into 6 competency levels of proficiency. These five areas are: information and information literacy, communication and collaboration, digital content creation, safety, and problem-solving. Please refer to Figure 2 for more details. The six progressive levels of proficiency are: A1 Basic Level, A2 Basic Level, B1 Intermediate Level, B2 Intermediate Level, C1 Advanced Level, and C2 Advanced Level (INTEF, 2017).

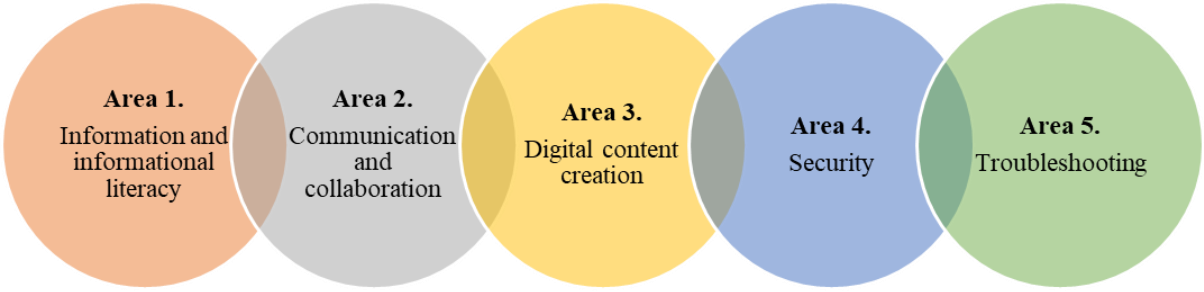

Figure 2: Areas of digital teaching competencies

Here is a description of each of the areas of digital teaching competencies:

Information and Information Literacy

This area focuses on the proper search for information on the internet and different digital platforms. It involves finding reliable, critical, easy-to-process information and being able to evaluate, organize, and analyze it effectively (INTEF, 2017).

Communication and Collaboration

This area involves how to share information using different digital tools, and understanding how digital communication is managed and presented. It includes being able to share information and knowledge responsibly, actively interacting with different people online, and being capable of defending and protecting oneself and others from potential online dangers (INTEF, 2017).

Digital Content Creation

In this area, teachers learn to create, develop, modify, and edit both existing and new content in different digital platforms and formats. This includes multimedia content, texts, presentations, animations, spreadsheets, forms, and tests, among others. It also emphasizes respecting copyright and the different digital licenses associated with each application or software used (INTEF, 2017).

Safety

This area focuses on protecting information and digital content created and shared online. It involves safeguarding personal data and digital identity, respecting the privacy of all individuals who interact online, and protecting the workplace and the environment by minimizing technological pollution (INTEF, 2017).

Problem Solving

This area involves identifying the technological needs of both teachers and students based on their level and study conditions. It requires finding solutions to potential problems related to hardware and software. Furthermore, it emphasizes the need for continuous updating and improvement of knowledge to be considered a competent and adequately prepared teacher capable of sharing knowledge (INTEF, 2017).

Digital Competencies in Education

The situation experienced in recent years, particularly the COVID-19 pandemic, has radically changed the education landscape, from basic to higher education. It has highlighted the need to promote the development, research, and application of new online teaching methods. The difficulty of conducting face-to-face training has inevitably driven the use of ICT at all levels of education (Rodríguez, Martínez-Picazo, & Jara, 2022).

Currently, education is seen as a competency-based teaching-learning process. The aim is to have teachers in educational institutions who go beyond simply transmitting content, theories, formulas, and disconnected knowledge. Instead, they foster critical and reflective thinking in students, enabling them to have a transformative vision of their reality (Murcia, Barreto, & Triana, 2016).

Military Education

Education is essential at all levels and in all countries, especially in the military context. It has notably emerged and adapted to various educational and technological changes. In this article, we gather information on military education in some countries in all America and Europe.

Military Education in the United States.

Providing security in an unpredictable and rapidly changing world, and maintaining national security, still heavily relies on the military, their morale, motivation, and specialized skills, which are influenced by their academic training, professional education, and military training (Plifka, 2011).

In this context, the wars of the 21st century and future years will increasingly be fought against non-state actors, relying more on technology, information, and non-traditional methods (Plifka, 2011).

To meet the training, education, and development needs of its members, the U.S. military must strongly incorporate contemporary pedagogical methods. This includes blended learning, which is the reflective fusion of face-to-face and online learning experiences, or an

environment created when part of the instruction is conducted individually, while the other part is carried out through non-traditional methods or the use of technology (Plifka, 2011).

Globalization, increasing computing power, and the proliferation of low-cost advanced technologies have created an unprecedented level of global complexity. This growing complexity makes military operations extremely challenging. To succeed in a volatile, uncertain, complex, and ambiguous environment, military personnel must be able to respond quickly and comprehensively to enemy actions (Culkin, 2019).

The incorporation of ICT in education requires careful consideration of the goals and challenges of education. It is crucial to determine how and under what conditions the presence of ICT in education contributes to its improvement. The first and most important step is to determine the purpose of ICT in education and identify the pedagogical model that can directly contribute to improving the quality and equity of education (Díaz, Carneiro, & Toscano, 2021).

ICT and TLK in Latin America

Technology has encouraged significant changes in teaching thinking and learning processes. Various studies in Latin America have shown the effectiveness of integrating technology resources in learning processes. A study evaluating the digital competencies of teachers in Mexico found that despite the not-so-sophisticated technical use of technology, most teachers demonstrated a high degree of appropriation of ICT in their teaching and learning processes. Their use of technology was timely and relevant in educational processes, suggesting that further training in ICT for these teachers would result in positive impacts on both teachers and students (Lamschtein, 2022).

The authors Coello, Menacho, Uribe, and Sánchez reflect their ideas in a program using the virtual classroom developed on the Canvas platform, under the blended learning modality in Peru. This program, AVCCSS, and the use of the virtual classroom had a positive and significant influence on students' academic performance, serving as a potential complement to face-to-face classes and applying constructivist theory (2019).

A long-term comparative study conducted between 2012 and 2017, focusing on 1,829 cases of university professors from public and private institutions in Argentina and Latin America, examined the teachers' preparation and attitude for using ICT and TLK in their classrooms. The study aimed to understand the state of the innovation process in an evolving educational scenario (Ehuletche, Lado, & Atlante, 2018).

TLK is fundamental in accessing education, as stated by Reynoso, Mejía, and Cruz, based on their study on TLK's role in mathematics education, equality in quality teaching and learning, and teacher training within the educational system. Latin America is not exempt from the trend of integrating TLK in education. The integration of digital technologies in schools in Latin America and the Caribbean has led to improvements in teaching methods across all areas, facilitating the revision and reformulation of prevailing practices (2020).

In the military context, pedagogical interactivity emphasizes communication and the reciprocal relationship between students and teachers based on the collective construction of knowledge. In the research on learning paradigms and experiences in military education in Colombia, officers and non-commissioned officers from the Combined Arms School of the

Army (ESACE) have strengthened the use of technological tools, particularly virtual platforms such as Cedoc 360 and Blackboard. These platforms are part of the military personnel's training in various promotion courses, providing parameters and guidelines for virtual learning exercises and yielding positive results (Contreras, 2021).

According to Hernández (2021), when using TLK-mediated didactic sequences for teaching English, teachers should take advantage of the available technological tools to allow students to develop digital competencies. This approach helps students construct knowledge through technology, enhancing creativity. The author analyzes the role of TLK in language teaching, highlighting its potential to reduce anxiety, motivate students to learn English, build self-confidence, and foster active learning in the classroom, leading to better language acquisition performance.

ICT and TLK in Ecuador

Lozano (2011) presents the following definition:

TLK aims to guide information and communication technologies (ICT) towards more formative uses, both for students and teachers, with the goal of learning more and better. In essence, it involves understanding and exploring the potential didactic uses that ICT have for learning and teaching. In other words, TLK goes beyond simply learning to use ICT and instead focuses on exploring these technological tools in service of learning and knowledge acquisition.

We believe that the use of ICT in the educational field has a greater impact when teachers also make use of the now not-so-unknown TLK. TLK serves as a complement that should be considered when delivering classes and facilitating the teaching-learning process (Polo, 2018).

Methodology

The scientific method with a descriptive scope was applied in this study. The survey technique was employed, using a questionnaire as the data collection instrument, administered to different stakeholders including managerial staff, administrative personnel, teachers, and military instructors at ESFORSE.

For obtaining secondary information related to the study variables, a bibliographic or documentary exploration was conducted, utilizing available resources such as books, journals, articles, etc., at a global level.

Population

The study considered a finite population consisting of individuals involved in the academic teaching and learning processes. The total population of 124 participants was comprised of 20 women and 104 men, ranging in age from 26 to 65 years.

Instrument

For data collection, a structured questionnaire was administered, consisting of seven sections:

- General information: Title, questionnaire introduction, and personal data of the respondents to identify the characteristics of the participants (five questions).
- Support of ICT: Four main questions to measure digital support in teaching and learning.
- Information and information literacy, corresponding to competence one.
- Communication and collaboration, corresponding to competence two.
- Digital content creation, corresponding to competence three.
- Security, corresponding to competence four.
- Problem-solving, corresponding to competence five.

Procedure

Given the military context of this research, authorization was first obtained from the head of the Academic Administration Department at ESFORSE. Subsequently, the digital survey was administered using the Google Forms application. The results were tabulated and analyzed using IBM SPSS software, following the following phases:

First Phase: Respondents were identified based on variables such as age, gender, position, and study topic (competencies). Calculation of scores was then performed to establish ranges for proficiency levels, assigning a textual variable to each category for frequency counts and percentage calculations.

Second Phase: The obtained data was systematically organized in tables and graphical representations to facilitate the analysis and explanation of the results.

Results

Digital competencies in higher education teachers are essential for an optimal teaching and learning process. The following are the obtained results.

Various stakeholders participate in the military education at ESFORSE, identified by their respective roles. The majority of respondents were teachers and instructors, accounting for 67.7% of the participants (see Table 1).

Position	Frequency	Percentage
Managerial/Administrative	22	17,7 %
Teacher/Military instructor	102	81,4 %
Warehouse supervisor	1	0,8 %
Total	124	100,0 %

Table 1: Respondents classified by their position within the educational institution

Regarding the age of the personnel involved in military education, the majority (32.3%) fall within the age range of 41 to 45 years, as shown in Table 2.

Age (years)	Frequency	Percentage	Accumulated percentage
26-30	25	20,2	20,2
31-35	21	16,9	37,1
36-40	19	15,3	52,4
41-45	40	32,3	84,7
46-50	13	10,5	95,2
51-55	5	4,0	99,2
61-65	1	,8	100,0
Total	124	100,0	

Table 2: Age range of the population

Regarding the gender of the personnel involved in military education at ESFORSE, males dominate with 83.9%, as shown in Table 3.

Gender	Frequency	Percentage
Female	20	16,10%
Male	104	83,90%
Total	124	100,0%

Table 3: Gender of the population

There is a 58.06% of respondents who express that ICT provides significant support in the teaching-learning process, positively impacting lesson preparation and development, fostering motivation, and improving student learning. This contributes to professional development, with a tendency towards increasing knowledge through ICT training, as shown in Table 4.

Level	Frequency	Percentage
None	0	0,00%
Low	0	0,00%
Some	6	4,84%
Considerable	46	37,10%
Significant	72	58,06%
Total	**124**	**100,00%**

Table 4: Support of ICT in the teaching-learning process at ESFORSE

Regarding digital competencies in teachers and instructors at ESFORSE, Table 5 and Figure 3 display the proficiency levels for each of the 5 digital competencies, identifying that the majority surpass the basic level A1 in all competencies:

Competencies	Level	Frequency	Percentage	Accumulated percentage
Competence 1.- Information and information literacy	A1 Basic level	0	0,00%	0,00%
	A2 Basic level	4	3,23%	3,23%
	B1 Intermediate level	16	12,90%	16,13%
	B2 Intermediate level	51	41,13%	57,26%
	C1 Advanced level	37	29,84%	87,10%
	C2 Advanced level	16	12,90%	100,00%
	Total	**124**	**100,00%**	
Competence 2.- Communication and collaboration	A1 Basic level	2	1,61%	1,61%
	A2 Basic level	2	1,61%	3,23%
	B1 Intermediate level	20	16,13%	19,35%
	B2 Intermediate level	50	40,32%	59,68%
	C1 Advanced level	34	27,42%	87,10%
	C2 Advanced level	16	12,90%	100,00%
	Total	**124**	**100,00%**	
Competence 3.- Creation of digital content	A1 Basic level	1	0,81%	0,81%
	A2 Basic level	7	5,65%	6,45%
	B1 Intermediate level	12	9,68%	16,13%
	B2 Intermediate level	36	29,03%	45,16%
	C1 Advanced level	52	41,94%	87,10%
	C2 Advanced level	16	12,90%	100,00%
	Total	**124**	**100,00%**	
Competence 4.- Security	A1 Basic level	0	0,00%	0,00%
	A2 Basic level	4	3,23%	3,23%
	B1 Intermediate level	11	8,87%	12,10%
	B2 Intermediate level	50	40,32%	52,42%
	C1 Advanced level	43	34,68%	87,10%
	C2 Advanced level	16	12,90%	100,00%
	Total	**124**	**100,00%**	
Competence 5.- Problem solving	A1 Basic level	0	0,00%	0,00%
	A2 Basic level	9	7,26%	7,26%
	B1 Intermediate level	23	18,55%	25,81%
	B2 Intermediate level	39	31,45%	57,26%
	C1 Advanced level	37	29,84%	87,10%
	C2 Advanced level	16	12,90%	100,00%
	Total	**124**	**100,00%**	

Table 5: Digital competencies in teachers and instructors at ESFORSE

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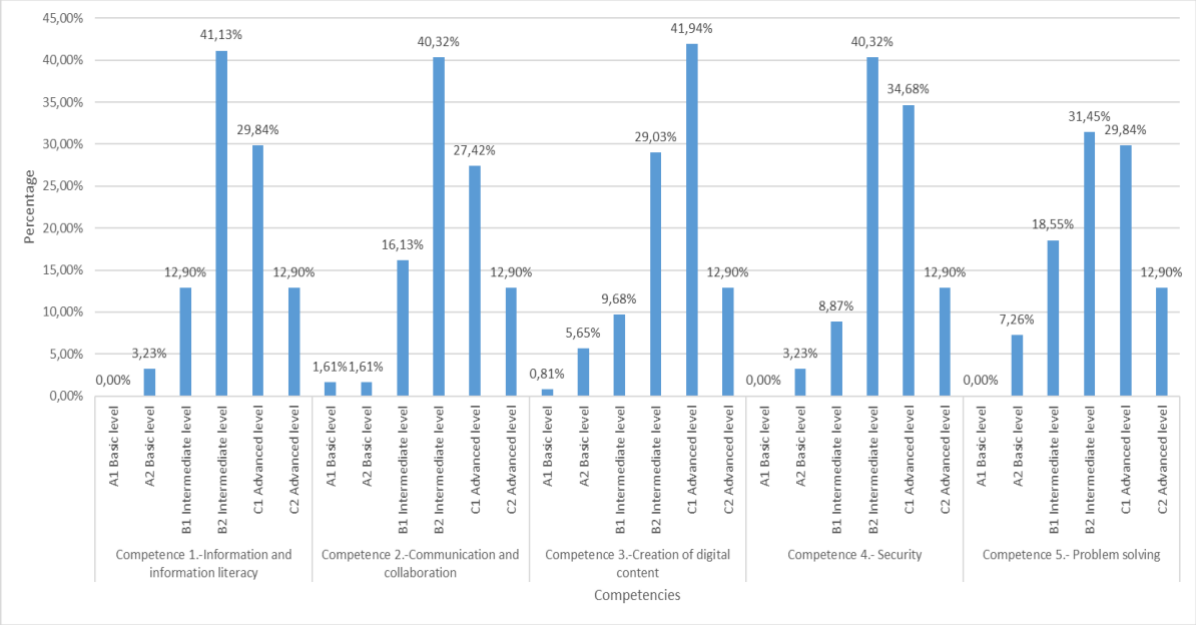

Figure 3: Use of ICT and digital competencies in teachers and instructors at ESFORSE

Discussion

The following are the relevant findings for each digital competence:

Regarding Competence 1: Information and digital literacy, 41.13% of the respondents reported using digital information at an intermediate level (B2). This indicates that the majority of respondents are able to select and organize digital information using search engines and databases, and they possess the skills to analyze and store information using digital tools such as Google Drive. However, 3.23% of respondents are at a basic level (A1 and A2) and would benefit from further reinforcement in this competence area.

Talking about Competence 2: Communication and collaboration, 40.32% of the respondents are at an intermediate level (B2), indicating that they are able to effectively use various digital tools for communication and collaboration. They responsibly interact with users online, share knowledge, and actively participate in online platforms, social networks, and educational forums. Only 1.61% of the respondents are at a basic level (A1 and A2) in this competence.

In Competence 3: Digital content creation, 41.94% of the respondents are at an advanced level (C1). They are capable of creating, modifying, and editing digital content using different platforms and file formats. The creation of digital content plays a crucial role in the current teaching and learning process. The use of ICT enables the creation and editing of various types of content, including text, images, videos, and sound, with the support of digital tools. This competence requires teachers to have a good understanding of computer literacy and the ability to navigate operating systems, applications, and configurations, as well as perform data backups. Developing this competence contributes to professional growth.

In Competence 4: Security, 40.32% of the respondents are at an intermediate level (B2). They protect their devices with antivirus software, have knowledge of digital security systems, and are conscious of protecting personal data and digital identity to minimize technological risks associated with internet use. They also demonstrate awareness of the environmental impact of

ICT. However, there is room for improvement in this competence, especially for those at the basic level (A1 and A2).

Regarding Competence 5: Problem solving, 31.45% of the respondents are able to solve technical problems related to hardware and software. They demonstrate innovative actions in the field, leveraging technology advancements and continuously updating their digital skills. Problem-solving competence requires a proactive approach and continuous learning to adapt to technological changes. The results highlight the need for ongoing professional development in digital competences.

Overall, the research findings provide an overview of the digital competences of teachers and instructors in the ESFORSE. The majority of respondents demonstrate an intermediate level of digital competence, which aligns with previous studies (Cabero, Barroso, Rodriguez, & Palacios, 2020).). It is important to note that ICT has become a valuable tool for teaching and learning, and its integration positively impacts the development of digital competences, as evidenced by contributions from Martinez et al. (2018) and Gonzalez et al. (2016).

The main objective of this study was to identify the level of digital competence among teachers in the ESFORSE and how ICT supports their development. The results indicate that teachers with knowledge in ICT have higher levels of digital competence. This finding is consistent with previous studies emphasizing the importance of ICT as tools for teaching and learning.

Moreover, the use of ICT has been shown to be an instructional pattern in the educational context. For example, a study conducted by Rosales (2019) at the Escuela Superior Militar “Eloy Alfaro” in Ecuador implemented ICT using the Deming Cycle of plan, do, check, and act. This model facilitated teaching and learning by integrating platforms, websites, electronic whiteboards, and educational mobile applications. The results showed improved student engagement, motivation, and performance.

This aligns with the findings of competences 1 and 3 in the present study. The military education context presents unique challenges, and the effective use of technology can help address them. The Ecuadorian Army aims to lead complex military operations by providing education based on a constructivist model. Technology is a transformative tool that can reshape communication, education, and work methods for teachers (Querembás, 2021).

The ESFORSE has recognized the need to implement ICT tools to cover various subject areas in the training of aspiring soldiers. This includes hiring teachers who possess digital competences. The success of educational programs depends on the commitment of the human resources involved. The institution and teachers should strive for high-quality strategies, appropriate educational tools, and a teaching staff that is both capable and willing to adapt to changing study requirements and technological challenges.

Conclusions

This section begins by addressing the research question, "What are the levels of digital competencies among the academic staff of ESFORSE?" and describes the main conclusions of the study:

According to the most relevant results, basic and intermediate levels are evident in the competence of security among 52.42% of the respondents. Considering that the Superior Technology Career in Military Sciences belongs to the Security and Defense Department of the Armed Forces University - ESPE, which is responsible for training professionals in the field of security and defense, it is essential to improve the digital competencies of the teaching staff and military instructors through specialized training processes.

ICT and TLK are related to the digital competencies of teachers, where ICT serves as support tools for teaching and TLK represents the application of ICT and how new knowledge is assimilated through technology. Therefore, higher education institutions, including ESFORSE, have had to deliver education in a virtual format, which has become indispensable during times of pandemic and social events in the country.

Digital competencies play a crucial role in current military education. In a nutshell, in this study, a significant percentage of teachers rely on technology and various digital tools available online to support their teaching and educational activities.

Recommendations

ESFORSE's military education must stay at the forefront of new technologies. Therefore, military instructors and teachers should receive continuous training to enhance their digital competencies and provide mission-oriented teaching and learning aligned with the vision of the Ecuadorian Army and the demands of society.

To ensure that students achieve the required learning outcomes and strengthen their digital competencies, it is recommended to include the subject of Office Tools in the curriculum with at least 2 credits, equivalent to a minimum of 96 hours.

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Multidisciplinary Education: About Some Aspects of Teaching Biophysics

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Abstract
This article presents one of the most pressing issues for undergraduate educational programs - interdisciplinary education. An interdisciplinary subject requires careful consideration of new issues and concepts in different contexts, identifying relationships between subjects, and developing common aspects, which is quite difficult to effectively implement within one discipline. This article discusses the problems and prospects associated with the teaching of biophysics. The main emphasis in the work is on the movement of blood in thin capillaries, the study of which is associated with microrheology. Various models have been proposed to explain the rheological properties of blood. These models, considered in the example of dispersed (two-phase) systems, describe the blood flow in capillaries only quantitatively, but the features of erythrocyte mobility in small capillaries within the framework of these models remain unclear. The laws of hydrodynamics or rheology alone cannot explain these features. To improve these models, we suggest that students consider the electrical properties of the dispersion system. This article considers the concept of blood cells and corpuscular elements functioning as electrical systems. These complex electrical systems are constantly moving in vessels of different diameters and, of course, are sensitive to changes in various hydrodynamic influences. Students are allowed to independently carry out practical work on these models, changing various indicators of blood. Unfortunately, microrheology and related issues are little discussed in textbooks. However, students must be familiar with the current problems, difficulties, and still scientifically inexplicable questions in this direction.

Keywords: Multidisciplinary Education, Interdisciplinary Approach, Biophysics, Microrheology, Dispersed System

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Introduction

It is unquestionable that all academic degree programs provide for the teaching of interdisciplinary subjects (Medicine, 2023). In the era of modern high technologies, it is necessary to introduce high-quality innovations in the educational process. Today it is not enough to rely on traditional methods to obtain the necessary knowledge - in an environment that is changing at an amazing speed, it is necessary to conduct the learning process based on innovative approaches. The teacher of each subject should arouse in the student a greater interest in the study of a subject, transfer to him not only the theoretical and practical knowledge accumulated in this area and acquaint him with modern achievements, but also focus on the prospects available here, modern research, i.e., to speak, "to see more" in his subject than it might seem at first glance (Dotsinsky, 2010).

This article discusses the problems and prospects associated with the teaching of biophysics. This applies to teaching the movement of blood in thin capillaries, the study of which is associated with microrheology (Kalandadze et al., 2022). To teach this subject matter effectively, one must possess extensive knowledge of the latest advancements in medicine, physics, biology, chemistry, and rheology. However, this can prove to be challenging in today's era of advanced technology (Figure 1).

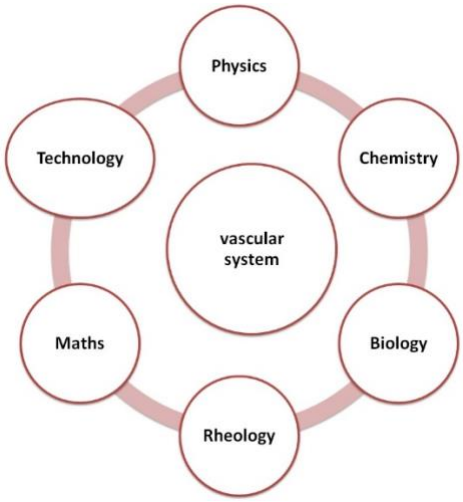

Figure 1: Vascular system is a multidisciplinary topic of biophysics

A textbook written by a group of doctors clearly suffers from a lack of use of the skills, achievements, and logical reasoning of the exact sciences. Accordingly, there is an incomplete physical, chemical and mathematical analysis of the pathological course of certain diseases, such as cardiovascular, microrheological, and other processes (Kalandadze, 2022).

We will discuss how interdisciplinary approaches in the learning process can be based on the formation of ideas between the integrity of knowledge and the different scientific fields. We will also explore how researching and analyzing the connections between subjects can help us understand the rheological properties of blood.

In the process of discussing some issues, it is also necessary to use a popular approach to the problem, which will help the student understand the material.

Let us recall the famous public speech of the American physicist Feynman in 1959 (Feynman, 2011). This is a good example of how important it is to convey complex topics in a popular speech to an audience. Especially those if a topic has a multidisciplinary level.

The main emphasis in the work is on the movement of blood in thin capillaries, the study of which is associated with microrheology. The features and approaches to the study of the physical laws of this issue are discussed. Microrheology and related issues are little discussed in textbooks (Glase, 2012). However, it is necessary that students be familiar with the challenges, difficulties and still scientifically unexplained issues in this direction that are relevant today. Knowledge of their physical foundations will greatly advance medical education, both in terms of practical use and from a scientific point of view.

Methodology

For students to better understand and perceive the depth of the material being explained and the difficulties associated with it, it is essential to divide the topic into multiple segments based on its level of complexity. The first part is explained and justified on a scientific level; the second part contains unsubstantiated assumptions about the events in question; then a joint discussion of possible hypotheses and approaches based on current existing research and, finally, forecasting the prospects of the issue. This is not easy, because the teacher must know the basic laws and patterns of subject disciplines.

In biophysics, the study of the flow of blood in the vascular system should begin with large vessels and end with a consideration of its movement in the capillaries (see Figure 2).

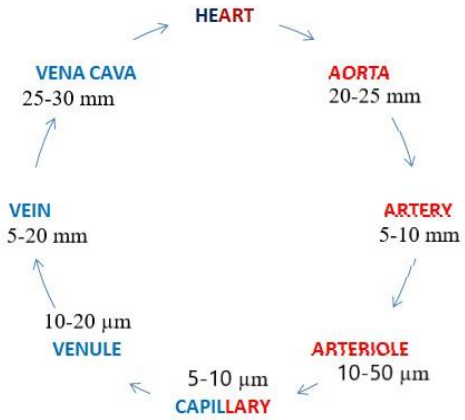

Figure 2: The diameter of blood vessels in the vascular system

First, it is necessary to consider the basic hydrodynamic equations underlying hemodynamics. With their help, the flow of blood in a large vascular system is explained (Pollock et al., 2023). After that, the movement of blood in the capillaries should be taken into account. The study of the movement of blood in capillaries is associated with the microrheological properties of blood (Vahidkhah et al., 2016). Explaining this aspect of the topic requires both knowledge and the skill of effective communication. The laws and regularities of natural sciences alone are insufficient to fully elucidate the processes occurring in this area.

The flow of blood within the cardiovascular system has certain distinguishing characteristics (Farina et al., 2021):

1. Fareus effect - dependence of hematocrit on vessel diameter;
2. the existence of a parietal (erythrocyte-free) plasma layer near the vessel wall;
3. obtuse (compared to the Poiseuille flow profile) profile speed;
4. the Fareus–Lindqvist effect is a clear dependence of blood viscosity on the diameter of a blood vessel.

When trying to understand the problem, students need to keep in mind that the model of viscous incompressible blood is suitable for large blood vessels (with a diameter of over 300 μm), while the flow of blood in small capillaries (with a diameter of less than 300 μm) requires consideration of abnormal properties related to microrheology (Koohyar et al., 2016).

Is it a myth or reality that the cardiovascular system defies the laws of physics? Using this phrase can be a helpful way to engage students in learning about the topic.

Results

The field of hemodynamics holds great significance in the domains of medicine and biomedical engineering. Its knowledge is vital for the development of innovative implantable devices and to comprehend the functioning of different diseases linked with blood circulation (Trejo-Soto et al., 2022).

The characteristics of blood flow in small arteries are of great interest in biomedical engineering. The results of such studies provide information that is useful in understanding in vivo blood flow conditions, in designing medical devices (e.g., organs on a chip), or in the development of more effective diagnostic tools. Although the blood flow in large arteries has been extensively studied (Nader et al., 2016) little work has been done regarding the blood flow in smaller vessels, mainly because both in vivo and in vitro experiments in arterioles and capillaries are difficult to perform.

There has been a recent increase in research on the microcirculation of red blood cells in small capillaries. Several models have been proposed to explain the rheological properties of blood in this context. However, these models only provide quantitative descriptions of blood flow in capillaries as dispersed (two-phase) systems. They do not explain the qualitative aspect of erythrocyte mobility in small capillaries (Guckenberger et al., 2017).

This study aims to provide students and physicians with a methodology that could be applied to the prediction of the overall pressure drop (ΔP) and flow characteristics across blood microvessels. This methodology involves three steps:

First, estimate the vessel diameter (see Figure 2);

Next, it is important to examine the blood velocity profile in microvessels (as shown in Figure 3) to determine the suitability of hydrodynamic formulas. When dealing with microvessels larger than 200 μm in diameter, it can be presumed that blood behaves as a consistent and uniform fluid. However, this assumption does not hold true for microvessels smaller than 200 μm, where the motion of individual red blood cells becomes significant. In such cases, blood should not be regarded as a homogeneous liquid, but rather as a cell suspension.

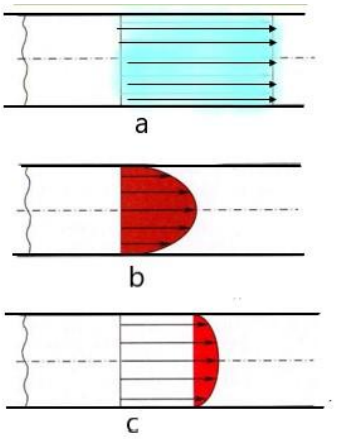

Figure 3: a) Velocity profile of an ideal liquid; b) Velocity profile of a real (Newtonian) liquid; c) Velocity profile of a non-Newtonian liquid

Blood is a complex system with unique properties. One such property is the Fareus-Lindqvist effect, which differs from the Newtonian and structural viscosity effects. In a non-uniform Newtonian fluid, viscosity increases as the diameter of the tube decreases, as per Poiseuille's law. However, for blood, a non-uniform non-Newtonian fluid, the opposite occurs. As the radius of capillaries decreases below 150 microns, blood viscosity decreases, facilitating its movement through the bloodstream's capillaries. It should be noted that the study of the properties of blood circulation revealed a number of features that distinguishes it from both Newtonian and non-Newtonian fluids. The laws of hydrodynamics or rheology alone cannot explain those peculiarities (Stergiou et al., 2019).

When studying blood movement in small capillaries, there are multiple methods available. Depending on their level of education (bachelor's, master's, or doctoral), a student may have the freedom to interpret the microrheological properties of blood in narrow capillaries as part of their research. One potential method is representing the corpuscular elements of blood as an electrical system. These systems are constantly in motion within blood vessels of varying sizes and are sensitive to hydrodynamic influences (see Figure 4).

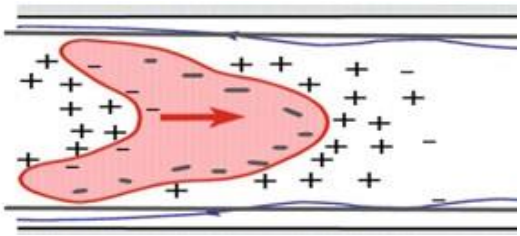

Figure 4: Deformed erythrocyte in a small capillary

Finally, the issue under discussion makes it possible to generalize the existing two-phase model (Sharan et al., 2001) using electrical parameters and conduct numerical experiments to study the microrheological properties of blood.

Conclusion

This article discusses the problems and prospects associated with the teaching of biophysics. The main focus of the work is on the movement of blood in thin capillaries, the study of which requires a thorough consideration of new issues and concepts in different contexts. The approach discussed in the article will help students to better understand the microrheological

properties of blood and outline further prospects for this issue. It is important because identifying connections between different subjects and developing shared perspectives is a complex task that is not easily accomplished within a single discipline.

Additionally, we expect that the specific examples offered and described in this article will help those involved in the teaching of biophysics gain a clearer understanding of the various processes that need to be taken into account.

We hope that we have captured the reader's attention and demonstrated the need for an interdisciplinary methodology for teaching the microrheological properties of blood.

Acknowledgments

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The Taboo of Negative Numbers in Primary Education

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Abstract
Performing subtraction, as opposed to addition, is a rather daunting task for many primary school children; especially when using the so-called method of 'Subtraction with Regrouping' (SWR). We argue that the main reason for this is because the concept of negative numbers is not introduced at an early stage of primary education. Negative numbers have been considered as a taboo for too long and measures need to be taken to break this taboo to increase children's interest in mathematics. The SWR method is well-understood when a small number is subtracted from a large one; especially when there are no zeros in the large number and every of its digit is greater than that of the smaller number, like 758-231. Things can get rather complicated for children when the large number contains 0 as a digit or when they have to subtract a large number from a small one, for example 7045-2658. In the SWR method, a non-zero number is decremented by 1 when 10 is borrowed from it; for example, 5 becomes 4 when 10 is borrowed from it. However, the exception is that 0 becomes 9 when 10 is borrowed from it. This leads to an inconsistency in the procedure; hence, creating a confusion in children's mind. In this paper, we propose a direct method of subtraction, whereby the number 0 can be rightly replaced by -1 without disrupting the procedure. This can only be done when the children are taught the concept of negative numbers before tackling subtractions.

Keywords: Subtraction, Primary Education, Regrouping Method

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Introduction

For many primary school children, performing subtraction, as opposed to addition, is a rather daunting and difficult task. In effect, Baroody (1984) argue that some of the root causes for children's difficulties in subtraction stem from their informal subtraction strategies. However, in this paper, we argue that an alternative cause for children's difficulties with subtraction is due to the fact that the concept of negative numbers is not introduced at an early stage of primary education. In effect, negative numbers have been considered as a taboo by educators and developers of children's curriculum since the early 1900s. Consequently, there is a real need to take the required measures to break this taboo, so that young children can develop an interest in mathematics. The method of subtraction commonly and widely employed in primary schools is the so-called method of *subtraction with regrouping or borrowing* method as described in the following.

The Classical Subtraction With Regrouping Procedure

In the context of early primary education, the regrouping/borrowing method is generally employed when small numbers are subtracted from large ones so that the answer is always positive or zero. When there are no zeros in the large number and every of its digit is greater than that of the smaller number, then the subtraction is straightforward. For example, if we are asked to perform the following subtraction: 785-143. We start by writing the numbers column-wise as follows:

$$\begin{array}{rrrr} & 7 & 8 & 5 \\ - & 1 & 4 & 3 \\ \hline & & & \\ \hline \end{array}$$

Then, we proceed by subtracting the rightmost digits and we gradually move to the left. That is, we subtract the numbers at the unit place, the numbers at the 10th place and finally the numbers at the 100th place as described below:

	7	8	5		7	8	5		7	8	5
-	1	4	3	-	1	4	3	-	1	4	3
			2			4	2		6	4	2
Step 1				***Step 2***				***Step 3***			

Things can get rather complicated for children when some digits of the large number have a smaller value than that of the small number. For example, consider the following simple subtraction: 735-296. The subtraction with regrouping procedure for this example is done in three steps shown below:

	7	$\dot{3}^{2}$	5		$\dot{7}^{6}$	$\dot{3}^{2}$	5		$\dot{7}^{6}$	$\dot{3}^{2}$	5
-	2	9	6	-	2	9	6	-	2	9	6
			9			3	9		4	3	9
Step 1				***Step 2***				***Step 3***			

As usual, we start by comparing the rightmost digits in the column (i.e. the unit column) and work to the left. Since 5 is less than 6 (and that 5-6 is a negative number), we borrow 10 from the number 3 at the tenth place. To symbolise this process, we put a dot on the top of the digit

3 and we write the number 2 (in small font) next to it to show that the number 3 has decremented by 1. Then, we add 10 to 5 which gives 15. After that, we calculate 15-6 which gives 9. Sometimes, we compute (10-6)+5 rather than (10+5)-6 which amounts to the same thing. Next, we repeat this procedure with the tenth column; that is, since 2-9 is negative, we borrow '10' from 7 and then compute (10+2)-9 (or (10-9)+2) to obtain 3. Since we borrowed 10 from 7, it decrements by 1 becoming 6. Finally, in the hundredth column, we subtract 2 from 6 to obtain 4.

Notice that, in the above procedure, we have avoided getting a negative result by all means by computing (10+5)-6=15-6 or (10-6)+5=4+5 in the first step. In other words, we have added 10 to 5 in order to get a number that is greater than 6 (i.e., 15) and then we have subtracted 6 from it. Similarly, for those proceeding as (10-6)+5, the idea is to subtract 10 from 6 which will always give a positive number (i.e. 4) and by adding a positive number to another positive number will yield a positive number.

The question is: *Why haven't we just computed (5-6)+10=-1+10 directly?* After all, we would have obtained the same answer! In other words, if we perform a direct subtraction 5-6, which gives -1, and then add the 10 which we have borrowed from 3, then we would get exactly the same answer as before. There is no need to follow a tortuous path to reach to the same answer! Similarly, instead of computing 10+2-9 (or 10-9+2) in Step 2, we could have just done a direct computation 2-9 which gives -7 and then we add 10 which we have borrowed from 7, giving again 3. This would yield the same answer.

Now, things can get even more complicated for children when they have to subtract numbers involving zeros. Consider, for example, 7045-2658. In the majority of textbooks, worksheets or online material, the solution to this subtraction, is expressed as follows:

$$\begin{array}{rcccc} & \dot{7}^{6} & \dot{0}^{9} & \dot{4}^{3} & 5 \\ - & 2 & 6 & 5 & 8 \\ \hline & 4 & 3 & 8 & 7 \end{array}$$

Here we proceed the same way as above except that we replace the ‘0’ digit with a ‘9’ when we borrow 10 from 7. To be more precise, we start by subtracting 8 from 5. Since 8 is larger than 5, we borrow 10 from 4. This gives 15-8 yielding 7 and we replace 4 by 3. Then, since 5 is larger than 3 we borrow 10 from 7 rather than from 0. In effect, in this regrouping method, it is said that we cannot borrow from 0. So, we have to borrow 10 from 7 which is then replaced by 6. Meanwhile, 0 is replaced by 9! Finally, we obtain the correct answer. Obviously, there must be some logical explanation of the above procedure, as it always yields the correct answer. We shall explain that subsequently.

However, at this stage, one might ask the following obvious question: *why can't we borrow 10 from 0 and why the '0' becomes '9' after borrowing 10 from the number 7? Why does it not become -1, as a matter of pure logical continuity? Why this lack of consistency in the subtraction procedure?*

Before answering to the above questions, we are going to propose a direct method of subtraction involving negative numbers.

Direct Subtraction Procedure

In fact, in the above example, there is nothing wrong in replacing 0 by -1 after borrowing 10 from it. In effect, we can perform the above subtraction in the following steps:

	$\dot{7}^{6}$	0	$\dot{4}^{3}$	5
-	2	6	5	8
				7

Step 1

	$\dot{7}^{6}$	$\dot{0}^{-1}$	$\dot{4}^{3}$	5
-	2	6	5	8
			8	7

Step 2

	$\dot{7}^{6}$	$\dot{0}^{-1}$	$\dot{4}^{3}$	5
-	2	6	5	8
		3	8	7

Step 3

	$\dot{7}^{6}$	$\dot{0}^{-1}$	$\dot{4}^{3}$	5
-	2	6	5	8
	4	3	8	7

Step 4

Starting from the right (Step 1), we compute 5-8=-3. Since -3 is negative, we add 10 to it, which we have borrowed from the digit 4 at the tenth place. This, therefore, gives 7 and the value of the digit 4 is decrement by 1 to become 3. Next, in Step 2, we compute 3-5=-2. Again, since -2 is negative, we borrow 10 from the digit 0 at the hundredth place and add it to -2, which gives 8. Now, we decrement the digit 0 by one to become -1, since we borrowed 10 from it. Then, in Step 3, we compute -1-6=-7. Since -7 is negative we add 10 to it, which we borrow from the digit 7 at the thousandth place, yielding 3. Again, the digit 7 then becomes 6 as we borrowed 10 from it. Finally, in Step 4, we compute 6-2=4, hence, yielding the required solution. We shall henceforth refer to this subtraction procedure as the "*direct subtraction procedure*".

The main question therefore is: *Why such a direct subtraction procedure is not used in early childhood education?*

Indeed, from several informal investigations carried out in several primary schools in the UK and abroad it was found that none of the schools used such direct subtraction procedure in their worksheets, reading materials and their reference books. In addition, the above subtraction procedure does not exist in any online learning resources and websites (like the Khan Academy, IXL, etc).

The main objective of this paper is to understand the underlying reasons as to why the direct subtraction procedure is not employed in primary schools. These are discussed in the next section. After that, we give the mathematical justification of the direct subtraction procedure. Finally, some recommendations and conclusions are given.

Discussion and Findings

In this section, we shall discuss and address the questions asked in the previous section. The two main questions asked with respect to the regrouping procedure were:

i) Why don't we employ the direct subtraction procedure albeit involving the use of negative numbers?

ii) *Why can't we borrow from 0 and why the digit 0 is replaced by 9 (and not -1) after borrowing 10 from a non-zero number in the classical regrouping method?*

At first sight, these questions might seem innocent. But when we ponder quite a while on it, one can notice that there is some kind of unconscious taboo on the introduction of negative

numbers in early-stage education, as well as some misconceptions on the way subtraction is tackled and taught at primary education level.

Essentially, there seems to be a hesitancy from educators in introducing negative numbers at an early stage of children education; probably because there is a subconscious prejudice towards the ability of children in understanding some seemingly 'difficult or complex' concepts in mathematics. The original intention is probably not to 'confuse' the children with the concept of negative numbers. One can understand why that would be case in the past, where there would be very few real-life situations involving negative numbers. However, today we are surrounded with real-life examples and situations where negative numbers are omnipresent. For example, we have lifts and elevators going from the 5th floor to floor -2 in the basement, and we have thermometers with negative readings etc. Despite these, there is still some hesitancy to boldly introduce negative numbers as a natural concept in children education. One can certainly notice that, in the vast majority of schools, the rulers that children use do not contain negative numbers. In fact, rulers that contain both negative and positive numbers exist in the market. This can be a good starting point to teach negative numbers to children and relating them to directions; like 'up' for positive, 'down' for negative or 'going right' for positive and 'going left' for negative.

Furthermore, the classical regrouping method, which avoids the use of negative numbers by all means, has been repeated over and over again and is still being widely employed in schools' worksheets, reputable books, learning resources and websites (like the Khan Academy, IXL, etc). There is even a song in YouTube about subtraction with regrouping which goes like "zero minus one can't be done!" (Maths song with numberock, 2016).

In fact, if we look at how subtraction is taught at schools, they are very much the same as our grandparents learned during their school days in the early 1900; except that today we tend to gloss it with colour books and dancing videos and songs; like in BBC Bitesize series (see BBC Bitesize). One of the reasons why the methods of teaching subtraction has not changed in our primary curriculum is because we tend to think that the methods of subtraction are well established and that there is nothing else, we can do or see there. Finally, there is some reticence in accepting new ideas by primary school teachers and curriculum developers, which reflects some sort of rigidity in primary education.

On the other hand, children are very logical and consistent in their reasoning and thinking (see e.g. T. Nunes et al. (2007)). In fact, children like consistency, they do not like exceptions to a rule. This tends to confuse them. For this reason, it is important to develop a consistent methodology in performing subtraction in primary education.

By not introducing negative numbers at an early stage of children's education, educators have made matters worse by impeding on their creativity and insight. In effect, the UK is ranked 14th out of 79 in terms of performance in mathematics among 15-year-old students according to the Programme for International Student Assessment (PISA) results in 2018 (see PISA 2018 results).

Finally, for comparison purposes, we shall tackle a final example using the new direct subtraction method using the following example is borrowed from Math Meeting, (2016).

$$\begin{array}{cccc} & \dot{9}^{8} & \dot{0}^{-1} & \dot{0}^{-1} & 4 \\ - & & 2 & 9 & 7 \\ \hline & 8 & 7 & 0 & 7 \end{array}$$

Starting from the unit place, we have 4-7=-3. We borrow 10 from 0 (at the tenth place) and add it to -3 to get 7 at the unit place. Then, we replace the 0 at the tenth place with -1. Next, at the tenth place we perform -1-9=-10. We borrow 10 from 0 (at the hundredth place) and add it to -10 to get 0 at the tenth place. After that, at the hundredth place we perform -1-2=-3. We borrow 10 from 9 (at the thousandth place) and add it to -3 to get 7 at the hundredth place. Finally, the digit 9 is replaced by 8. Subtracting 0 from the 8 at the thousandth place yields the correct answer. One can notice that the new method is more systematic and consistent.

Justification of the New Subtraction Procedure

Now, another obvious question one can ask is whether there is a rigorous mathematical justification of this 'new' method of doing subtraction compared to the standard classical way. Obviously, in the classical method, there is a rigorous mathematical reason as to why 0 is replaced by 9 when 10 is borrowed from another non-zero adjacent number. Otherwise, such a method would not have been taught for so long. In fact, for the above example, if we perform the subtraction by decomposing the numbers into tens, hundreds and thousands, we will clearly see as to why such is the case.

Classical Method

In effect, for the previous example, we have:

$$\begin{aligned} 7045 - 2658 &= (7000 + 40 + 5) - (2000 + 600 + 50 + 8) \\ &= 7000 + 40 + 5 - 2000 - 600 - 50 - 8 \end{aligned}$$

We can now perform this subtraction by an orderly fashion as above by subtraction unit numbers from unit numbers, then the tenth numbers from tenth numbers and so on. Hence, regrouping[1] the units, tenths, hundredths and thousandths number together, we get:

$$\begin{aligned} 7045 - 2658 &= (7000 - 2000) + (0 - 600) + (40 - 50) + (5 - 8). \\ &= (7000 - 2000) + (000 - 600) + (40 - 50) + (5 - 8) \end{aligned}$$

Here, we have written 0 = 000 simply to symbolise its location at the 100th place. By subtracting the unit numbers, we see that 5-8=-3, which is negative. Consequently, we borrow 10 from 40 as expressed below:

$$\begin{aligned} 7045 - 2658 &= (7000 - 2000) + (000 - 600) + (30 - 50) + (10 + 5 - 8) \\ &= (7000 - 2000) + (000 - 600) + (30 - 50) + 7 \end{aligned}$$

Next, by subtracting the numbers in the tenth place, i.e., 30-50, we get -20 which is negative. Since there is no strictly positive number at the hundredth place, we have to borrow 100 from 7000, i.e., from the number at the thousandth place instead[2]. These yields:

[1] This is where the term ‘regrouping’ comes from.

[2] That is also why we say that we cannot borrow from 0 in the classical regrouping method.

$$7045 - 2658 = (6900 - 2000) + (000 - 600) + (100 + 30 - 50) + 7$$
$$= (6900 - 2000) + (000 - 600) + 80 + 7$$

We then decompose the number 6900 again to get:

$$7045 - 2658 = (6000 + 900 - 2000) + (000 – 600) + 80 + 7$$

Then, we regroup the hundredth numbers again to obtain:

$$7045 - 2658 = (6000 - 2000) + (900 - 600) + 80 + 7$$

This is where the '9' appears in the classical subtraction by regrouping procedure.

Finally, by subtracting the numbers at the hundredth and thousandth place, we get the required answer:

$$7045 - 2658 = 4000 + 300 + 80 + 7 = 4387$$

New Method

Now, instead of borrowing 100 from 7000, we could have simply borrowed 100 from 0, as there is 0 at the hundredth place. More precisely, we have:

$$7045 - 2658 = (7000 - 2000) + (000 - 600) + (30 - 50) + 7$$
$$= (7000 - 2000) + (-100 - 600) + (100+30– 50) + 7$$

In this case, after subtracting the units and tens numbers, we would have:

$$7045 - 2658 = (7000 - 2000) + (-100 - 600) + 80 + 7$$

Note, that the '-1' superscript in the above new procedure appears in the -100 term. Therefore, at the hundredth place we have -700 which is again negative. Consequently, we borrow 1000 from 7000 to obtain:

$$7045 - 2658 = (6000 - 2000) + (1000 -700) + 80 + 7$$
$$= 4000 + 300 + 80 + 7 = 4387$$

This justifies the new method of subtracting numbers.

Remark

i) One might ask: "*why do we borrow only ten when we perform the calculation in a column-wise fashion rather than borrowing, 10, 100 and 1000 etc. when we perform the calculation using the decomposition method?*". The reason for this is simple: when we are subtracting in a column-wise fashion, we are doing the calculation in an orderly and systematic manner starting from the rightmost digit and moving to the left. Consequently, once we have subtracted the unit numbers, we can simply forget them and treat the numbers at the tenth place as the 'new unit' numbers, and similarly for the other numbers at the hundredth place and so on. It is for this reason we simply say that we are borrowing 10 rather than borrowing 100, 1000 etc. Consequently, ‘borrowing 10’ is just a misnomer.

ii) Note that the classical regrouping procedure is much more understandable when a decomposition method is used rather than using column subtraction.

Concluding Remarks and Recommendations

This paper has highlighted the need and necessity of introducing the concept of negative numbers at an early stage of primary education so that the direct method of subtraction can be employed in a consistent and systematic manner. This can be done by using day to day examples involving negative numbers such as elevators, lifts, financial transactions etc. and the use of rulers with both positive and negative numbers. Regardless of whether the classical regrouping or the new direct subtraction method is employed, it is imperative that both of these methods are explained through the decomposition method. This will give children the choice of the method with which they are comfortable with. Finally, training should also be provided to teachers and curriculum developers to embrace new ideas in primary education.

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Investigating Chinese Kindergarten Teachers' Emotions and Identities Through Activity System Analysis

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Abstract
Over the past decade, a growing number of qualitative studies have emphasized the importance of contextualizing teachers' experiences to understand their emotions and identities. However, despite the prevalence of emotional behaviours in the profession, there has been only limited research on kindergarten teachers, with most studies focusing on primary or secondary schools. This study aimed to address this gap by using the third generation of the cultural–historical activity theory (CHAT) framework to uncover contextual factors that influence Chinese kindergarten teachers' emotional experiences and identity construction. The study utilized individual semi-structured interviews as the primary data collection method. The findings revealed two activity systems that described situational factors in teachers' identity formation processes: the classroom activity system and the non-teaching-related activity system. By shedding light on the complex interplay of factors that shape teachers' emotions and identities, this study provides valuable insights into the challenges and opportunities that teachers face in their professional roles.

Keywords: Teacher Identity, Teacher Emotion, Kindergarten Teacher Education, Cultural–Historical Activity Theory

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Introduction

Emotion plays a vital role in understanding teacher identity (Beauchamp & Thomas, 2009; Yin et al., 2022; Yin et al., 2013). As stated by Holland and Lachicotte (2007), identities encompass intricate collections of thoughts, emotions, memories, and experiences that individuals can draw upon as foundations for their actions and responses. From a sociocultural perspective, identity and emotion can be understood as being more than cognitive aspects within individual minds and bodies. Instead, they represent human beings' self-conceptions, with which individuals form emotional connections, influencing their behaviours and interpretations (Holland & Lachicotte, 2007).

In fact, many scholars have highlighted how teachers frequently perceive themselves as individuals dedicated to promoting their students' progress and constantly strive to validate this aspect as part of their teacher identity (Tsang, 2014; Zembylas, 2011). Emotions play a pivotal role in this process of identity validation, as teachers' positive emotions serve as affirmations that they are effective teachers. Conversely, teachers' negative emotions may arise, leading to perceptions of being inadequate in terms of their teaching abilities (Tsang, 2018, p. 45). Drawing on poststructuralist views, emotions can be seen as subjective experiences and as practical strategies for integrating individuals into society, and they develop through a person's active interactions with others (Zembylas, 2011). Hence, to comprehend teacher emotions, it is essential to explore the dynamic interactions and social processes through which individuals develop and negotiate their emotional responses.

Due to predominant stereotypes, such as low salary and lack of professionalism, kindergarten teachers have long been placed in a marginal position in the field of education (Moloney, 2010; Zhang & Jiang, 2023). These negative stereotypes have become an obstacle that can prevent kindergarten teachers from recognizing their professional identities (Moloney, 2010). While there is no lack of research discussing teacher identity and emotion, most of the contexts studied have been primary and secondary schools. There is shockingly little research seeking to discover kindergarten teachers' emotional experiences in terms of their identity formation. Moreover, even fewer studies have examined teacher emotion and identity in a Confucian cultural context. To fill these gaps, this research aimed to: (1) understand how Chinese kindergarten teachers perceive their identities and emotions; (2) investigate what kinds of Chinese kindergarten teachers face in forming their identities and emotions based on the cultural-historical activity theory (CHAT)?

Cultural-Historical Activity Theory (CHAT)

Cultural–historical activity theory (CHAT) offers a comprehensive framework for analysing learning activities by considering the interconnectedness of multiple components (Engeström, 1987). This theory embraces a non-dualistic ontology and recognizes the intricate nature of human activity within real-life contexts(Yamagata-Lynch, 2010). The CHAT framework has undergone several waves of evolution, and this research employed the third generation, which identified seven components and four levels of contradictions that mediate collaborative learning. Engeström argued that contradictions in professional activities arise from conflicts between intended goals and actual outcomes. These contradictions serve as catalysts for development, as they generate tensions that necessitate resolution (Engeström, 2015). Hence, the tensions present in each activity can serve as a valuable mediator for uncovering teachers' emotional experiences during their processes of identity formation. Identifying the specific

tensions encountered by teachers in their professional activities becomes an invaluable resource for promoting the development of teachers and their professional growth.

A Pilot Study

The research was conducted in two public kindergartens in Mainland China in 2021. Public kindergartens in China refer to government-run organizations that provide 3–6-year-old children with formal education. Adopting a qualitative research approach, interviews has been used as the data collection method. The research questions were formulated to specifically explore the teachers' identities and the emotions they experienced during interactions with various stakeholders in their work environment, including children, parents, principals, and colleagues.

The data analysis process was divided into two stages. In the initial stage, using the NVivo 12 platform, a coding scheme was developed based on the CHAT framework, classifying six elements (subject, tool, object, rule, division of labour, and community). Subsequently, in the second stage, we conducted a thematic analysis. In this stage, we considered the teachers' emotion-related identities as an outcome element of their activities, and our focus was on identifying different themes related to the teachers' emotion-related identities. To ensure data reliability, a peer check strategy (Thomas, 2016) was implemented. Following the first researcher's development of a set of codes, the second researcher and the first researcher engaged in discussions regarding the coding results and reviewed the original transcripts to confirm the accuracy of each theme. Once the final themes were confirmed, we translated the themes and original quotes into English.

Preliminary Findings

This research discovered two activity systems that the kindergarten teachers engaged in: classroom activity and non-teaching-related activity. The research identified six elements for each activity system. Classroom activity refers to a list of activities that teachers initiate, and the purpose of these activities is to support children's learning in the classroom setting. The classroom setting in early childhood education does not just refer to the physical classroom, as there are many outdoor activities. Thus, in this research, classroom activities referred to activities that were scheduled and initiated by the teachers. These activities indicated the teachers' active roles as leaders in the classroom. By contrast, the non-teaching-related activities encompassed a variety of tasks, including administrative duties, involvement in teacher training programmes, addressing parental concerns, and engaging in community services. These activities often required the teachers to assume more passive positions, following instructions from other parties.

Regarding the outcome component, this study revealed five emotion-related identities, then we categorized each outcome in relation to the distinct activity systems. Through a comparison of these two activity systems, we found that the teachers had rather contrasting emotions regarding them. The teachers were most likely to have positive emotions when they interacted with young children, but they had rather negative emotions when they interacted with principals and parents. Although we cannot make the absolute judgement that teachers are always happy with children and unhappy with principals and parents, by looking at the activities that the teachers engaged in with these parties, we discovered a positive correlation between the teachers' positive emotions, their associated identities, and object alignment.

Theoretical and Practical Implications

Many studies on teacher identity have highlighted the significance of the *ideal self* and its impact on the formation of teachers' identities. According to Boyatzis and Dhar (2021), the ideal self is defined as an aspirational target that individuals set for themselves. It is dynamic and evolves as teachers develop their situational understandings (Boyatzis & Dhar, 2021). While there is no direct research indicating that attaining the ideal self leads to positive emotions in teachers, there is evidence suggesting a positive association between teachers' job satisfaction and their pursuit of the ideal self (Evans, 2002). Based on studies of the ideal self, Lauriala and Kukkonen (2005) provided a framework consisting of three dimensions of self: the actual self (representing the current state), the ought self (reflecting the societal or external group–defined goal), and the ideal self (representing the individual's self-defined target for achievement). It is acknowledged that these three dimensions of self-interact dynamically with each other. By adapting this concept of self, the current research adopts the term *ideal professional self*, which describes the agreement that teachers make between the ideal self and societal expectations (the *ought self*).

In situations where the teachers actively participated in activities that aligned with their visions of their ideal professional selves, they were more likely to discover purpose in their work and undergo positive processes of identity formation. Conversely, tasks that deviated from their ideal professional selves, such as administrative duties and handling parent-related matters, might occasionally evoke negative emotions among the teachers, as these tasks were not at the core of their professional objectives. In terms of relationships, this study revealed that teachers' emotions can serve as indicators reflecting the extent to which the desired professional identities of kindergarten teachers are acknowledged and embraced by various stakeholders, such as children, parents, and kindergarten principals. Sociological studies on teacher emotions have pointed out that adults with different social lives can have different opinions on the qualities of a profession, and these disagreements can result in tensions between teachers and different societal groups (e.g., principals and parents; (Hargreaves, 2001). Understanding the social cultures in different groups is essential for understanding the tensions between different stakeholders.

The high-stress examination-oriented curricula implemented in secondary schools in Mainland China have had cascading effects, exerting top-down pressures on primary schools and kindergartens. The emphasis placed by parents on children's academic achievements has diminished the importance of play in early childhood education, further creating a divide between teachers and parents in terms of their perspectives on children's education (Wai-Yan Wan & Leung, 2022). In addition, the relationships between teachers and principals lie beneath the bureaucratic nature of the school system. In teacher education research, scholars have highlighted the importance of teachers being researchers in their own classrooms and emphasized teachers' exercise of agency in their professional development (Elliott, 2011). However, teachers often cannot avoid the feeling that they are school employees. Under the above background, this research found that emotions had a mediating role in the teachers' identity formation. However, the relation between emotion and identity was not as straightforward as positive emotion resulting in positive teacher identity and negative emotion leading to negative teacher identity. Instead, the teachers had a mechanism of utilizing self-reflection to manage their emotions. In our interviews, many teachers, especially experienced teachers, reported that they self-reflected and evaluated their teaching practices and social interactions, especially when conflicts occurred. The reason why this

reflection process happened was connected to the teachers' self-identification with their professionalism.

Conclusion

By addressing the two activity systems, this research has revealed a positive correlation between kindergarten teachers' emotion-related identity and the alignment between their *ideal professional self* and the desired objectives. Consequently, gaining a deeper understanding of the *ideal professional self* holds promise as a potential avenue for fostering teacher emotions and cultivating job commitment. The present study contributes by highlighting how self-reflection on emotions can also generate positive self-conscious emotions, such as pride and confidence. This process significantly strengthened the kindergarten teachers' commitment to their professional identities and fostered a deeper understanding of what it means to be a kindergarten teacher. In addition, regarding the teacher–principal relationship, it is crucial for schools and districts to recognize the power dynamics and emotional rules placed upon teachers in both their classroom and non-teaching activities. By fostering a positive emotional climate and prioritizing teacher well-being, an environment can be created that supports and enhances the emotional experiences of teachers.

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Exploring Users' Sensory Experiences in Physical Learning Spaces: Politecnico di Milano School of Design as a Case Study

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Abstract
The paper aims to identify learning space users' sensory needs and preferences and determine which interior design elements and strategies best meet them to positively influence behavior and impact learning, educational performance, and individual and social well-being. A two-phase mixed-methods research (MMR) methodology is employed in the study. First, a thorough literature review was conducted to understand the sensory characteristics of learning spaces, particularly in higher education institutions (HEIs), and the common metrics for assessing the sensory performance of learning space users. This was followed by a field research methods phase encompassing surveys of 55 participants, including students and educators, at Politecnico di Milano (PoliMI) School of Design regarding their sensory experiences in four different classrooms. In addition, direct observation was done in the same classrooms. The findings of this paper have revealed that sight is the most important sensory factor, followed by sound, smell, touch, and taste. Lighting, indoor air quality, and ventilation are the interior design elements with the greatest sensory importance, with the highest equal percentage of 58.2%. Acoustics and noise level are next, with 54.5% and 52.7%, respectively, followed by thermal comfort, colors, smells, shapes, and textures. Furthermore, a noisy learning space reduces focus and raises anxiety, while poor air quality and insufficient temperature can cause headaches. This highlights the necessity of improving the quality of learning space design and taking sensory preferences into account during the design process.

Keywords: Learning Spaces, Sense-Based Design, User Experience, Spatial Behavior

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Introduction

Higher education institutions are constructed facilities to host and support academic-related activities, such as teaching, learning, and research. These facilities typically accommodate a variety of faculties with various specializations (A. O. Abisuga et al., 2019). Additionally, they have a range of spaces, including offices, lecture halls, classrooms, open areas, cafeterias, libraries, studios, workshops, and laboratories. The effectiveness of these learning environments affects staff and student behavior, health, and productivity (Abisuga et al., 2015, 2016; Leung & Fung, 2005; Vafaeenasab et al., 2015). Therefore, it is essential to understand students' perceptions of their physical learning spaces to meet their needs.

Students engage their five senses—sight, touch, smell, taste, and hearing—to perceive, gather, and analyze data from the learning environment. Each of these senses serves a purpose by collecting data from the environment and relaying it to the brain, which analyzes the information (Kaleem, 2022). When the brain receives information about the environment via perception and cognition, such as light, aesthetic shapes, textures, colors, patterns, acoustics, odors, objects, and furniture, the brain responds with what is known as "spatial behavior" (Mostafa, 2008; X. Zhang, 2016). Together, these mental processes enable the students to respond to their surroundings, affecting their performance (Kaleem, 2022).

Although research into the design of learning spaces is receiving more attention (Perks et al., 2016), more needs to be understood about what students consider a high-quality learning environment (Riley, 2013; H. Wilson & Cotgrave, 2020). In HEIs, architects, estate/property managers, and teaching staff do most of the research on space design and often make recommendations based on pedagogical or technical considerations; students' sensory perceptions are rarely explored in their studies (Cleveland & Fisher, 2014). This highlights the necessity for improving the quality of learning space design and taking sensory preferences into account during the design process (Patel et al., 2022).

Therefore, the objective of the paper is to recognize the sensory requirements and inclinations of individuals using learning spaces. It seeks to establish the most effective interior design elements and approaches that can have a constructive influence on behavior, enhance learning, improve educational performance, and contribute to individual and communal well-being.

Learning Environments' Sensory Experience Evaluation Tools

As the number of new learning spaces has increased, academics have begun to look into ways to evaluate these new environments. Many of these methods are discussed in two Australian books where researchers suggest various tactics for figuring out how these novel spaces function (Alterator & Deed, 2018; Imms et al., 2016). These methods are classified according to the occupancy stage, including pre-and post-occupancy evaluation tools.

Acton, Riddle and Sillers (2018) present a study of post-occupancy evaluation methods and list the most common techniques, such as surveys, interviews, focus groups, and teaching practice observations. They also introduce additional emerging tools for evaluating spatial data, such as the Most Significant Change (MSC) approach, a narrative-based dialogic process, and the Day Experienced Method, which analyzes student perspectives and experiences through diaries, photos, videos, and audio recordings. Loughborough University (Bryant et al., 2009), Sheffield Hallam University (Harrop & Turpin, 2013), Iowa State

University (Rands & Gansemer-Topf, 2017), Singapore Institute of Technology (Mui et al., 2019).

On the other hand, the pre-occupancy tools include the Learning Space Rating System (LSRS), Learning Environments Evaluation Programme (LEEP), Pedagogy-Space-Technology (PST) Framework, Learning Space Toolkit (LSTK), and Flexible Learning Environments eXchange (FLEXspace). They generally provide a framework for assessing the potential performance of a learning space, that is, what learners and instructors can do in it (Brown et al., 2017). These tools have been used to evaluate the learning spaces of several universities, such as Bond University (G. Wilson & Randall, 2010), PoliMi (Sancassani et al., 2019), and Penn State University (Waltz et al., 2020).

However, Cleveland (2016) criticizes current guidelines for learning space evaluation for failing to consider the learning environment's social or human aspects and urges the development of new prospects that directly link pedagogy and space. Similarly, Oliver (2016) notes that existing evaluation models frequently occur in the distinct fields of architecture or education. The common assessment elements associated with the sensory dimension are listed in Table 1 and have been collected from a variety of evaluation tools and studies. Each element is presented as a feature of a broad evaluation category, not especially for evaluating the sensory performance of the learning community users. They are summed up into eight different elements, including lighting, acoustics, colors, thermal comfort, visual display, furniture, equipment, and layout, as well as indoor air quality and ventilation.

Assessment Elements	Relevant Literature/Reference
Lighting	Christensen Hughes (2002), Hebert & Chaney (2012), Brown (2015), Sanni-Anibire & Hassanain (2016), Mustafa (2017), Kim et al. (2018) and Peng (2022)
Indoor Air Quality Ventilation	Christensen Hughes (2002), (Cooper & Kerns, 2006), Griffin (2007), Ashrae (2009), Yang et al. (2013), Sanni-Anibire & Hassanain (2016), Mustafa (2017), Kim (2018), Z. Zhang (2019) and Peng (2022)
Acoustics	Christensen Hughes (2002), Yang et al. (2013), Dunn et al. (2014), Brown (2015), Beckers et al. (2016), Sanni-Anibire & Hassanain (2016), Mustafa (2017) and A. O. Abisuga et al. (2019)
Colors	Ukoha & Beamish (1997), Liu (1999), Hassanain (2008), Fatoye & Odusami (2009), Hassanain et al. (2010) and Sadiq Mahmoud et al. (2018)
Thermal Comfort	Christensen Hughes (2002), Yang et al. (2013), Beckers et al. (2016), Sanni-Anibire & Hassanain (2016), Mustafa (2017), Watch & Tolat (2017), Kim et al. (2018), Sadiq Mahmoud et al. (2018), Lau et al. (2019) and Peng (2022)
Visual Display	Ukoha & Beamish (1997), Christensen Hughes (2002), Griffin (2007), Ashrae (2009), Fatoye & Odusami (2009), Brown (2015), Watch & Tolat (2017) and Sadiq Mahmoud et al. (2018)
Furniture and Equipment	Christensen Hughes (2002), Fianchini (2007), Yang et al. (2013), Muhammad et al. (2014), Brown (2015), Sadiq Mahmoud et al. (2018) and A. O. Abisuga et al. (2019)
Layout and Size	Penn et al. (1999), NRC (2000), Toker (2004), Griffin (2007), Toker & Gray (2008), Watch & Tolat (2017), Sadiq Mahmoud et al. (2018) and Peng (2022)

Table 1: The common assessment elements for the sensory dimension gathered from several studies. Source: table created by the researcher, based on literature review

Politecnico Di Milano School of Design as a Case Study

The literature review findings reveal the common metrics for measuring and assessing the sensory performance of learning space users. These metrics served as the cornerstone for the activities that followed in the field study phase in accordance with the research methodology.

The results of the field research activities, which began with an analysis of PoliMi space typologies, provided a framework for the following observations and surveys. Figure 1 illustrates the nine learning space typologies present at the design campus, as classified by PoliMi. It includes department classrooms, lab rooms, teaching labs, meeting rooms, conference rooms, a library, exhibition spaces, and study rooms. The spaces' learning activities are divided into four groups: lecture classrooms, individual study, drawing, and computerized spaces. To better compare spaces with the same activity, surveys, and observations for the typology of the teaching rooms—particularly those hosting design studios—were initially conducted.

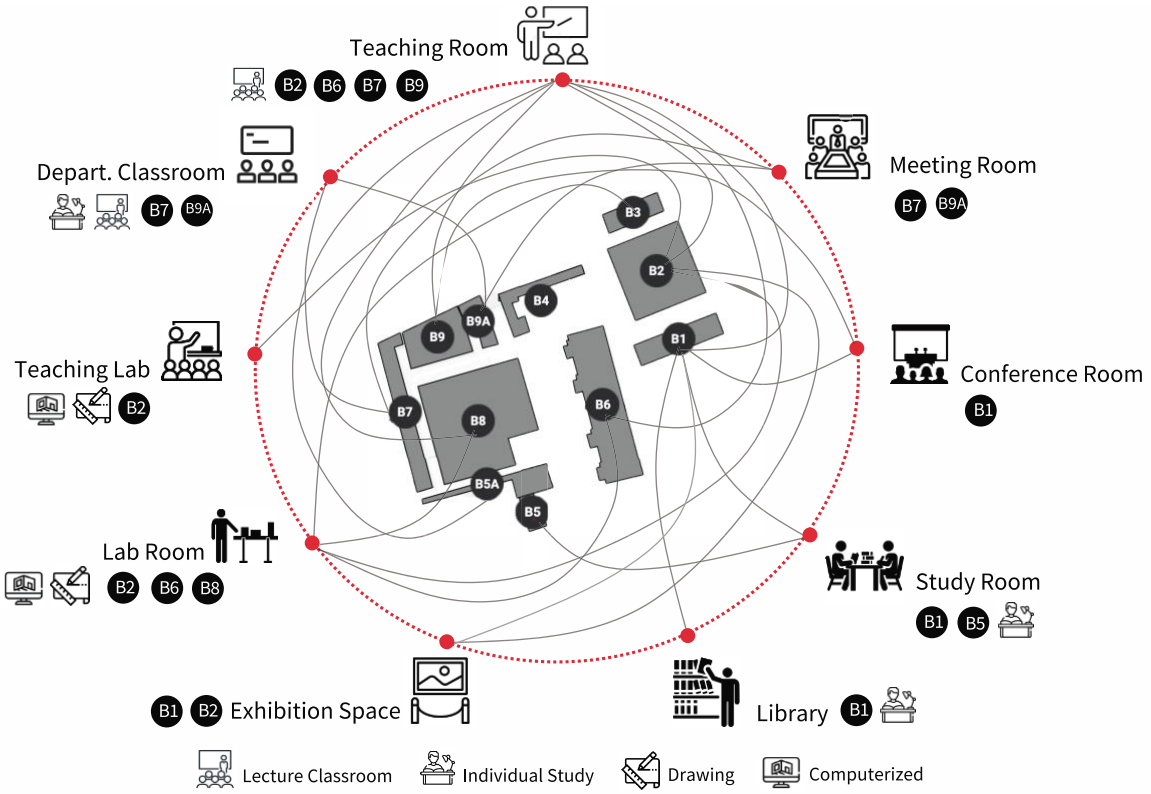

Figure 1: Learning space typologies and activities of Politecnico di Milano, Design campus
Source: figure created by the authors

The Design of The Survey Form

The online survey was developed and analyzed using Microsoft Forms. The online link was published via WeBeep platform, the official communication channel of PoliMi Design community, after taking permission from the class teaching staff. The survey collected 55 responses and feedback from bachelor's and master's students, teaching assistants, Ph.D. candidates, researchers, and professors regarding their sensory experiences in design studio classrooms. In particular, the interior design elements include sound, light, color, smell, texture, and visual stimuli. Appendix A illustrates the structures of the survey questions and the methods of answering available.

Analysis of Survey Responses

The first three questions in the survey were about the respondent's identity, including their profession, gender, and design major of study. There were 55 participants in the survey; the

number of bachelor students was 31, with 56%, followed by master students, at 33%, and Ph. D. candidates and researchers, at 5%, and ended with teaching assistants and professors at 4 and 2%, respectively (see Figure 2). Females were the primary gender of the respondents, with 85% and interior design was the respondents' highest design major compared with the rest of the majors.

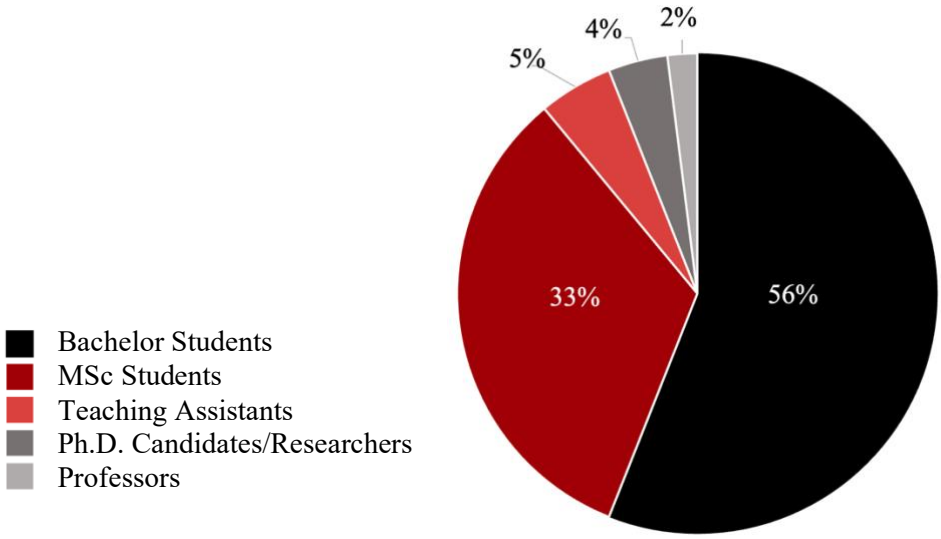

Figure 2: The percentage of survey respondents by profession
Source: figure created by the authors

In order to better understand how feedback might vary depending on the classroom, the fourth question asked about the respondent's design studio classroom. The findings revealed that the respondents had evaluated 12 classrooms, with B1 Aula Fratelli Castiglioni, B2.2.2, B2.1.2, B2.1.3, and B2.1.13 receiving the most ratings. The evaluation of the learning environment began with an awareness of the respondent's feelings while staying in the selected classroom through the fifth question, in which the respondent had the option of selecting more than one response from among eight possible feelings. These included feeling anxious, unfocused, out of the mood, cannot wait to leave, calm, focused, inspired, productive, motivated, and safe. As shown in Figure 3, the feeling of calmness received the most votes (20), followed by productivity and motivation (17). At 11 and 10, respectively, the contradictory feelings of being focused and unfocused were extremely closely rated. Being anxious received nine responses, and being out of the mood and feeling safe received seven responses each. Desire to leave the classroom receives the lowest percentage.

A. Anxious
B. Unfocused
C. Out of mood
D. I cannot wait to leave
E. Calm
F. Focused and inspired
G. Productive and motivated
H. Safe and secure
I. Other

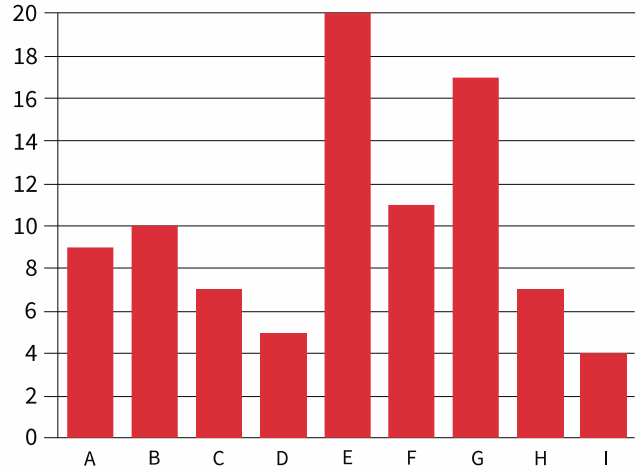

Figure 3: The ratings of respondents' feelings in the learning space
Source: figure created by the authors

The sixth question required the participants to rank their senses regarding how much they impacted their overall performance in the learning environment. The outcome revealed that sight comes first, followed by sound in second, and smell in third. The fourth and fifth positions are given to touch and taste (see Figure 4). 27 respondents provided justifications for ranking and selecting particular senses and feelings towards the learning environment in response to the following question. They relate the value of sight to the impact of colors, lighting, and shapes on productivity and positivity. On the other hand, a noisy learning space reduces focus and raises anxiety. Poor air quality and insufficient temperature might cause headaches, especially when spending too much time in the same classroom. The significance of smells in remembering the space has also been addressed through their ability to trigger vivid memories and emotions, making them a valuable element in our perception and recollection of interior environments.

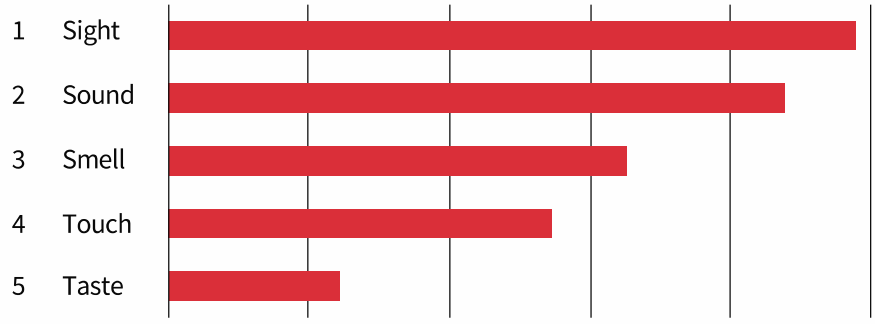

Figure 4: The ranking of senses according to their importance in affecting the overall performance in the learning space. Source: figure created by the authors

Question eight aims to evaluate the interior elements that affect the sensory experience in the learning space based on the literature review. The respondent is therefore given a list of factors, including lighting, colors, interior shapes, acoustics, noise level, textures of walls and

furniture, smells, indoor air quality and ventilation, thermal comfort, and furniture layout, to rate on a scale of extremely ineffective to extremely effective. The percentage of respondents who rated the element as extremely effective is indicated in dark red in Figure 5, in which lighting, indoor air quality and ventilation have the highest equal percentage of 58.2%. Acoustics and noise level are next, with 54.5% and 52.7%, respectively. Thermal comfort got 47.3% of the vote, followed by colors (32.7%), smells (32.6%), shapes (18.2%), and then the textures of the furniture and walls (5.5%).

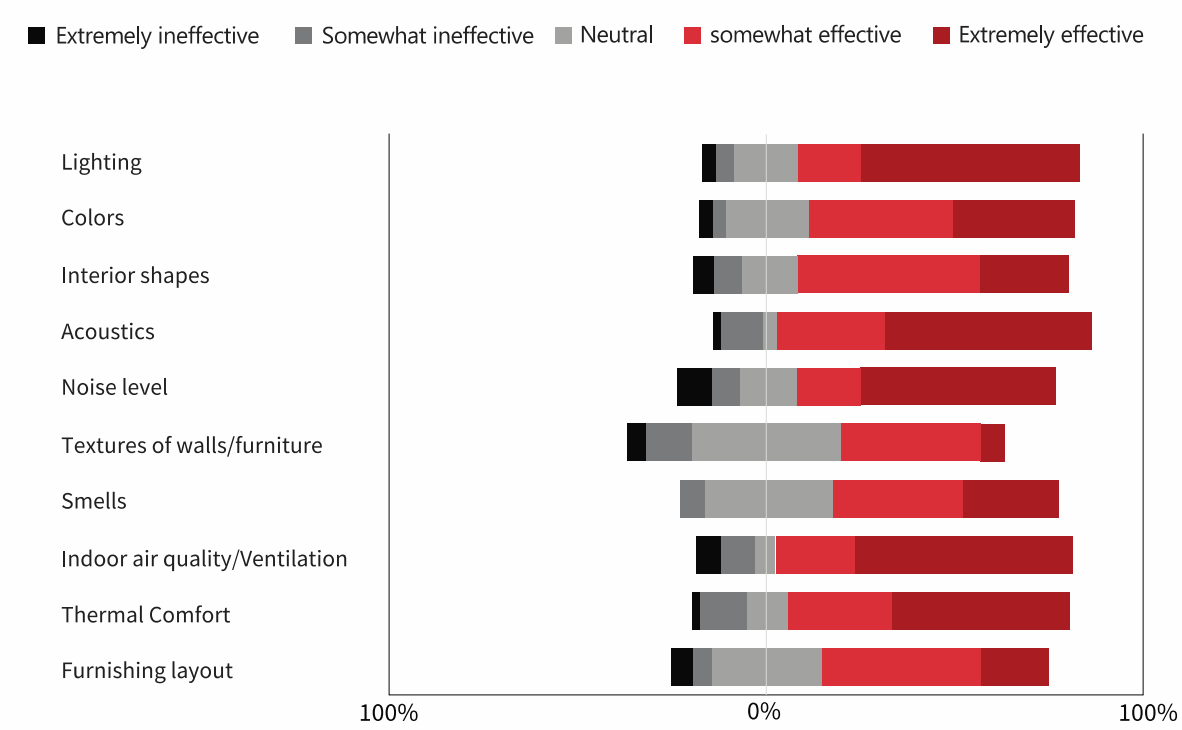

Figure 5: The rating scale results for interior elements that impact the sensory experience in the learning environment. Source: figure created by the authors

The following question asked the participants if other elements should be added to the previous list to enhance the sensory experience. The results showed that 48 out of 55 respondents answered "none". Two respondents noted the technological factor, and two others mentioned the interaction between users of the learning space. The classroom infrastructure, environmental factors, movement, furniture quality, and shape were also mentioned.

The tenth question focused on the sensory assessment of the respondent's chosen classroom. The respondent was asked to rate the space on a scale of extremely poor, poor, fair, average, and good, as shown in Figure 6. The results revealed that "fair" is the predominant rating for all categories of evaluation, including visual (38.2%), olfactory (41.4%), tactile (49.1%), auditory (32.7%), and taste (56.4%).

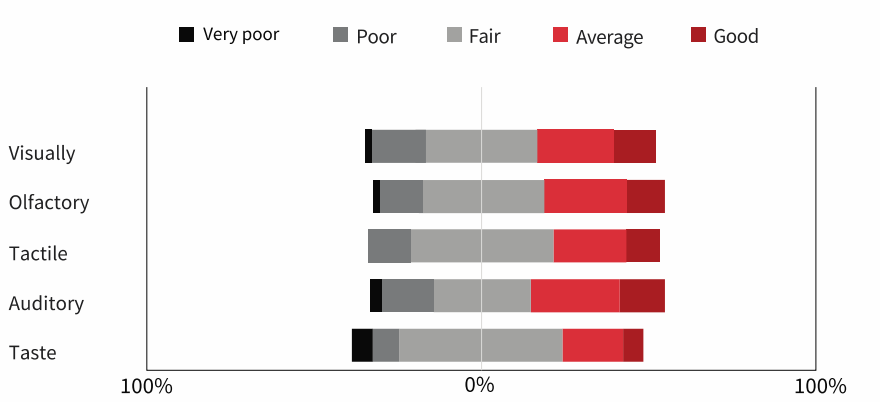

Figure 6: The results of the respondent's selected classroom's sensory evaluation
Source: figure created by the authors

In the last question, the 55 participants were given a chance to mention the sensory elements they believed could be improved. Sixteen respondents highlighted how noisy classrooms are, commenting, "When we work in groups during studio time, the noise inside the class is annoying if we have to stay for many hours." A different respondent continued that it is important not to hear sounds from outside or from other classes. Nine out of the fourteen comments submitted for improving the visual aspect dealt with lighting-related problems, such as lighting tone, glare, and the need for more natural light. A respondent explained: "After a long time watching the board screen, my eyes start to get tired from that light and to get annoyed by the other lights." "I hate when we have to close the curtains because, without natural light, we lose space-time perception," another respondent noted.

In addition, nine respondents brought up the issue of poor indoor air quality, particularly during the winter, which one of them described as having a "stuffy air" feeling accompanied by unpleasant smells. Also, the temperature in the classroom is too warm, which promotes sleepiness and lack of concentration, as seven participants commented. Another respondent suggested that the classroom interior design reflects a design studio by using stimulating colors, a furniture layout that encourages both individual and collaborative work, and more comfortable seating.

Observation Method and Analysis

A prepared form (see Appendix B) was used for the observation and filled out with the data collected. It is divided into two sections: the first covers the key information of the observed space, including the observed classroom number, degree program, user number, and a drawing of the design of the learning space. The second part of the essay includes the observational aspects of the space's features, educational activities, and sensory qualities. The observed classrooms are the same ones evaluated by the survey to reinforce the research data. Four classrooms—B2.0.1, B2.1.2, B2.1.3, and B2.2.4—have been observed during a design studio lesson.

The observation findings matched the survey outcomes regarding auditory and olfactory issues in particular. Figure 7 illustrates the sound circulation in two different classrooms with the same linear interior layout; the classroom on the left (B2.1.3) featured a frontal lecture in which the sound source was only focused on the class users. In contrast, there were group tutorials in the classroom to the right (B2.2.4), where the noise level was extremely

distracting due to the abundance of sources for the chattering sounds across the room. On the other hand, the lack of fresh air entering the classroom made it obvious that the air quality was poor, accompanied by the space's uncomfortable temperature.

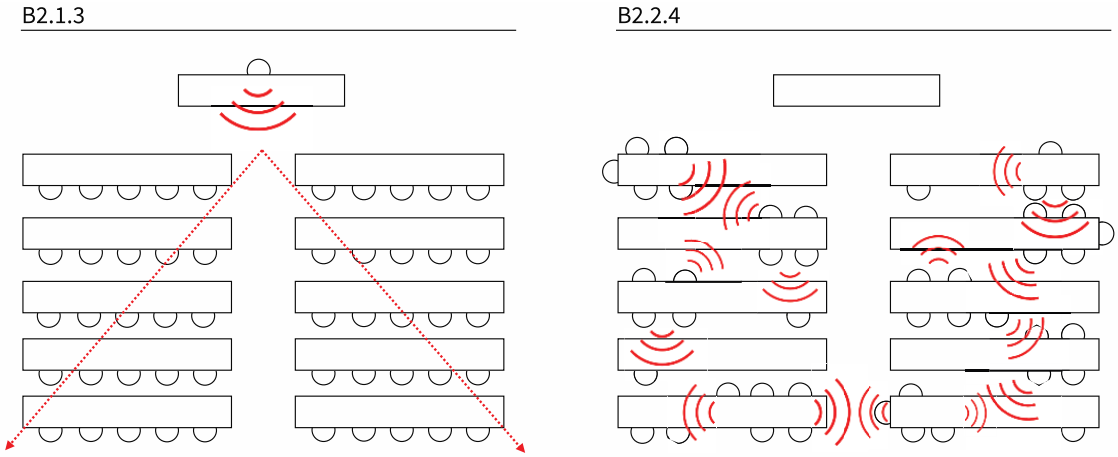

Figure 7: The sound diffusion in two selected classrooms
Source: figure created by the authors

Conclusion

This paper conducted a two-phase mixed-methods research to investigate the sensory needs and preferences of users in learning spaces, particularly in higher education institutions. The study explored the impact of interior design elements on behavior, learning outcomes, and well-being. The initial phase involved a literature review to establish sensory characteristics and assessment criteria. The subsequent field research collected data from 55 participants at Politecnico di Milano School of Design, including surveys and direct observations.

The findings highlighted that sight was the most crucial sensory factor, followed by sound, smell, touch, and taste. Interior design elements like lighting, indoor air quality, and ventilation were identified as the most important, with acoustics and noise levels close behind. The study revealed that noisy environments hinder focus and raise anxiety, while poor air quality and temperature can lead to headaches. Consequently, the research emphasized the necessity of incorporating sensory preferences into the design process to enhance the quality of learning spaces and promote better educational performance and well-being.

Appendices

Appendix A
Survey form

1. Profession *

- ◯ Bachelor Student
- ◯ MSc Student
- ◯ Teaching Assistant
- ◯ PhD Cadidate/Researcher
- ◯ Professor

2. Gender *

- ◯ Female
- ◯ Male
- ◯ Non-binary
- ◯ Prefer not to say

3. Field of study *

- ◯ Interior Design
- ◯ Product Design
- ◯ Service Design
- ◯ Fashion Design
- ◯ Communication Design
- ◯ Digital and Interaction Design
- ◯ Design and Engineering

4. Could you please indicate the classroom number where y ou had/have your design studio? *

- ◯ B1 Aula F.LLI CASTIGLIONI
- ◯ B2.1.2
- ◯ B2.1.3
- ◯ B2.1.5
- ◯ B2.1.6
- ◯ B2.1.8
- ◯ B2.1.10
- ◯ B2.1.13
- ◯ B2.1.15
- ◯ B2.2.2
- ◯ B2.2.4
- ◯ B2.2.6
- ◯ B2.2.7
- ◯ B2.2.10
- ◯ B2.3.1
- ◯ B8 2.3

5. How do you feel while staying in this classroom? *

Feel free to choose more than one answer!

- ☐ Focused and inspired
- ☐ Unfocused
- ☐ Anxious
- ☐ Out of mood
- ☐ Safe and secure
- ☐ Productive and motivated
- ☐ Calm
- ☐ Cannot wait to leave
- ☐ Other

6. Which senses affect your overall mood/performance in the learning space? Please order y our responses from most important to least important. *

- Sight
- Sound
- Smell
- Touch
- Taste

7. Could you please explain the connection between the interior space elements and the feeling/s you choose in the previous question?

8. From your opinion, how does each of the f ollowing elements affect your sensorial experience in the learning space? *

	Extremely ineffective	Somewhat ineffective	Neutral	somewhat effective	Extremely effective
Lighting	◯	◯	◯	◯	◯
Colors	◯	◯	◯	◯	◯
Interior shapes	◯	◯	◯	◯	◯
Acoustics	◯	◯	◯	◯	◯
Noise level	◯	◯	◯	◯	◯
Textures of walls/furnitur es	◯	◯	◯	◯	◯
Smells	◯	◯	◯	◯	◯
Indoor air quality/Ventil ation	◯	◯	◯	◯	◯
Thermal Comfort	◯	◯	◯	◯	◯
Furnishing layout	◯	◯	◯	◯	◯

9. Do you think other elements should be added to the previous list f or enhancing the sensory experience? *

10. How can you evaluate the classroom from a sensorial perspectiv e? *

	Very poor	Poor	Fair	Average	Good
Visually	◯	◯	◯	◯	◯
Olfactory	◯	◯	◯	◯	◯
Tactile	◯	◯	◯	◯	◯
Auditory	◯	◯	◯	◯	◯
Taste	◯	◯	◯	◯	◯

11. What are one or more sensory elements that y ou believe should be improved? And how? *

Appendix B
Field observation sheet

Observation form – Politecnico di Milano	
Date of observation:	Classroom number:
Degree level:	Design program:
Number of students and staff:	Lesson type/topic:
Start time:	Finish time:
Drawing of learning space	
Observation	Reflections
Space Atmosphere (Formal – informal – Flexible) Layout type:	
Activities Class task: Used tools: (manual/digital)	
Sensorial Qualities Lighting (natural & artificial) Colors: Interior shapes: Acoustics: Noise level: Textures of walls/furnitures Smells: Indoor air quality/Ventilation: Thermal Comfort: Furnishing layout:	
Pictures: (yes – no) Notes:	

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Strength in Numbers: Analysis of the Effectiveness of Team Teaching in Mathematics in Middle School

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Abstract
Mallya Aditi International School, Bangalore, India, is an inclusive school that caters to a wide range of students from high-end socio-economic backgrounds to economically underprivileged students, admitted under the Right to Education Act. The students have been exposed to team teaching from the early years of school and continue to experience the same in Middle School. This study was an enquiry into the school's philosophy of team teaching, whether educators collaborate effectively towards a common objective and how far it helps students enhance their understanding of Mathematics. The qualitative and quantitative study was conducted on 87 students of two sections of Grades 7 and 8. Data was collected from students through a questionnaire consisting of both option-based and opinion-based questions. This was tabulated and interpreted using the Numbers App. The descriptive answers were documented for further detailed study. The result highlighted that Team Teaching is a powerful tool in reaching out to an inclusive group. However, some responses underlined that 17% of students were reluctant in this scenario, mostly because they were newly admitted to the class and had no exposure to this method of teaching. Therefore, the study also enhanced the need for greater acquaintance and encouragement for such students to bring them into the ambit of teaching Mathematics through Team Teaching. While on one hand team teachers facilitate most students who need help in understanding concepts, they also need to tweak their methodology of teaching to cater to students who need individual intervention.

Keywords: Team Teaching, Inclusive, Middle School, Survey, Quantitative, Qualitative, Right to Education Act, Collaboration, Methodology

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Introduction

American author and educator Hellen Keller quotes[1]:

> "Alone we can do so little;
> Together we can do so much."

"Team Teaching" is the perfect example of these words – the process implies a group of educators, teaching in a team. The group may include 2 to 4 teachers who prepare individual lesson plans and teach a topic or a concept to the same group of students. The main insight of the educators is to collaborate effectively with one another to work towards a common goal. Each teacher, working in the team applies his/her experiences, abilities and a variety of resources and projects.

Teams can be single-discipline, interdisciplinary, or school-within-a-school teams that meet with a common set of students over an extended period. New teachers may be paired with veteran teachers. Innovations are encouraged, and modifications in class size, location, and time are permitted. A team-teaching approach allows for more interaction between teachers and students. Working as a team, teachers exemplify respect for differences, interdependence, and conflict-resolution skills.

Types of Team Teaching

Team teaching includes several different approaches. Some of the more common are:

1. Interactive team-teaching:- Two faculty members present in front of the class simultaneously.

2. Rotational format team-teaching:- Faculty alternate teaching the class. This rotational format has a number of variations depending on the subject matter and the number of faculty involved.

3. Participant-observer team-teaching:- All participating faculty are present for all the classes, but only one is "teaching" at a time. Roles that the other teachers could play as participating observer(s) are model learner, observer, panel member, or resource.

4. Team coordination:- Faculty arrange and integrate a curriculum so as to maximize learning and connections using paired or linked courses, an integrated cluster of independent courses, or freshman interest groups. Though not necessarily team teaching per se, this curriculum-level an approach to interdisciplinary can help to achieve some of the expected gains of team teaching.[2]

[1] www.brainyquote.com
[2] Beggs, David W., III. 1964. Team Teaching: Bold New Venture. Bloomington: Indiana University

Different Ways in Which a School Can Use Team Teaching

Team teaching is a powerful tool that can significantly enhance the learning environment. Here are nine creative ways that schools can leverage team teaching to advance teacher knowledge, improve outcomes, and develop new skills:

1. Parallel Teaching: Two teachers simultaneously instruct different groups of students in the same classroom, allowing for more individualized attention and feedback. This approach can be particularly effective in large classes or when students are working on complex tasks.

2. Complementary Teaching Skills: Teachers with different areas of expertise can collaborate to provide a more comprehensive and diverse learning experience.

3. Professional Development: Team teaching provides an excellent opportunity for teachers to learn from each other, enhancing their pedagogical skills and knowledge. Observing a colleague's teaching methods can offer valuable insights and inspire new teaching strategies.

4. Enhanced Student Engagement: The dynamic nature of team teaching can make lessons more engaging and interactive, which can lead to improved student outcomes.

5. Flexible Grouping: Team teaching allows for flexible grouping of students, which can be adjusted based on the learning objectives or students' needs. This can be particularly beneficial for differentiated instruction.

6. Shared Responsibility: Team teaching distributes the responsibilities of instruction, planning, and assessment among multiple teachers, reducing the workload and stress associated with these tasks.

7. Improved Communication: Team teaching encourages regular communication and collaboration among teachers, fostering a more cohesive and supportive school community.

8. Modelling Collaboration: By working together, teachers model the importance of collaboration and teamwork to their students, skills that are crucial for success in the 21st-century workplace.

9. Innovative Problem-Solving: When faced with challenges or obstacles in the classroom, team teachers can brainstorm and implement innovative solutions together, leveraging their combined expertise and perspectives.[3]

10. As the educational researcher Elizabeth Cohen[3] once said, "When teachers work together, they can create a learning environment that is greater than the sum of its parts." Indeed, the benefits of team teaching are manifold, from enhancing teacher development to improving student outcomes.

[3] www.structural-learning.com/post/team-teaching

The philosophy of Team teaching was initiated by Mallya Aditi International School from 1984 since its inception and this philosophy has been in practice ever since. Mallya Aditi International School is a private school located in Bangalore, India. There are 718 students (from grade 1 to 12) of which 144 students belong to the Middle School section. Talking about the VISION of the school; ***Aditi creates opportunities for students to become confident, independent individuals who are sensitive to diversity, aware of their heritage, and able to face the challenges of their time.*** [4] Therefore, over the years, the teachers have worked at developing more objective observations.

The staff timetable is created in a similar manner to accommodate a group of teachers in their respective classrooms for a specific subject. It has helped to improve the quality of the teaching. Team-teaching plans are flexible and hence the teachers are able to modify the classroom teaching according to the students' abilities, interests, strengths and challenges. The educators work together, take up different responsibilities, and play different roles to implement this vision. This teaching-learning process has no hierarchy; all the team members have equal roles, and work together towards common objectives. Team teaching is based upon the collective responsibility of teaching given to a small group of teachers rather than giving the entire responsibility of teaching to one teacher only. In team teaching, different topics / branches of the subject are taught by an individual teacher turn by turn. On the other hand, the other teachers facilitate the students who need help in understanding the concept being taught in the class. When there is a group discussion or activities conducted in the class, teachers move around to different groups & observe the students' work. Sometimes two teachers introduce the concept or share strategies for the better understanding of the concepts. This pedagogy has provided a positive experience for teachers and the teachers believe this practice has benefitted students too. This teaching- learning ideology urges the students to question the conventional, challenge theories, validate hypotheses and employ analytical reasoning. However, the Middle School Math team has always been curious about, "whether this pedagogy has been effective or not?" And hence, a survey was conducted with the learners of the Middle School.

Objectives of Research

We have been practising team-teaching since the commencement of our school. So, we wanted to know how students respond to this methodology and how many students actually prefer team teaching over a Single teacher. To get a precise information about students' preferences, we conducted a survey on two grades of Middle School i.e. grade 7 and 8. We made a conscious decision to conduct the survey on these classes as they have been exposed to team teaching by the same team of teachers for a significant period of time. Being exposed to the same team of teachers helped students understand the methodology of team teaching better and enabled them to assess it more effectively. Our sample set had a wide range of students, including students who have been in Aditi since the Elementary section, new students from different institutions, first generation literates and students from challenged socio-economically challenged backgrounds. Student's diversity and their preferences according to their experiences have reflected in the results of our survey as well. Other aspects of the results of our survey will be shared in the later part of our paper.

There are multiple ways to conduct a survey such as:

[4] https://www.aditi.edu.in/

Online Surveys [5] - Online surveys are surveys with structured questionnaires that your target audience completes through an online form.

In-Person Interviews[6] - In-person interviews are the surveys where the interviewer asks a set of questions to the target audience in order to collect the information on a given subject.

Focus Group [7] - A focus group survey is a research method which is used to collect the information or opinion or feedback from a specific group of people about a specific concept or product.

Mobile Surveys [8] - A mobile survey is one that's specifically designed to fit a smartphone or tablet screen and makes it easy for respondent to use touchscreen gestures to answer the questions.

Methodology

Over the years, we have found online questionnaires to be the most convenient and efficient way for collecting students' responses. Quantitative research basically consists of questions which are objective and used to analyse detailed information on a given topic. Quantitative questions help us to get clear and precise answers for the study. The reason behind using quantitative questions was to avoid errors on the primary data level. This type of research enables the researcher to obtain a pattern and infer the information from it.

On the other hand, Qualitative research allows you to ask questions that cannot be easily put into numbers to understand human experience. Getting at the everyday realities of some social phenomenon and studying important questions as they are really practiced helps answer big questions [9]. Qualitative research brings out the detailed responses collected by the interviewees on the given topic. Qualitative research helps us to understand the issue deeply and thoroughly.

So, our team chose to prepare a questionnaire that included quantitative and qualitative questions. This allowed students to give their opinions in short as well as detailed answers to questions that aimed to gather feedback on team teaching.

The objective of the conducted research was to get students' responses on their experience of team teaching as well as the reason for their responses. These quantitative and qualitative responses gave us a clear picture of the important aspects of Team teaching and its impact on various topics.

The outcomes of the quantitative as well as qualitative research questions were then tabulated and represented in the form of graphs on the Numbers app in IOS, for a clear understanding and interpretation of the data and its responses.

[5] https://www.usability.gov/how-to-and-tools/methods/online-surveys.html#:~:text=An%20online%20survey%20is%20a,vary%20in%20length%20and%20format.
[6] https://nexlooks.com/in-person-survey/#:~:text=In%2DPerson%20Survey%20or%20Face,understood%20correctly%20by%20the%20respondent.
[7] https://www.cdc.gov/healthyyouth/evaluation/pdf/brief13.pdf

The Survey Results

The survey showed that 72 students out of 87 students opted for team-teaching, while 15 students out of 87 students preferred a single teacher. The survey also indicated that a majority of the students understand Algebra better compared to Arithmetic and Geometry, due to the team of teachers. There were variety of questions in the survey such as, "Please share your response to the given statement, 'My team teachers ask each one of us whether we have understood what has been taught and help us in case we have doubts'" which also had options ranging from "*Strongly agree*," "*Agree*," "*Disagree*," and "*Strongly disagree.*" We also wanted to know if students found team teaching confusing as there were multiple teachers in class. Therefore, our questionnaire included questions such as, "*Different teaching methods by different teachers of the team, can be little confusing at time in Math*.", which also had options ranging from "*Strongly agree*," "*Agree*," "*Disagree*," and "*Strongly disagree.*"

It was very evident from the survey that the majority of students prefer having multiple teachers in class. The qualitative questions reflected why most students prefer team teaching. Most of the students are scared to clarify their doubts in front of the entire class as they have a fear of being judged by their peers. There are times when students are absent, and they need one on one assistance to catch up with the class. The detailed response from students helped us understand the effectiveness of Team Teaching.

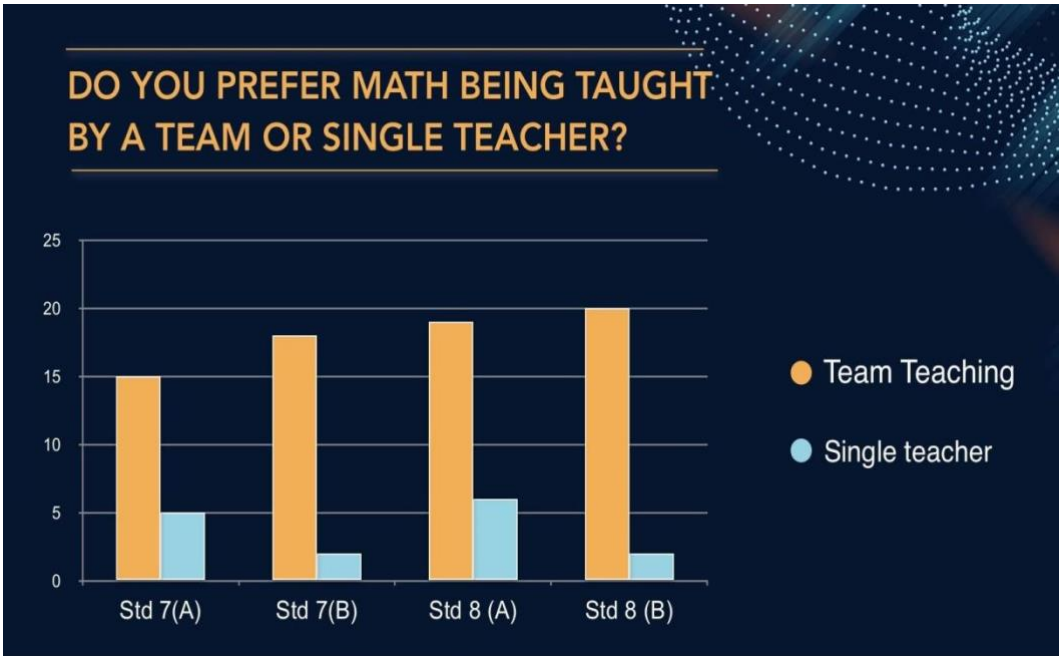

Figure 1: Result of Quantitative Analysis

[8] https://www.surveymonkey.com/mp/how-and-why-to-create-mobile-centric-surveys/#:~:text=A%20mobile%20centric%20survey%20is,The%20text%20is%20larger

[9]Qualitative%20research%20allows%20you%20to%20ask%20questions%20that%20cannot%20be,practiced%20helps%20answer%20big%20questions

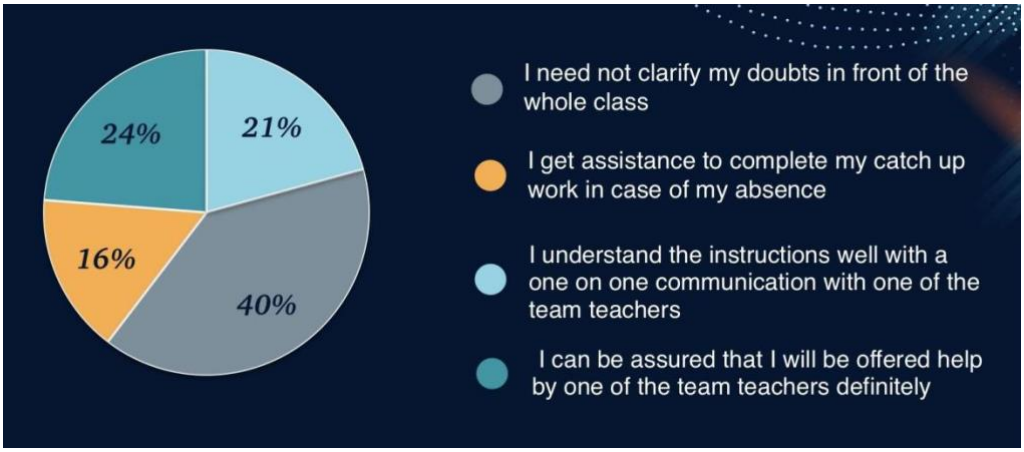

Figure 2: Result of Qualitative Analysis

Right to Education Act

Picture 1: Image courtesy: sentinelassam.com

The Right to Education Act, [10] also known as the RTE ACT 2009, was enacted by the parliament of India on August 4, 2009. It describes modalities of the importance of free and compulsory education for all children aged between 6 - 14 years in India under Article 21 (A) of the constitution of India. This act came into effect on April 1, 2010 and made India one of the 135 countries to have made education a fundamental right for every child.

Some Features of RTE Act:

1. This act mandates that any out of school children should be admitted to an age appropriate class and provided with special training to enable the child to come up to age appropriate learning level.
2. This act prohibits all minds of physical punishment and discrimination based on gender, caste, class and religion.
3. It prohibits screening procedures for admission of children.
4. This act makes it obligatory on the part of the government to ensure admission, attendance and completion of elementary education by all children falling in the age bracket 6-14 years.

5. Essentially this act ensures free elementary education to all children in the economically weaker sections of society and preventing child labour.

At Mallya Aditi International School, we team teachers cater to the RTE students with more care and guidance.

Our Team teaching is organized according to the interests, abilities and needs of the RTE students. Since the team, as a whole shares the teaching task, it provides better opportunities to take care of the difficulties and needs of the individual students.

While working with these students who are not on par with the rest of the class, teachers regularly turn to them to provide educational, behavioral, personal care and logistical support. In a way we all act as mentors to these students providing a sort of foster care in the classroom. This was reflected more during the COVID times, when they used to reach out to us after school hours too.

We wish to share what our RTE students felt about team teaching in the Math classes.

1. They felt relaxed in physical and online classes.
2. They felt included and not left out with the rest of the class, as the group activities were designed by the teachers in an attenuated or ethereal way. We made sure all students came under a common umbrella.
3. They were encouraged to participate in class discussions.

Picture 2: Sarva Shiksha Abhiyan. Image courtesy: studypoweracademy.com

Inference

What was the takeaway from the survey analysis?

[10] https://www.education.gov.in/rte

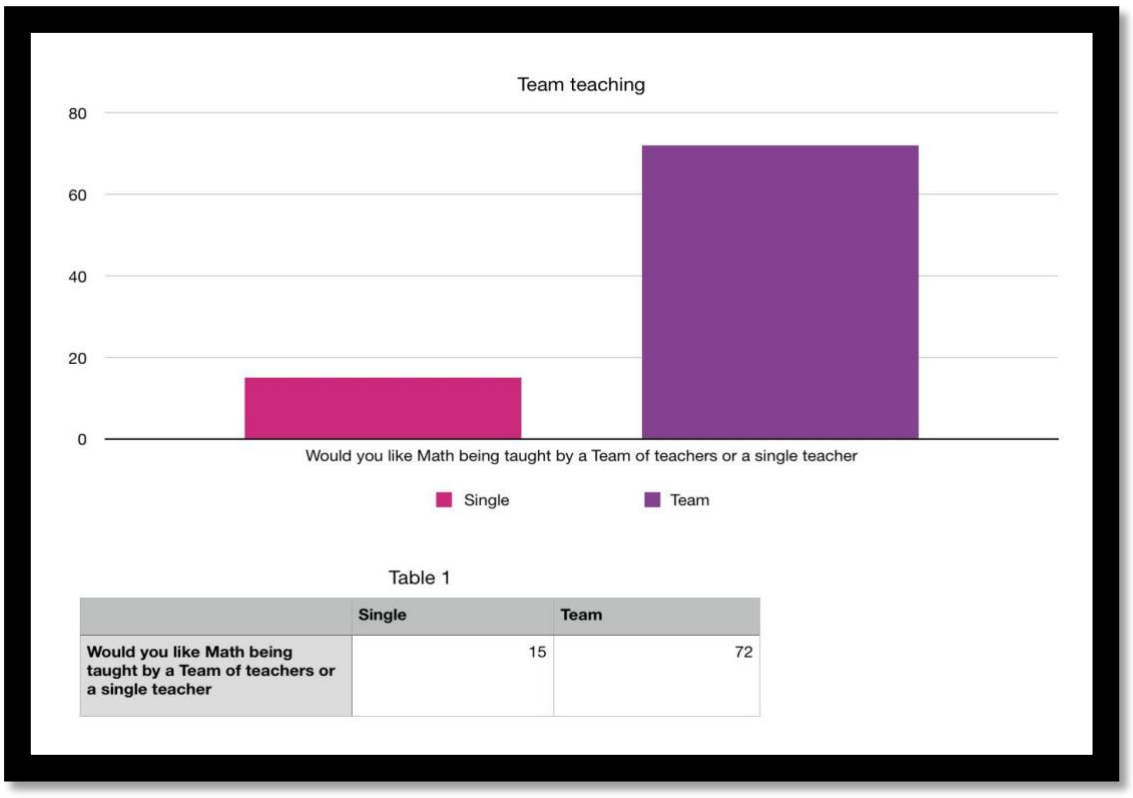

Table 1

	Single	Team
Would you like Math being taught by a Team of teachers or a single teacher	15	72

Figure 3: Graph representing number of responses

82.75% felt that they preferred team teaching over single teachers.
The reasons given were:

- they felt included
- it was easy to clarify doubts
- they gained confidence in the subject
- they were exposed to a variety of teaching methods.

17.25 % preferred single teachers to team teaching.
The reasons were:

- some were new to the team teaching methodology
- presence of many teachers was overwhelming
- they were probably not used to different styles of teaching.

While we were happy that the majority of students preferred team teaching, we were intrigued at the 17.25 % and wanted to design our course of action based on their response.

These are the strategies we teachers wish to adopt in the future:

1. Adaptation: Introducing team teaching to the class in a gradual way.
2. Scaffolding: Greater attention to students who are new to the system
3. Explicating: Elucidating details about creative activities and projects.
4. Guided practice: Inquiry of prior knowledge of concepts for the previous institution.

Conclusions

Team teaching is a strategy that involves 2 or more teachers working together to teach a class. It is also known as 'co-teaching' or 'shared teaching'. In this scenario, the teachers simultaneously work in the same classroom with the same students on the same topic, delivering the same activities and using the same resources. In other words, teaching duties are shared.

Advocates of team teaching [11] say that it has a number of key benefits, such as:

- improving the work environment, staff morale, job satisfaction and staff retention
- teachers learning from one another
- challenging students to respond more positively to a different teacher (due to personality type)
- a shared workload in terms of planning, resource development and marking
- the addition of more expertise (especially in specialty areas)
- modelling teamwork and cooperation to students
- additional support for behavioural issues
- fewer issues if one teacher is absent
- Students regularly turn to them to provide educational, behavioural, personal care and logistical support. Purely from a time management perspective, a teacher can only help so many students in any given lesson. As we said, many students with special needs and RTE students require one-on-one support. Since us teachers have more experience with the same group of children as we are moving up with them, team teachers are a lifeline for existing teachers and for those operating in challenging classes.

There are a number of simple steps that we team teachers take to maximise the effect of team teaching in our classroom such as:

- including all team members in planning and resource development activities
- holding regular team meetings and communicating throughout the day
- clearly defining roles, expectations and tasks (such as administration tasks)
- ensuring that there are no misunderstandings and resolving issues quickly
- Setting, enforcing and maintaining a high standard of professionalism **through these years of working together as a team, we find this model of teaching to be very effective** as it involves students actively. It involves **mental and physical simulation of students**

"It is a form of organization in which individual teachers decide to pool resources, interest, and expertise to the device and implement a scheme of work suitable to the needs for their pupils and the facilities of their school."- as per **David Warwick [12]**

[11] https://content.wisestep.com/advantages-disadvantages-team-teaching-method/
[12] samareducation.com
https://www.samareducation.com › B. Ed. (ENG.)

Advantages and Disadvantages of Team Teaching

Advantages:

1. Low cost:
   One can get an efficient form of learning at a very low cost; no new resources are required to start team teaching.

2. Support for teachers:
   Team teaching eliminates problems such as completing the curriculum within a stipulated time, or not being able to implement creative ideas due to lack of guidance. When teachers collaborate, they operate and act on their strengths and weaknesses, thus finding a successful way to teach and learn.

3. Closer integration of staff:
   With team teaching, teachers are bound to bond, as frequent discussions and planning make them develop a good relationship. A happy staff can effectively inculcate the vision of the Institute.

4. Variety of ideas:
   When teachers come together with their teaching style, ideas and expertise come together, if planned perfectly, the mixture of best ideas and styles will put forth many ways out of a single topic. It thus helps in better learning and better involvement of students.

5. A new method is always appealing; students might wonder what new things they are going to learn. A team of teachers will have various ways and ideas to put forth, which make the students, put on their thinking cap and question '**why**' for all things. They will come up with various questions, queries, and ideas. A dynamic discussion session.

6. Mental stimulation to students:
   In traditional lecture only one teacher is teaching, the ideas, thoughts are only one way.

7. Team teaching helps them question the theories and facts. When the students are involved it brings out the creativity and the habit of questioning things.

8. Breaks traditional lecture boredom:
   Distraction is a common scenario in traditional classrooms. An interactive session, debates, help of visual aids and the like evokes interests among students. Team teaching does exactly that.

9. Better bonding between student and teacher:
   Humans bond when they interact, it is as simple as that. The bonding is increased when teachers often ask questions and listen to what students have to say. People when heard and appreciated, will ultimately be more engaged.

10. Provokes participation / interaction:

During team-teaching, a variety of ideas are put forth by teachers. A perfectly planned lecture will provoke even the most notorious and most aloof people to be engaged. Team teaching helps teachers deal with students of all personalities well and get better engagement.

11. Imparts the lesson of team management:
    When students see the way teachers work in a team, they indirectly get the lesson of team management and the importance of working in a team. Everyone in their career will need to work in teams.

12. Develops interpersonal skills and logic of students:
    Students' interaction and logic are improved drastically as they learn to question things and learn how to communicate their ideas effectively. While in case of a debate, students learn how to respect the contradictory ideas, accept them and also voice their thoughts in return.

13. Teachers can give individual attention:
    We know that all students are different and everyone has their own learning pace. In team teaching, if one teacher is speaking the other teacher can solve the queries student raises, without disturbing the whole class.

14. Staff development:
    There is no limit to learning, provided if one wishes to, team teaching allows teachers to learn and grow themselves. Teachers also get a chance to brush up their skills, work up to their fullest potential and along with that their creativity, motivation, and team management skills get a solid boost too.

15. Long-term knowledge retention:
    Students are more engaged in a dynamic and interactive session and they learn better. Knowledge retention is much higher than the traditional learning approach.

Disadvantages:

- Acceptance of change by teachers: Let's face it, we humans dislike change, teachers may not accept the idea of team teaching, they are often rigid and want to stick to the traditional teaching techniques. The idea that they will have to put extra effort and work hard makes them reluctant. Team teaching can only be effective if teachers are willing and happy to be involved in the new form of teaching. A forced approach is bound to fail.

- Rigidity in teachers: Apart from accepting the change in the form of teaching, teachers often have the rigidity to accept and adjust with other teachers, while working in a team we have to accept others' ideas and drop ours. Teachers should not have an ego and should handle criticism openly.

- Bad team management: Internal coordination and good team tempo are extremely important, internal conflict may result in a complete failure.

- Personality conflict: People with contradicting personalities must devise a way to work together effectively. A dominating person will overpower other people, a

collaborative approach will help everyone grow and devise an effective process of team teaching.

- Inability to complete curriculum: While devising creative curriculum & engaging students in an interactive session, the curriculum may fall behind. Even though creative teaching is necessary, it is also important for completing the course syllabus. This is one of the major challenges faced during team teaching.

- Time for coordination and planning: Teachers have to take out time from their busy schedules and sit together to devise the lecture flow and activities that have to be carried out.

- Hard to keep track: The sessions at times can get super interactive and teachers will forget the link. The teachers have shared responsibility and have an individual role to play. If anyone of the teachers is absent for some reason then the whole session will be jeopardized.

- Takes time to develop: Teachers may have to involve deep research and planning out activities that will be appealing to students. Thus it takes lots of time and effort before even starting a session.

- Going overboard: While being creative and lining up too many activities, it could get way beyond the required amount. A little simulation to students' brains will bring the best in them, but if it gets too much they will find it too hard to comprehend. One needs to find the right amount.

- Resistance from students: Some students might have got used to the traditional form of teaching. They like the structure and the repetitiveness of the lectures. Some Students like the basic lecture and then they do their self-study to learn in depth about it. You could find students coming up with specific problems that they find difficult. Teaching them everything in detail and inculcating activity, debate or different methods to teach the same topic may make them feel that their time is getting wasted.

- Takes time to develop: This new teaching style is fresh to students as well as teachers. Teachers would not have perfect coordination at the first go; they will have to do many trials for reaching the most effective format. There can be an overlap of ideas among teachers or they could not impart whatever they thought of. It could also happen that they overestimated or underestimated the time required to complete the planned tasks. If one of the teachers finds it too difficult to carry out and opts out of it then the whole team will be disrupted. Teachers can also face resistance from the students. Too many ideas and discussions will make the classroom chaotic. Patience from teachers as well as students is required for a successful team-teaching.

- Affordability of team teachers by schools: Not all schools or institutions may be able to afford having team teachers in classes. It is considered a privilege to have team teachers in schools like us.

Necessary Skills Required in the Team of Teachers[13]:

- A team of teachers with various sets of skills perspective and expertise.

- Vision and sense of direction.
- Ability to coordinate internally.
- Excellent team planning.
- Friendly nature and ability to keep the environment conducive.

Tips To Make Team Teaching Effective:

- The openness of mind- Teachers and students must be open to change and must embrace this new form of learning.
- An effective strategy is necessary which requires undivided attention and time, willingness to make the learning effective. The strategy should involve coverage of course syllabus, activities and quizzes to be carried out, a flow of lecture and documenting and developing a database of the same.
- Regular meetings and follow up.
- Rotation of roles to enhance learning and reduce boredom.
- An effective way to assess students' performance.
- Respecting other's ideas.
- Training to new teachers who are new to the concept of team teaching.

Henry Ford has quoted "Coming together is a beginning, staying together is progress, and working together is success" (Henry Ford). [14]

Acknowledgments

We would like to express our gratitude to our school Mallya Aditi International School, Bangalore, India which has supported and guided us throughout the process of conducting this research and completing this essay.

We are immensely thankful to our Principal, Mr. Satish Jayarajan, for his unwavering guidance, insightful feedback, and continuous encouragement. We would like to thank the Professional Development Centre team, Mallya Aditi International School, Ms. Sateja Joshi, Ms Suravi Banerjee, and Ms. Preetha Kumar. Their expertise in helping teachers grow professionally has motivated us to jump into this research project.

We extend our appreciation to the Middle School section, Coordinator Ms. Hema Mandanna, for providing the necessary resources and facilities that enabled us to conduct this research effectively.

[13] https://education.stateuniversity.com › pages › Team
[14] http://www.picturequotes.com/henry-ford-quote-545651

Appendix
Google form questionnaire

Learning with Team teaching

Please answer the following questions in the form.

shivangi.singh@gsuite.aditi.edu.in Switch account

Not shared

* Indicates required question

Name *

Your answer

Date *

Date

dd-mm-yyyy

1) Who are your Math team teachers this year? *

Your answer

2) For how many years have you been taught Math by the above team ? *

- 1 year
- 2 years
- 3 years
- More than 3 years

3) Were you comfortable with Math being taught by a team of teachers or by a single teacher so far? *

- Team teachers
- Single teacher
- Other:

4) Depending upon your answer from the previous question, choose the reason below: *

- They provided emotional support as a team
- At least one of the team teachers would reduce my fear towards the subject.
- I felt confident to reach out to the team teachers at any time of the day.
- Atleast one of the team teachers would provide constructive feedback on our assignments/projects
- I would find it confusing to follow multiple instructions given by the team.
- Other:

5) State the topics that you find easier to understand with team teaching in Math. * (As many topics as you are comfortable with)

Your answer

6) Are you comfortable clarifying your doubts with the Math Team Teachers outside the class personally? *

- ○ Yes
- ○ No
- ○ Sometimes
- ○ Other:

7) Choose two areas where the teachers of Math team have helped you. *

- ☐ Clarifying doubts personally
- ☐ Clarifying doubts through iMessage
- ☐ Helping understand difficult concept from different teacher perspective
- ☐ More inclusion of variety of activities and assessments

8) State one branch or area where you would have found difficult without team teachers in Math. *

- ○ Arithmetic
- ○ Algebra
- ○ Geometry

9) Please share your response to the given statement "My team teachers ask each one of us whether we have understood what has been taught and help us in case we have doubts". *

- ○ Strongly agree
- ○ Agree
- ○ Disagree

10) According to you, what are the benefits of team teaching in Math? *

Your answer

11) I understand Math concepts well when there is a team of teachers because, (Choose more than one option) *

- ○ I need not clarify my doubts in front of the whole class
- ○ I get assistance to complete my catch up work in case of my absence
- ○ I understand the instructions well with a one on one communication with one of the team teachers
- ○ I can be assured that I will be offered help by one of the team teachers definitely.
- ○ Other:

12) Do the team teachers approve your work collectively or give individual feedback in Math? *

- ◯ Yes, they appreciate my hardwork collectively
- ◯ Yes, they appreciate individually

13) Do your team teachers in Math guide you collectively or individually? *

- ◯ Yes, they always guide me to set targets collectively
- ◯ They rarely guide me to set targets
- ◯ They individually guide me to set targets

14) Different teaching methods by different teachers of the team, can be a little confusing at times in Math. *

- ◯ Strongly disagree
- ◯ Disagree
- ◯ Neutral
- ◯ Agree
- ◯ Strongly agree

15) My team teachers in Math clarify my doubts across all the Math concepts regardless of the concepts being taught by them. *

- ◯ Strongly disagree
- ◯ Disagree
- ◯ Neutral
- ◯ Agree
- ◯ Strongly agree

16) Do math team teachers encourage you to participate in class? *

- ◯ Yes
- ◯ No
- ◯ Sometimes

17) Do Math team teachers appreciate you asking the doubts even on the basic concepts? *

- ◯ Yes
- ◯ No
- ◯ Sometimes
- ◯ Other: _____

18) Do Math team teachers make you feel comfortable while forming groups for a Math activity? *

- ◯ Yes
- ◯ No
- ◯ Sometimes

19) When do you feel more comfortable in a Math group activity? *

- ◯ When Math team teachers form groups
- ◯ When I am given choice to form our groups
- ◯ I am comfortable either way.
- ◯ Other:

20) One or more of Math team teachers make an effort to explain concepts in simple english or regional language. *

- ◯ Yes
- ◯ No
- ◯ Sometimes

21) Math team teachers allow me to work on our projects /assignments with extra time. *

- ◯ Yes
- ◯ No
- ◯ Sometimes

22) State two areas where the Math team teachers provided you support during online classes. *

Your answer

23) During online classes,, Math team teachers allowed us to stay off video due to connectivity issues which helped us in better attention. *

- ◯ Strongly disagree
- ◯ Disagree
- ◯ Neutral
- ◯ Agree
- ◯ Strongly agree

24) Would you like team teaching to continue in future classes also? *

Your answer

What PISA Set Aside?
The Ignored Role of Writing Skills and Reading Fluency in OECD PISA Reading Literacy Assessments

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The European Conference on Education 2023
Official Conference Proceedings

Abstract
The OECD/PISA Reading Literacy Assessments (RLA) are the most accepted but controversial large-scale measurements, which generate significant debates about their validity. The consequences drawn from the survey reports of 2000-2022 seem to be misleading in several cases, especially how they discuss/ignore writing skills and reading fluency. In my lecture, I claim that (1) the PISA RLA's conceptual background didn't make allowance for the role of writing in reading, nor the tasks and answer sheets. (2) PISA RLA took reading fluency among 15-year-old students for granted, and this was in contradiction within their own conceptual background. (3) These are significant conceptual mistakes with huge effects on the assessments' results. Thus (4) the results of the PISA RLA before 2018 should treated with reservation or be re-evaluated involving proper inclusion of writing skills and reading fluency. (5) Without this, we have strong grounds to criticise all the PISA RLA results before 2018. (6) PISA2018 did take into consideration writing skills implicitly in the evaluation process but it did not assess them explicitly. (7) Also, PISA2018 discussed reading fluency, but the opposing claim of the framework leads to an inner conceptual anomaly, and it is unclear how the survey considers fluency in the evaluation process. (8) Hence, the results of the RLA before 2018 are also questionable. In my paper I am aiming to proof my statements through specific examples from the OECD PISA RLA Assessment and Analytical Framework documents.

Keywords: OECD Pisa, Reading Assessments, Writing Skills, Reading Fluency, Literacy, Text Comprehension, Screen Reading, Digital Reading

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Introduction

This paper is willing to show some controversies and difficulties in assessing reading literacy skills. The case study of the discussion is the Reading Literacy Assessments (RLA) of the Programme for International Student Assessment (PISA) that are conducted by the Organisation for Economic Co-operation and Development (OECD) between 2000-2022 (OECD PISA, n.d., OECD, 2016b; OECD, 2016c). These most accepted but controversial large-scale measurements generate significant debates about their validity (Zhao, 2014; Zhao, 2016a; Zhao, 2016b; Zhao, 2019; Zhao, 2020); however, they are unique in their own kind. These international assessments repeated in every three years are focusing on 15-year-old students from all over the word, pursuing their Mathematics, Science and – the subject of this paper – Reading Literacy skills throughout various paper and pencil, or onscreen digital tests (OECD PISA FAQ, 2017).

Investing massive amount of money, enormous work and effort on pursuing students' reading and text comprehension skills cyclically is a reasonable and essential achievement, since we are living – from at least our first year of school until death – in a world where basic everyday information as well as high level knowledge are coded, stored, available and shared in texts. No matter whether we are talking about offline or online, handwritten, printed or digital contents, we must reach a level of proficiency in reading, comprehending and even writing to manage life, improve and prevail. Typically, those countries whose people are failed behind in literacy are also failed behind in other fields, because being literate is the key to knowledge, to self- and common improvement. (OECD PISA, n.d.) Nevertheless, these statements are trivial, reading literacy is still an issue in many countries – and not necessarily in the developing ones only (OECD PISA, n.d.). Money of course can determine the educational methods, system, and policy of a country; however, open discussion, groundbreaking innovative attitude, and cooperation between the different actors of the various fields of education are more important. Unfortunately, it seems that the OECD PISA become a 'monolith' that causes unnecessary and even harmful competition between the countries taking part in the assessment's series, and the loud media coverage after every new PISA report easily supress real scientific discussion or lead them to wrong directions (Xhiha, 2016; Zhao, 2019; Zhao, 2020; OECD and PISA…, 2014).

The findings of this paper are part of my recent ongoing research (Szabó, 2020) and publishing them aims to break out from above mentioned purposeless debate about the legitimacy of the OECD PISA RLA. Instead, the purpose is to give some conceptual aids, remarks, feedback or even criticisms concerning the high prestige RLA for future upgrading, addressing them to those educators and researchers who are (a) working on the improvement of the OECD PISA RLA; and (b) interested in the education, improvement, and assessment processes of children's reading literacy. Methodologically, I did a close critical reading meaning examining all the analytical and framework documents of OECD PISA RLA between 2000-2022 (OECD, 1999; 2003; 2006; 2009; 2013; 2016a; 2016d; 2019a; 2019b; 2019c). The aim was to compare these documents to the contemporary literature and exploring the conceptual, theoretical, and methodological deficiencies – if there are any, focusing on the involvement of writing skills and reading fluency. Based on these comparisons, I will argue along eight strongly connected hypotheses, separate them into those that focusing on (A) writing skills and (B) reading fluency. Then, (C) I will present the relevant improvements of the RLA according to the latest, available OECD PISA RLA documents. After presenting the argumentation, the paper shows the consequences of the

research findings as well as some possible ways of further research that are necessary to meet the challenges of reading literacy especially in the digital age.

Hypotheses

Reading through all the already referred analytical and framework documents of the OECD PISA RLA that has been officially published between 2000-2022, I claim the following hypotheses focusing on writing skills and reading fluency: (1) the PISA RLA's conceptual background didn't make allowance for the role of writing in reading, nor the tasks and answer sheets. (2) PISA RLA took reading fluency among 15-year-old students for granted, and this was in contradiction within their own conceptual background. (3) These are significant conceptual mistakes with huge effects on the assessments' results. Thus (4) the results of the PISA RLA before 2018 should treated with reservation or be re-evaluated involving proper inclusion of writing skills and reading fluency. (5) Without this, we have strong grounds to criticise all the PISA RLA results before 2018. (6) PISA2018 did take into consideration writing skills implicitly in the evaluation process but it did not assess them explicitly. (7) Also, PISA2018 discussed reading fluency, but the opposing claim of the framework leads to an inner conceptual anomaly, and it is unclear how the survey considers fluency in the evaluation process. (8) Hence, the results of the RLA before 2018 are also questionable.

In the following section, I will present proofs/refutations along theses hypotheses with the help and on the ground of contemporary scientific literature about reading, focusing on the role of writing skills and reading fluency in reading and in literacy assessments.

Discussion

A. The Ignored Role of Writing Skills

Reading through carefully the given analytical and framework documents of the OECD PISA RLA, it was striking how the conceptual background ignores the essential role of writing in the process of reading. However, nearly all the examined contemporary scientific literature cited in the list of References are agreed on that writing has an inevitable role in reading and text comprehension, and the two processes are so strongly connected and have almost inseparable effect on one another that they cannot be assessed wisely if we left one of them from the picture. Especially, when we analyse children's reading performance, writing should not be ignored, since it is a building brick in the improvement of literacy skills. "A child's literacy development is dependent on this interconnection between reading and writing. […] reading affects writing and writing affects reading. […] practice in writing helps children build their reading skills." (K12 Reader, 2016, para. 1). This theory has two important consequences: (1) one can assess and capture the level and improvement of children's reading literacy skills if they examine reading and writing together; (2) those children who are taught and practiced in writing for e.g., essays and short stories or in answering to open-ended questions, should have better reading literacy skills comparing to children who do not write regularly and who are trained for filling true or false and multiple choice questionnaires that require no or negligible wording and phrasing skills. This latter statement contradicts the RLA results if we take some of those accusations against PISA about how certain countries and regions gain advantage and reach higher score in the assessments by training constantly their students to filling tests. Thus, the tasks do not assess reading literacy skills but test-

filling-under-pressure-skills, which is a completely different set of skills – and presumably not the purpose of the testing.

In its assessment series, the RLA applies the method of the multiple-choice, complex multiple-choice question and open constructed response tasks (OECD PISA FAQ, 2017; OECD 2003, p. 117). Let us focus on the latest, when children need to phrase their answers individually, with their own words, in complete sentences. According to literature, "15-year-old children are in the interval of practice their writing skills, meaning that performing a well-phrased answer can be a challenge for them by default (Kellogg, 2008, p. 4). If we accept this statement, we can easily see that giving fine answers to open-constructed response tasks do not entirely depends on reading comprehension but writing skills as well. Thus, it can occur, for instance, that a student comprehends a text well but presents a poorly phrased written answer due to difficulties in writing, and therefore she will get bad scores. "Considering a topic under study and then writing about it requires deeper processing than reading alone entails" (Fordham, Wellman & Sandmann, 2002, p. 151).

Another issue here is the evaluation. According to the RLA's analytical and framework documents, in the case of open-constructed response tasks, some "[…] require considerable subjective judgement by markers, as when the reader is asked to summarise a text in his or her own words" (OECD 1999, p. 34). Since the RLA does not explain in detail how subjective the subjective judgments are, these can be critical points. Therefore, we can presume that (1) those students who are better writers gain an advantage; (2) answers, which consist of all the right keywords and formed at a high level, are worth a higher score than those responses which do the same but with a poor sentence quality; (3) two students for similar answer quality could get different points from different evaluators. No matter whether they have good literacy and writing skills or good literacy but bad writing skills: in neither case, we will know whether they have good comprehension skills or not. What we will know is a subjective judgement on their writing skills. Nevertheless, the framework documents of PISA2000-PISA2012 completely ignored the issue of writing skills and did not refer to it at all. However, the percentage of open constructed response items were 44% (PISA2000) and 43% (PISA2003; PISA2006) even in the beginning of PISA surveys.

The inadequacy is more striking in the case of electronic/digital reading material. In 2015 the whole assessment was conducted via digital platform, and the in the analytical and framework document PISA2015 stated that there "is research evidence that a computer-based testing environment can influence students' performance in reading" (OECD, 2016d, p. 58). This occurs not just because of the different methods and strategies of reading required by the platform shift and contents styles but also the surface, more precisely the medium itself that – among many other attributes and variants – makes readers to act mentally (for e.g., digital text inclusion vs. information seeking; processes of the brain reacting to digital signs and interactive visual elements; skipping and scrolling; memorizing digital information; struggling with distractions rooted in the digital nature of the content, etc.) and physically (managing the electronic device; blue screen and 'screen-tiredness'; reading poses; the physical experience of touching and holding electronic surfaces, etc.) different than in the case of print reading.

In 2018, when the digital assessment continued, PISA2018 claimed the following: "Several studies based on PISA data suggest that the response format has a significant effect on the performance of different groups." (OECD, 2016d, p. 31). This should not be a surprise, if we remember the essential role of writing in the reading performance. As in the case of paper

and pen, children must learn how to create digital content with the use of the physical or on-screen keyboard (typing and touching) and all the digital aids (for e.g., sidebars, visual guiders, icons, changeable sized textboxes, and windows, etc.) There is research evidence that brain processes are different during handwriting than in the process of typing, so as the way how we memorize information. No matter how 'digital-native' (Prensky, 2001) the examined 15-year-old age group is, to perform written content in a given electronic tool (vs. not with their own familiar pencil or pen) is an additional challenge during the assessment. However, both PISA2015 and PISA2018 assessments considered writing as an "administration mode" (OECD, 2016d, p. 58), and not as a skill, which is strongly connected to, but also not identical with, text-reading and processing skills. If children who are more skilled in digital writing perform higher quality responses than the others struggling with composing, editing, typing, etc. via digital platforms, then we get a picture about digital writing skills and not about digital reading skills – or reading skills at all. Regarding the high percentage of open constructed response formats remained in the digital assessment process as well, the role of digital writing skills should not be disregarded. Nevertheless, the RLA did not face the existing problem of children who read the actual texts but cannot solve the connected tasks because they have a lack of writing or composing skills or have difficulties in grammar both in paper-and-pencil and computer-based tests. Thus, if the aim was only to examine reading skills without writing skills, then open constructed response items should have been better to leave out of the survey.

B. The Ignored Role of Reading Fluency

The tight connection of reading and writing is one issue, but reading fluently, without major obstructions and in a considerably rapid way – thus fast enough to progress but slow enough to capture the meaning – is another essential aspect of reading. According to literature, fluency […] is in strong connection with reading comprehension; moreover, "robustly predicts performance on state reading tests across grades and states" (Penner-Wilger, 2008, p. 4). We can talk about oral and silent fluency, the previous occurs in reading aloud situations, while the latter in individual reading without no audience. Large-scale testing situations such as the OECD PISA RLA, of course, involve silent reading fluency. Silent reading fluency involves comprehension (making meaning), automaticity of word recognition (rate and accuracy), and the use of syntactic cues ("chunking" of words into larger units) (Oakley, 2003).

According to literature, "text-reading fluency skill can be considered a »proxy« for overall reading competence" (Crosson & Lesaux, 2010, p. 476); however, proficiency in reading fluency depends on the reading situation, varies according to genres (e.g., magazine articles vs. academic papers), readability of the text, reader's background knowledge, "and the priority the student gives to speed versus accuracy in the specific situation […]" (Penner-Wilger, 2008, p. 3). The specific assessment situation, when children need to read and answer questions in a limited time interval, influences students' fluency level, therefore their overall reading performance. Decoding has a reciprocal relation with comprehension; when reading in an area of expertise, comprehension can aid decoding" (Penner-Wilger, 2008, p. 3-4). In contrast, poor fluent readers must focus on decoding, word recognition, and sentence-connecting harder. Hence, they may not have the energy and cognitive effort to understand the meaning of the text. Thus, the level of reading fluency, whether we talk about print or screen reading, is not equal to the level of comprehension. Slow or non-fluent reading is not necessarily equal to poor text comprehension or futile reading, and vice versa (Walczyk & Griffith-Ross, 2007).

Despite of the various available research about the role of fluency in reading assessments, the OECD PISA RLA took reading fluency among 15-year-old students for granted. According to PISA2000-PISA2015: "it is assumed that most 15-year-olds will have acquired these [=] reading fluency)" (OECD, 1999, p. 13), but this attitude was in contradiction within their own framework until the construction of PISA2018. The latter claimed that: "[…] such as fluent reading […] are critical skills for processing complex or multiple texts for specific purposes" (OECD, 2019, p. 24), but there is no trace of considering this issue in the analytical and framework document at all. Considering the above and knowing that PISA2015 and PISA2018 were conducted entirely or partially via digital platforms, we cannot presume that the platform shift has no effects on the decoding process at all, and on reading fluency either. However, "fluency needs to be a concern for teachers at all grade levels, not just teachers of beginning readers. It makes good sense that even older students who read with a lack of sufficient fluency will have difficulty comprehending what they read" (Rasinski, Padak, McKeon, Wilfong, Friedauer & Heim, 2005, p. 27). Thus, ignoring the factor of reading fluency is the RLA's severe methodological mistake with huge effects and influence on the assessments' results and the evaluation process. PISA2018 has started to reflect on the issue of reading fluency that can be considered as an improvement; however, it is not clear how the survey took into consideration the factor of fluency in the evaluation process.

C. The Ignored Field of Reading Literacy

In April 2019, due to the unfortunate Coronavirus situation and home schooling, the OECD PISA did the following announcement in the beginning of the new assessment and framework document: "OECD member countries and Associates decided to postpone the PISA 2021 assessment to 2022 to reflect post-Covid difficulties. This draft vision was created before the crisis. The final version will reflect the new name of the cycle "PISA 2022" (OECD, 2019c, p. 1). The draft components of the PISA2022 are the followings: Creative Thinking, Financial Literacy, ICT, Mathematics and Questionnaire (OECD, 2019c). Thus, surprisingly, PISA interrupts its tradition started in 2000, and completely deleted the Reading Literacy Assessment from the assessment series – or merged it into other assessment topics. Analysing the available documents, PISA did not give any clear explanation or justification of this decision so far, which is more striking since the complete program for texting students skills started with reading literacy as a major topic in 2000. Creative Thinking and ICT seem to be the closest topics to reading literacy, but in the available analytical and framework documents do not mention or refer to literacy. The major assessment topics in 2025 will be Learning in the Digital World (OECD PISA, n.d.), but without further detailed information we cannot say whether it is going to involve at least digital reading or not. Naturally, nothing can be said about the role of writing skills and reading fluency in the assessment series conducted in 2022 or will be conducted in 2025.

Concluding Remarks and Directions of Possible Further Research

The consequences drawn from the survey reports of 2000-2022 seem to be misleading in several cases, especially how they discuss/ignore writing skills and reading fluency. In this paper, after having analyised all the available analytical and framework documents by the method of close critical reading, and comparing them to the cited contemporary literature of the field, I stated the following eight hypotheses:

(1) the PISA RLA's conceptual background didn't make allowance for the role of writing in reading, nor the tasks and answer sheets. (2) PISA RLA took reading fluency among 15-year-old students for granted, and this was in contradiction within their own conceptual background. (3) These are significant conceptual mistakes with huge effects on the assessments' results. Thus (4) the results of the PISA RLA before 2018 should treated with reservation or be re-evaluated involving proper inclusion of writing skills and reading fluency. (5) Without this, we have strong grounds to criticise all the PISA RLA results before 2018. (6) PISA2018 did take into consideration writing skills implicitly in the evaluation process but it did not assess them explicitly. (7) Also, PISA2018 discussed reading fluency, but the opposing claim of the framework leads to an inner conceptual anomaly, and it is unclear how the survey considers fluency in the evaluation process. (8) Hence, the results of the RLA before 2018 are also questionable.

Surprisingly, PISA 2022 deleted the topics of reading literacy from the assessment series without clearly phrased explanation or justification, and unfortunately, the new framework of Critical Thinking and ICT do not refer to literacy or the issues of text comprehension at all. At present, the analytical and framework documents of PISA2025 are not available yet, but after their future release they can hopefully serve a good material to discover the new approach of the OECD PISA assessments series and find out the actual stance of the institution concerning literacy. Personally, I consider the examination both print and digital reading performance inevitable in the future, and I support to continue the research and keep literacy among the major individual fields of testing. In the era of digital reading, learning, and teaching, understanding comprehension processes and gain information about digital and visual literacy, evaluating information, the new reading experience or processes of memorisation could be the key for creating useful digital contents, entertaining and teaching material for children to improve their skills and cognition in a long run.

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Digital Literacy: From Embodied to E-bodied Reading Experience

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Abstract
According to the approach of Embodied Reading (Malafouris, 2013; Mangen & Schilhab, 2012) the reading body and the reading brain get into a dynamic interaction with the pure materiality of the medium. During reading, this interaction of the Body-Brain-Medium Triad creates a complex reading experience, which "depends on direct experiences in the moment as well as in the past" (Schilhab, Balling & Kuzmičová, 2018). It could lead to reading engagement or even to Flow (Csíkszentmihályi, 2022). What are the consequences concerning the reading experience if we change one component or feature of the Triad, as we have been doing for a while in the case of the medium? Presumably, changing the reading platform from hardcopies to screens requires different physical interactions with the medium and, consequently, with the brain. Could this change result in the same Multisensory Experience (Sanchez, Dingler, Gu & Kunze, 2016), the same Embodied Reading, engagement, or Flow as in the case of traditional reading, and must it result in them at all? Some researchers warn of "the danger of superficiality and shallowness" (Nyíri, 2022, p.1) of screen reading that goes against a complex reading experience. Others suggest going further in screen reading and creating the digital embodied reading experience with the genre of video essays (Sabatino & Pisapia, 2022). In my paper, I take a stand in this debate and show how critical it is to understand the effect of the medium and the E-bodied Reading Experience in the future of reading.

Keywords: Embodied Reading, Body-Brain-Medium Triad, Reading Experience, Multisensory Reading Experience, Reading Engagement, Digital Literacy, Screen Reading

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Introduction

In this paper, based on the relevant literature listed in the References, I will (1) describe the notions of three different types of experience: reading; articulated and multisensory experience. Then I will (2) present the concept of Embodied Reading, which is not a new approach; however, because of the emerging trend of digital reading, should gain attention again. Following this track of thoughts, I will (3) explain the Body-Brain-Medium Triad along with the consequences of changing the Medium, that (4) cause an essential change in the reading experience, and that which I call the "E-bodied" Reading Experience. Then (5), based on the previous, I will also give some thoughts to the Reading Debate and present my stance. Finally, I give some concluding remarks and opportunities for further discussion.

The significance of the topics is striking if we consider the trends of the reading industry, particularly those technical improvements and connected research that try to capture, find, reserve, or transform traditional reading experience into screen and digital devices (Yulbarsovna1 & Topvoldievna, 2021). In the era of emerging digital contents – reading, learning, and studying material – engaging children and adults to read and give them not just information but experience is a tough one. Especially, if the already massive amount of screentime people spend with their devices – and which is beyond dispute unhealthy – seems to contradict the wish for stronger digital engagement. Thus, what I argue for is not about increasing screentime but improving quality reading with the tools are available to go beyond simple information seeking, skipping, and scrolling, and find joy again in reading both on print and digital platforms.

1. Types of Reading Experience

A reading experience can be understood as a process that is consciously influenced by its cultural, psychological, and historical contexts. Reading experience can mean "[…] being absorbed in a good story, when we forget about time and place, forget to eat or even to go to bed. A good read is when we learn about the world, learn about the human mind, and learn about ourselves. It is pleasure and entertainment, excitement and having a good time, but it is also self-realization and mind expansion" (Balling, 2016, p. 37). In other words, as they phrased in the framework of the RED Project: "a 'reading experience' means a recorded engagement with a written or printed text – beyond the mere fact of possession" (RED Project, para. 1).

Since reading happens in our head – no matter whether we are talking about silent reading or reading aloud – the reading experience is both physical and mental phenomenon that is difficult to verbalize or articulate. (Balling, 2009; Berntsen & Larsen, 1993). Even readers with a high degree of reflexivity express difficulties with putting their reading experiences into words (Balling, 2009). Some researchers, based on their examination, tried to capture the essence of good reading experience which allows reader to:

- Gain knowledge about the world and oneself.
- Experience recognition and identification with the characters.
- Become emotionally involved.
- Forget time and place.
- Enjoy a book that is well written.
- Activate the reader's imagination (Balling, 2009; Toyne & Usherwood, 2001; Ross, McKechnie & Rothbauer, 2006).

One can see from the above list, that we are discussing some hidden and very subjective phenomena here, where getting information (i.e., learning something new), stepping out of reality (i.e., activate imaginary mind games), feeling familiar and unfamiliar emotions (thus practicing empathy), and receive some kind of value (i.e., quality content) are highly important.

2. The Embodied Reading Experience

Reading is also physical in the sense that it involves the whole body, not just the mind, and this is what the concept of Embodied Reading Experience refers to. "Reading fiction is a silent activity, where readers come to know imaginary worlds and characters from the book's pages. However, we perceive the natural world with more than our eyes, and literature should be no different. Thus, an embodied reading experience is proposed, adding sound effects and haptic feedback to allow readers to listen and feel the narrative text" (Sanchez, Dingler, Gu & Kunze, 2016, p. 1). Here, in other words, we are discussing a kind of multisensory reading experience in which aspects beyond the brain – such as smell, touch, sense, hear, see, body posture and moves – play a significant role in the cognitive processing.

3. The Body-Brain-Medium Triad

During process of reading, the reading body and the reading brain get into a dynamic interaction with the pure materiality of the medium (the book, the paper, and, eventually, the text itself). Concerning the body, readers choose various postures to read: hold the book or the reading device in their hands; lay it on the table or lean it on to a pillow; sitting, standing or laying on something; holding the text close to the eyes; flipping the pages with one hand or scrolling up and down the page by one finger, etc. Finding the right posture that is comfortable for the reader as much as they can nearly forget about the physicality of the situation influences the reading process and quality, therefore on the reading experience as well.

The brain has also an essential part and hard work in the reading process. When we read, the left occipito-temporal cortex of our brain instantly associates each written word with its spoken equivalent. One part of our brain analyses the meaning of a word, while another part allows it to recognize words automatically. (Eden, n. d.) Interestingly, the brain does not differentiate much between reading about an experience and practicing or witnessing it in real life. In both cases, the same nerve regions are stimulated. Rich detail, fictional metaphors, accurate descriptions of people and their actions: rich picture that approximates reality. As Keith Oatley (professor of cognitive psychology, University of Toronto, Canada) phrased: "when literature affects the brain, it works like simulation programs run by computers" (The Scientific World, 2021, para. 28). Thus, in reading, you can physically change the structure of your brain, and even trick your brain into thinking you have experienced what you have only read in novels.

The third element of the Triad is the medium, that can be nearly everything that can contain readable content. Handwritten messages, paper and pencil or pen texts, printed newspapers and books or digital files, e-books, online newspapers, e-mails, digital textbooks, etc. Even a billboard can fulfil the role of medium if it has something to do read. At first is seems, that the medium is just the carrier or container of the information; however, since Marshall McLuhan's (1964) well-known phrase: "The medium is the message," the power and effect of the medium on the other two elements of the Triad is kind of trivial. The brain must

cooperate with the actual medium according to different strategies, while the body also must arrange itself into the most efficient and comfortable posture and make moves that the medium requires in order to progress in the text.

4. Changin the Medium – Changing the Game?

Now, what are the consequences for the reading experience if we change one component or feature of the Triad, as we have been doing it for a while in the case of the medium? During the history of reading, many medium changes happened; however, by shifting from hardcopies to screens and the emergence of the New Medium the whole process of reading has been changed. Interestingly, according to research, our brain adapts to reading e-books in seven days, "[…] while our biology (brain, perceptional apparatus etc.) is not *per se* well-suited, let alone designed, for reading, our reading materials (and, one should add, reading practices) have developed and adapted to our biology – i.e., the cultural evolution of reading has been constrained by the architecture of our cortical areas […]" (Benne, 2021, p. 101-357).

Nevertheless, digital texts, such as E-books lack spatial navigability: distractions, eye strain, inadequate navigation features, a lack of overview, and insufficient annotation and highlighting functionality. For these reasons – or for others – the National Endowment for the Arts (NEA) study claimed that reading digital contents or learning online are "not reading," but "activities that distract one from reading" (Coyle, 2008, p. 3-4). Furthermore, they claimed that digitalism will give us new experience, "which is not exactly »reading«" (Badulescu, 2016, p. 148; Szabó, 2019; Szabó, 2020).

5. The E-bodied Reading Experience

Now what is this "new experience," which can even question the quality of the process itself and stretches the boundaries of the well-known concept of reading? The tap, the hyperlink, the zoom through the pinch, the lightness and portability of the object, the practicality in pinning, highlighting, referring to something else with external links constitute a new reading experience, between euphoria and distraction. (Sabatino & Pisapia, 2022) This great interactivity between reader and text is changing the texts to the point of leading them to be other than themselves, to be increasingly complex, annexing within them images, audiovisuals and interactive sections. I call this almost intangible phenomenon "E-bodied" Reading Experience, referring to the medium (e.g., e-book), to the quality of the content to be read (e.g., digital text), the new strategies that the brain must adapt in order to cooperate with the content (e.g., decode, comprehend, memorise), and the body which must learn how to manage the medium, and should places itself into postures that are comfortable and effective enough to read.

6. The Missing Experience?

While I consider digital reading real reading and discuss the e-bodied reading experience, debates about the nature, quality, attributes, and legitimacy of digital reading are still going on.

Some researchers warn of "the danger of superficiality and shallowness" (Nyíri, 2022, p. 1). Others say that e-books do not provide external indicators to memory in the way that printed books do (Morineau, Blanche, Tobin & Gueguen, 2005), therefore print reading and paper as

a medium is much better than screen reading. Some results of reading assessments and other researchers also express cautions concerning the quality of reading literacy and text comprehension, stating that "the more we read online, the more likely we were to move quickly, without stopping to ponder any one thought" (Konnikova, 2014, para. 3) and "good reading in print doesn't necessarily translate to good reading on-screen" (Konnikova, 2014, para. 8).

There are concerns about the reading experience as well and considerations that advocates to return to the paper as soon as possible, while others motivate to going further in screen reading. "Do we care about how children and teenagers enjoy reading, or are we more interested in them meeting our ideal of what a reader is […]?" (Gatward, 2017, paras. 4-5) A highly new concept, for instance, is the format of video essays, which is highly engaging, it mixes verbal and audiovisual language, virtually very interactive, and it seems to be a possible direction in which to think about reading and learning in the screen age we are living (Sabatino & Pisapia, 2022).

According to my point of view, we should not want the impossible. We cannot reach the same reading experience of traditional reading in a completely different technological guise and with different methods. It cannot be the same, because the brain and the body do things differently and the nature of the text is also different. In fact, we don't want the same thing: we want to surpass it. The extended reading, of course, rises questions, such as the limitations of the extension. Will digital reading cross the line as far as we cannot call it reading anymore, but VR reality or simulation? Is the story really the essence, the experience, and not the technological exploitation? I claim that it depends on the genre, what is needed. But if we get used to overwhelming digital experience in entertainment literature, then the obligatory reading for information will not be enough.

Thus:

1. We must decide when we want an experience. Do we want an experience at all?
2. The medium must be adapted to the genre, and not the genre to the medium.
3. The answer to the question of how to engage the reader with digital content should not be the device but the quality; it should be as analogue as possible.

Concluding Remarks and Directions of Possible Further Research

In this paper, I (1) described the notions of three different types of experience: reading; articulated and multisensory experience. Then I (2) presented the concept of Embodied Reading, and (3) explained the Body-Brain-Medium Triad along with the consequences of changing the Medium, that (4) cause an essential change in the reading experience, and that which I call the "E-bodied" Reading Experience. Then (5), based on the previous, I also gave some thoughts to the Reading Debate and presented my stance. As a conclusion, I claim that at present, in the tenors of making screen reading effective, comfortable, and very practical, the biggest challenge is to accomplish and bring back the missing experience of classic reading, namely: engagement, emotion, inner motivation, complex mental, physical, and sensual experience that makes print reading specific. To achieve this, further research on digital reading and text comprehension, visual literacy, reading experience, user satisfaction of reading devices and designing digital reading materials are required.

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Exploring the Use of Technology to Enhance Parental Involvement in Children's Education: A Qualitative Study in Selected Rural Schools in Limpopo Province

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Abstract
Parental involvement is a crucial factor in enhancing children's academic achievement and success. However, in rural areas parental involvement in children's education is often limited due to challenges, such as the lack of resources, and inadequate communication channels between parents and schools. The study responded to the question of: How do teachers and educators perceive the role of technology in enhancing parental involvement in children's education? This qualitative study aims to identify and evaluate technology-based tools and applications that can facilitate parental involvement in their children's education in selected rural schools in Limpopo Province. The study used multiple case study design, and data was collected using a semi-structured interview guide with parents, teachers, and school principals who were purposively selected from the four schools. The data was analyzed using thematic analysis that yielded two key themes of resources and communication that related to the use of technology in enhancing parental involvement. The study recommended for the collaboration of schools' stakeholders and policy makers to ensure equitable access to technology in all schools, provide training and support for parents and teachers, and foster partnerships with community organizations. By harnessing the power of technology, rural schools can strengthen the teacher parent relationship, promote educational equity, and contribute to improved performance for their children.

Keywords: Parental Involvement, Technology, Children's Education, Rural Schools, Communication

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Introduction

The constitution and the South African School Act of 1996, state that parents can make a substantial contribution to their children's education (Republic of South Africa, 1996). Therefore, the use of technology to enhance parental involvement in children's education is a promising approach, particularly in rural areas where traditional modes of communication and participation may be limited. The South African Schools Act (1996) including other policy documents recommends that the learners in South African schools should have access to the same quality of learning and teaching, similar amenities, and equal educational chances (Maphalala & Khumalo, 2023). Furthermore, government has pledged to intervene by providing technology among other strategies to allow the satisfactory delivery of services and resources to improve rural education (Maphalala & Khumalo, 2023). Technology in rural schools refers to the integration of digital tools and resources in educational settings that are in rural areas (Maja, 2023). This includes the use of computers, tablets, software applications, online platforms, and other digital technologies to enhance teaching and learning processes. Maja (2023) further suggest that the use of technology can improve teachers' method of teaching and the way children learn. While recent research established that low technology channels can easily be used by learners in the provision of education content in a meaningful way (Dlamini, Daltry, Jordan, Hills, & Evans, 2022).

However, the use of technology is not without challenges. According to Aruleba and Jere (2022) the socio-economic background of communities around rural based schools in South Africa is predominantly characterized by poverty, unemployment, and low educational attainment. Other studies highlight that many parents have not completed their own education, which could impact their ability to provide academic support using technology to their children (Letswalo, 2023; Aruleba & Jere, 2022, Mthethwa & Kutame, 2023) particularly in rural schools. The authors found that the lack of access to technology and limited digital literacy skills among parents are significant barriers, including inadequate infrastructure and limited funding for technology initiatives in rural schools (Mthethwa & Kutame, 2023). However, Themane and Thobejane (2018) established that teachers' resilience when resources are inadequate could overcome some of the barriers that are experienced in schools. This means that technology could possibly be used to facilitate communication between parents and teachers where teachers could use emails or messaging apps such as WhatsApp, Twitter, and others to communicate with parents about their children's progress, answer questions, and provide feedback (Dlamini et al., 2022). Technology use could enable parents to have a more direct and ongoing dialogue with teachers, which could lead to more productive partnerships and better outcomes for students (Maja, 2023).

The study responded to the question of: How do teachers and educators in selected rural schools in Limpopo Province perceive the role of technology in enhancing parental involvement in children's education? Based on the above, this study is important as it might contributes to the design and implementation of innovative programmes that could leverage technology to overcome barriers to communication and parental support. Again, harnessing technology in schools could create more inclusive and collaborative learning that benefits both students and parents in rural schools in the Limpopo Province, South Africa. The following sections will discuss technology in enhancing children's education, theoretical framework, methodology, findings, discussions, and the concluding remarks.

Technology in Enhancing Children's Education

The use of technology to enhance parental involvement in children's education in rural schools has substantial possibility. This is supported by a study that was conducted in Zimbabwe, which exposed the need to ensure that rural institutions have access to technologies that ensure productivity and develop collaborative encounter with students (Maphosa & Dube, 2020). Moreover, Maja (2023) stipulates that technology can enhance parental involvement in children's education, particularly in rural schools. Maja (2023) argued that technology provides parents with a better understanding of their child's academic progress and increases their engagement with the school community. Furthermore, technology can enable parents to communicate more effectively with teachers, receive timely updates on school events, and access learning resources that can support their children's learning (Dlamini et al., 2022). In addition, technology can facilitate communication between parents and teachers, enabling them to collaborate more effectively and share information about their children's academic and social progress (Dlamini et al, 2022). Technology was used in the advent of Covid-19 pandemic where schools opted for online and blended learning by using various smart and mobile technologies to continue with teaching and learning. In that way parents were able to monitor their children's academic performance (Ogbonnaya, Awoniyi, & Matabane, 2020).

Although several studies have shown the possible benefits of using technology in schools, there are challenges that are worth noting. According to Maja (2023), one of the major challenges facing the use of technology in rural schools is the lack of resources. This includes inadequate infrastructure, insufficient funding, and limited access to technological devices such as computers and the internet (Ogunshola, 2015). These challenges could result in a lack of parental involvement in their children's education, which could negatively impact student achievement. Researchers have suggested the need for increased government funding and support for rural schools (Maja, 2023; Maphalala & Khumalo, 2023). Moreover, Letswalo (2023) recommend the provision of ongoing professional development opportunities for teachers to improve their technological skills and increase their confidence in using technology in the classroom. Improving communication between teachers and parents through regular meetings and the use of technology can help to overcome some of the barriers to parental involvement in children's education (Maphosa & Dube, 2020) as well as improving the perceived usefulness.

Technology Acceptance Model (TAM)

The study adopted the use of Technology Acceptance Model (TAM) that was introduced by Davis in 1989. The TAM by Davis (1989) suggests that individuals' attitudes and perceptions towards technology play a crucial role in determining their willingness to use it. TAM is a model that predicts and explains the acceptance of technology by users, in this case by parents and teachers alike. TAM is based on two key factors: perceived usefulness (PU) and perceived ease of use (PEOU) (Davis, 1989). Perceived usefulness refers to the intensity to which an individual believes that technology will enhance their performance or productivity. While perceived ease of use refers to the point to which an individual believes that using technology will be easy and effortless (Davis, 1989). TAM can enhance parental involvement in their children's education by increasing their perception of its usefulness and ease of use. For example, the use of educational technology such as online learning platforms, parent-teacher communication applications, and virtual parent-teacher conferences can help parents and teachers to stay connected while improving the children's education (Dlamini et al,

2022). These technologies can also make it easier for parents to communicate with teachers, access academic resources, and monitor their children's progress (Dlamini et al, 2022).

According to Lwoga and Chigona (2019), barriers that can prevent the successful implementation of TAM in enhancing parental involvement in their children's education in rural schools include the lack of access to technology. Many parents in the rural areas do not have access to computers or the internet, which makes it difficult for them to use technology to get involved in their children's education (Ogbonnaya, Awoniyi & Matabane, 2020). Another barrier is the lack of technology skills and knowledge among parents, which can hinder their ability to effectively use technology to support their children's learning (Letswalo, 2023). The latter author identified issues of limited comprehension by teachers towards parental involvement, while parents lack the confidence, time, and adequate skills to use technology to support their children's education (Letswalo, 2023). Letswalo further indicates that attitudes can also be a barrier to the adoption of technology for parental involvement in rural areas, as some parents may believe that it is the sole responsibility of teachers to educate their children, and therefore may not see the need to get involved in their children's education using technology. To overcome these barriers, Maphalala and Khumalo (2023) recommended that education policymakers and school administrators should provide training and support to parents to improve their technology skills and knowledge. Nevertheless, TAM can be strengthened by Epstein's (1995) model of school-parent-community partnerships with its six types of involvement: parenting, communicating, volunteering, learning at home, decision-making, and collaborating with the community (Epstein, 1995). Although in rural areas, parental involvement could be affected by geographical and socio-economic factors.

Methodology

This study was conducted in a rural area of Limpopo, South Africa with rural schools that are located within and around the surrounding community's poverty (Maja, 2023). Some of the classes in these rural schools are congested while others meet the South African primary school-teacher ratio (Department of Basic Education, 2016). This study used an interpretative paradigm and qualitative research approach. The use of qualitative nature was to explore the experiences, meanings, beliefs, views, and perspectives that participants assign to a social phenomenon (Nieuwenhuis, 2020). Purposive sampling was used to select four rural schools to participate in a multiple case study design that was found to be helpful because persons and locations are selected for holding information and features in which the researcher is interested (Creswell, 2014). McMillian and Schumacher (2014) regard the primary purpose of the research design as to specify the plan to draw conclusions from empirical evidence. The participants comprised of four principals, nine teachers and six parents who were sample as key informants of the study from the four primary schools, making a total of nineteen.

All the participants were interviewed individually using a semi-structured interview guide (Greeff, 2017) at their respective schools. According to Greeff (2017), semi-structured interviews are defined as interviews organised around an area of a particular interest, while still allowing considerable flexibility in scope and depth. The inclusion criteria were to select teachers who have had more than ten years' teaching experience in those schools and parents who were currently serving in the school governing bodies (SGB) in all the four rural schools. The believe was that the teachers were familiar with issues concerning the parents of children and therefore, could better respond to the questions as key informants who are knowledgeable about the school and its environment. The author has access to the designated

primary schools as part of the community engagement project; therefore, data were collected through in-depth face-to-face interviews during the baseline and intervention support phases. English Language was used to gather data from the individual interviews that lasted for about forty to sixty minutes with each participant. Thematic analysis following Braun and Clarke (2006) style to analyse qualitative data was embarked, whereby data was transcribed, coded, and categorized to identify themes to answer the research questions. Some of the field questions that were asked are:

1. Which technologies does the school allows for children to use during learning? (Follow-up: Which social media page does the school use?).
2. How do teachers communicate about the learners' needs to their parents? (Follow-up: how is the communication facilitated? Do you use technology to communicate? How do parents inquire about the progress of their child?).

To protect the participants, pseudonyms were used to anonymise all the participants, also by adhering to the ethics per the ethical clearance that was granted by the University of South Africa (Ethics certificate no: 2016/09/14/90171969). The participants were informed about the purpose of the study and that they were free to withdraw from participating at any time without consequences. In return the participants granted and signed the informed consent forms.

Findings

The data yielded the themes of 1) Resources and 2) Communication. The responses from all the participants were presented using the selected direct quotations to support the identified themes.

Resources

Teachers were asked about technological resources that are used in the school by both teachers and children for teaching and learning such as smartphones or any mobile devices. The responses received indicated that children were not allowed, and that it was against the school policy. Shiella from School C said:

> I know technology is very important at school, but we say no because it's not easy to manage these kids with technology; just look at one child at home, when you try to send them somewhere when they are having the phone in their hand, they can't even hear you. So, it's the same with these kids when they bring the phones into the school. They google these irrelevant things other than education. And then during breaks, you will always solve issues… So, it's not, it's not something that we can promote. (Shiella, teacher, School C)

The same was confirmed by Vuma, a parent on the same school who said, "*No, the school policy does not allow phones*." He further indicated that "*Some children do not use these phones for education purposes. They watch TikTok and videos. While some may use them honestly*."

On the same issue Thando corresponded:

> Unless if we have our tablets, where we put them at school, for children to use, then after that we collect them to a safe place, but with them [children] bringing their

> phones, you don't know what's inside the phone. We try to avoid reports that so and so is saving a phone with video… what can you say? to who? Even on weekends, because there's no one at home, there's not even an elder person. So that's why it's a total No, at school. (Thando, teacher, School D)

Resources could be challenging for the socio-economically disadvantaged children as Lilly pointed out that:

> And this [use of technology] will make one learner to feel excluded, not having the phone and going back home it means they will have problems as they [parents] will again come here to say principal you want these kids to have phones, where do you think we can get money to buy phones? Because the school is not providing data for learners, so, that can be a problem for us. (Lilly, teacher, School A)

Teachers reported that children do not use technological resources such as mobile devices for learning at school because it is against the school policy. A follow-up question was asked as to why the children were not made to become part of the bigger community that is using technologies, because during the covid-19 pandemic, life continued because of resources such as technology. The principal of school A responded by saying "*And it's true, you know, you just open my eyes, you know, I'm studying ICT with Wits. Now, they're also encouraging us this thing*." On the same issue, School B principal said:

> I think we need to talk about it in our principals' meeting, [and] in the parents meeting, just to encourage parents, sometimes we are the ones who are encouraging them [parents] not to buy these smartphones for the kids, they don't buy them because they're taking all their minds, they're not learning. (School B Principal)

The use of technology resources is perceived negatively by teachers in the selected rural schools. This means that even the parents are discouraged to buy the smartphones for their children simply because teachers believe that if children can be provided with technology, they can be distracted not to do their work. Teacher Thando from School D indicated that if they had tablets, they would allow children to use them. On the same issue, Thelma from School C said:

> Yeah, I think we need to address this. And we need to allow these kids because we can even control them. Let's say the Grade 7 can bring their phones in the morning and put them on my table. When it's time for Natural Science then the teacher can come and take the phones and tell them that to go to WWW dot one two three … check this after that you take the phone with you. After school they can just collect them. (Thelma, teacher, School C)

The benefit of using technology was supported by a parent when saying:

> Technology is important for our children. Usually when they come back from school, they request us to buy data for them. So, if they do not have such it becomes difficult for him or her to search for information and do their homework. But it can help our children too much. (Themba, parent, School A)

Tim from School B said, "*We don't use technology in this school, more so, the policy does not allow that.*" On another note, Simon from School D stated:

> We do have tablets for the school, well sometimes us teachers are using those tools for teaching and learning. And sometimes we give [tablets] to those Grade 7s in subjects like NS [Natural Science] but sometimes when you are out of class, they [children] will be googling something else. (Simon, teacher, School D)

Some parents supported the use of technology, although they reported the awareness of what the policy entail. Steven said:

> The policy does not allow children to bring their phones to school but there are days where teachers make special arrangements with learners for them to bring along their gadgets so that they could perform a particular task. (Steven, parent, School D)

It can be noted that some schools have tablets that are used on arrangement by some teachers with children in some of these schools. While some teachers and parents thought that if technology could be allowed, children could search for relevant information to enhance their learning. It is interesting to note that the schools' policies do not allow children to use technology resources, which is a challenge for these schools. This had serious implications for education as well as the impact on the future lives of the children particularly in this digital age. The lack of resources therefore, affected communication.

Communication

When responding to the question of whether the school has a social media page where they communicate with parents about their children's needs or to make any announcements, Selby, a teacher from School B responded by saying, "*No, we call a meeting. If the child has psychological needs, we call sisterly departments such as the social workers to come and address the issue.*" Another teacher, Tim in the same school indicated that "*We call them [parents] when we have functions like the end-of-year events to thank them*." Tim further indicated that "*I have so many videos for awards giving. I have all the evidence of what we are doing that I can share with the community*." The same sentiments were shared by Vuyo, a parent from school B who said, "*The secretary does phone us whenever there is a meeting*." A follow up question was asked as to how the schools facilitate communication between teachers and parents.

Teacher Lilly from school A said "*It is difficult because most of them[parents] do not have phones. We write letters to the parents via children. We tried to use WhatsApp group but only 10 learners have it*." In another response teacher Taylor from the same school A elaborated that "*Yeah, those with WhatsApp are in Gauteng, so grannies are the ones taking care of the kids. We do have the WhatsApp group for the school but only for less than 15 people*." Similarly, Peter from School B indicated that many parents were illiterate especially the grandmothers who were looking after the children. Further, he stated that some parents were not on WhatsApp because they usually indicate problems with their phones. In his words, "*Their phones are not working… It's like the parents keep changing the SIM cards… while some are unable to read especially the illiterate grannies at home, they are not able to read from WhatsApp*." This was mentioned by another parent, Zihle from School A when saying, *"I stay alone with a child, and I am not able to read and write, therefore, I cannot help my child with homework."*

Most children were reported to be raised by their grandparents. Some of these grannies were described to be illiterate and therefore could not read if messages were communicated

through WhatsApp. This implies that technology is a big challenge to the grandparents, which could also affect their involvement in assisting children with schoolwork. On the question of how teachers get the parents to visit the school and to make follow ups on progress of their children's work, the responses varied. A principal in School C reiterated that:

> They [teachers] give them time depending on the timetables, whether the teacher is free or not. And if the teacher is still in class the parents have to wait for the teacher. So that's why we encourage parents to talk to the teacher first before visiting. They [parents] must make an appointment before they come to check on the progress of the learner. (School C Principal)

Parents reported that they make follow ups with teachers on account that they are challenged by the content:

> My challenge is I don't get examples or guidance on how to help him, especially that what I learned during my school days differs from what is learned today. To address that I make a follow-up by going to ask the teacher if what my child has written is correct. (Mabel, parent, School B)

On the same issue:

> I do help him where I can, but there are questions which I am not able to assist with because today's curriculum differs from what we learnt. I call those siblings who can help him with his homework. Then later I do the follow up with the teacher. (Thomas, parent, School A)

Parents stated that they randomly walk to the school to make follow ups on their children's progress with the teachers, even though they must wait for the free time. Another response from School D showed that parents are given the reports when the term comes to an end:

> We give them reports each term. Again, when we want to communicate with these parents, there's a responsible person who will give us all the details and we use those contact numbers to give them feedback. And sometimes by calling them from the office like if the learner is not performing well for the continual assessment, then we'll call them individually to the school. (School D Principal)

Parents confirmed what the principal reported. For instance, Brian from school A said, "*I do come to check my child's performance and the teacher show me*."

> Where we experience challenges, we come to school to report. And teachers do call us when they experience challenges with our children. But the burning issue is the ability to read and write. (Thembinkosi, parent, School C)

> We go to the principal who directs us to the teachers. In most cases teachers know about our children's problems that we bring. For instance, I have a child who is in Grade 5 and is not able to read and write. I talked to the teacher, and we agreed that my child will attend extra classes in another school and that helped him a lot. (Purple, parent, School D)

The principals in these rural schools reported that parents would sometimes walk to schools to make follow ups about their children's progress, which was confirmed by several parents. The active role played by parents signify their interest in their children's education, which technology could be harnessed to foster a sense of community among parents and teachers, allowing them to collaborate, share insights, and learn from each other's experiences. This could be easy as the reports by principals showed that they have records of parents' contact numbers. However, if teachers cannot be persistent about the use of technology in schools, it could be difficult for them to encourage parents of children to use it, for whatever reasons including communication.

Discussion

The study was conducted to explore the use of technology to enhance parental involvement in children's education in the selected rural schools in Limpopo Province, South Africa. It was found that resources are a challenge in these rural schools, which confirms recent research (Letswalo, 2023; Mthethwa & Kutame, 2023). This finding is like what Aruleba and Jere (2022) established about the limited access to resources, which is challenging for rural areas and schools in South Africa. Similarly, this finding is concurring with Themane and Thobejane (2019) and Maja (2023) who stated that the use of technology to involve parents can be a challenge in rural schools. The findings revealed that these schools' policies do not allow children to use technology (smartphones and other mobile devices) at the school premises. This was a unique finding particularly in this digital age where technology is advancing in almost all spheres of life, including its use in education, especially after the recent scourge of covid-19 pandemic (Ogbonnaya, Awoniyi, & Matabane, 2020). Interestingly, the plans by government to provide technology as a strategy to enhance the schools' performance, in addressing challenges faced in rural education is not realized by some schools in the rural areas of Limpopo Province (Maphalala & Khumalo, 2023).

The use of technology to assist children by parents seemed to be a far-fetched issue as teachers in this study revealed that they were discouraging parents from buying the mobile devices for their children. This suggested that teachers do not support the use of technology by children, which could imply that parents may not be keen to use technology in assisting children with schoolwork at home. The challenges highlighted point to the need for targeted interventions and support (Maphalala & Khumalo, 2023) for all: teachers and parents in the rural areas to bridge the digital divide and enable technology-based parental involvement in children's education. This is because some teachers do not use technology to teach and might perceive it as an obstacle that disturbs children from learning rather than it being an assistive resource as indicated in TAM (Davis, 1989). There may be several reasons to this limited use of technology by teachers, including their attitudes and little understanding (Letswalo, 2023). Besides their compliance with their school policies that do not allow the use of technology by children in the school environment, teachers may lack the digital skills and professional development in the use of technology. The lack of technology skills by teachers confirms what Aruleba and Jere (2022), Mthethwa and Kutame (2023) and Letswalo (2023) revealed which stipulated that without proper training, teachers may not be able to effectively integrate technology into their lesson plans, resulting into limited impact on children's learning outcomes. This implies that teachers could not challenge the school policy due to how they might perceive technology, which tallies with TAM with its aspect of how people may perceive the usefulness of technology including its easy to use (Davis, 1989). However, studies have indicated that teachers can survive the challenges even when resources are

scarce (Themane & Thobejane, 2019), which is different from what was found in the rural schools of Limpopo Province.

Furthermore, the findings illustrated that communication by these rural schools is relying on traditional ways of writing letters to parents through their children when they call parents meetings. This finding refutes recent research that encouraged the use of technology for effective communication by teachers and parents (Dlamini et al., 2022). It was revealed that many children stay with their grandparents, who were described as illiterate and therefore, making it difficult to communicate with them using the communication applications such as WhatsApp. Additionally, teachers reported that most of the grandparents either do not have cellphones or keep changing their contact numbers. This finding confirms issues raised by Aruleba and Jere (2022), Mthethwa and Kutame (2023) and Letswalo (2023) regarding the poor socio- economic background of some rural schools and their surrounding communities. The findings reflected that parents walk to schools to make follow-ups on their children's progress with teachers due to the inadequate use of technology, which could save them time and distance. This finding refutes what Maphosa and Dube (2020) indicate, that technology can foster frequent meetings and smooth communication by teachers and parents to ensure for the children's improved performance in schools.

Conclusion

In conclusion, recent research has sheds light on the significant role that technology can play in enhancing parental involvement in children's education, particularly in rural schools. However, the selected rural schools in Limpopo Province have acknowledged the challenges that may arise with the integration of technology, in terms of resources and communication. Limited access to reliable internet connectivity, technological illiteracy among parents and teachers, and the unavailability of gadgets to use are some widespread obstacles.

Therefore, the recommendation is that policymakers, educators, and school stakeholders could collaborate and address these challenges by ensuring equitable access to technology, providing training and support for parents and teachers, and fostering partnerships with community organizations. This study emphasizes the immense potential of technology in enhancing parental involvement in children's education, particularly in rural schools. By harnessing the power of technology, rural schools can strengthen the teacher- parent-school relationship, promote educational equity, and contribute to improved performance for children.

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A Design-Led Approach to STEM Education: Challenges and Opportunities in Hong Kong Secondary School Teachers' Responses to D-STEM

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Abstract
Science, Technology, Engineering, and Mathematics (STEM) education is now recognised as a key factor in the development of a country's workforce and economy. In Hong Kong, the design-led approach to STEM (D-STEM) facilitates the integration of creativity and technology and thereby encourages students to adopt collaborative and reflective processes and helps them develop the interdisciplinary skills necessary to solve real-world challenges. In fact, there are several difficulties facing by the secondary school teacher's in promoting D-STEM during execution in which there was limited research focusing on this issue in the past. Therefore, this paper aims to examine the challenges of the secondary school teachers in teaching and learning D-STEM and to investigate potentials opportunities accordingly via the use of a design-led approach as a solution in tackling problems. A mixed-methods approach was adopted for the study in both quantitative and qualitative measure in data collection. The findings showed that this intervention addressed the teachers' deep concerns about the management of STEM teaching and learning in schools by providing guidelines during the implementation of D-STEM classes, content based on advanced technology and materials, and a teaching toolkit with materials and activities. The participating teachers expressed a high degree of satisfaction with the programme and they believed that the interdisciplinary approach of D-STEM would provide opportunities for students to learn from each other's strengths. The findings reported here and those of the whole research will advance D-STEM education and serve as a guide for developing and implementing D-STEM curricula in Hong Kong.

Keywords: Design-Led STEM, Secondary Schools, Hong Kong, Teaching and Learning

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Introduction

Science, Technology, Engineering, and Mathematics (STEM) education takes a multidisciplinary approach to school-based learning in which students find solutions to specified problems in authentic situations (Holmlund, Lesseig, & Slavit, 2018). D-STEM uses design as the media for problem-solving in STEM education to promote authenticity and student engagement in which creative and scientific disciplines naturally intersect (Trevallion, 2020; Henriksen et al., 2019). According to Toomey and Kapsali (2014), there are four principles of D-STEM practice: (a) design using advanced fabrication, (b) designing advanced material systems, (c) designing with advanced materials, and (d) designing products with advanced functionalities.

Despite an enormous funding in HK$500 million in STEM teaching and research from the government, lacking of clear teaching guidelines in STEM education still was a critical issue suffocate the promotion and development of STEM (Ho, 2021). The review of Lee, Chai, and Hong (2019) found that despite many studies being labelled as STEM-focused, most have in fact placed emphasis on one of the four aspects of STEM, usually science. There is an urgent need to realise this interdisciplinary and collaborative approach to ensure that local students meet the competitive demands of the future workforce (Lo, 2019). This study examined a design-led approach to STEM education that aims to integrate design thinking and practice in the delivery of STEM content.

In the absence of a standardised curriculum, schools have been given the autonomy to develop their own STEM content, and there has been a tendency for schools to skew towards science (Geng, Jong, & Chai, 2019; KO, 2018; Leung, 2018; Yeung et al., 2017; Yip & Chan, 2019; Yip, 2019). Besides, Hong Kong lacks clear guidelines for STEM learning and evaluation (Education Bureau of The Government of the Hong Kong Special Administrative Region, 2016). In 2019, the Federation of Education Workers interviewed 50 principals/ deputy principals, 172 STEM teachers, and 98 teachers taking part in STEM education (Oriental Daily, 2019). When asked about the difficulties encountered in teaching STEM, 51% of the respondents reported that they lacked suitable teaching materials and 29% that they had limited expert support and had failed to master the appropriate teaching approaches; only 29% of the respondents believed that the Education Bureau was providing adequate professional support to schools and around 60% disagreed that the Bureau provided clear guidelines and long-term plans for the implementation of STEM education. Many Hong Kong teachers do not have a science background and therefore find it very demanding to teach interdisciplinary STEM education effectively (Leung, 2018; Yeung et al., 2017). A number of studies have identified challenges to the implementation of STEM education in Hong Kong. A study by Geng et al. (2019), for example, indicated that STEM teachers have deep concerns about the management of STEM teaching and learning in schools, and Yip and Chan (2019) reported that science teachers had limited opportunities to improve their STEM teaching skills before they were required to conduct classes. To address these challenges, there is a need for a systematic, multi-stakeholder approach based on close cooperation between the government, education professionals, and design and technology enterprises (Ng, 2017). Education policymakers should formulate plans to resolve the issue of inadequate resourcing and provide clear guidance on how to implement STEM education. Guidance is vital because STEM teachers are drawn from different specialist backgrounds and most are used to working in a highly teacher-centred system. As Yip (2019) noted, teacher professional development in STEM education should consider factors such as the teacher's background, teaching experience, and understanding of the STEM curriculum.

To encourage the synthesis of design and technological skills, the project reported in this article implemented practice-based workshops using creative experimentation as a "critical activity to interrogate the possibilities of materials" (Toomey & Kapsali, 2014). The teacher workshops featured in this study were part of a longer project implemented over a 15-month period from September 2020 to November 2021. This study investigated Hong Kong secondary school teacher's responses to D-STEM in relation to current teaching approaches to STEM, drawing on data collected through questionnaires and interviews conducted during workshops held for teachers who were delivering D-STEM education to over 480 students. The workshops were conducted by the authors, who are staff members of the Hong Kong Polytechnic University and the Royal College of Art. Design professionals from the Hong Kong design community provided expert reviews of the project. The project sample comprises 31 teachers from nine secondary schools.

The project aimed to address STEM-related challenges by integrating four main features: (a) The use of innovative technology relevant to everyday life as a medium to deliver the D-STEM approach; (b) Practice-based workshops that use hybrid practices to synthesise creativity and technology and thereby foster innovative real-world problem solving; (c) Cross-sector collaboration between academics from Hong Kong and the United Kingdom and the wider Hong Kong design community to co-nurture students and contribute to the teaching and learning experience; and (d) Workshops in studio-lab environments that encourage collaborative practice. The following research questions could be addressed in this study:

1. What experience do the participating teachers have of staff development for STEM?
2. How is STEM content delivered in participating teachers' secondary schools?
3. What impression do the participating teachers have of the D-STEM approach after attending the workshops?
4. What insights can be gained from the participating teachers regarding the feasibility of implementing D-STEM in their schools?

Theoretical Framework

Our practice-based workshops used the UK Design Council's Double Diamond framework for innovation (Design Council, 2019), which encourages both divergent and convergent thinking and combines exploration of the conceptual and practical aspects of a problem. According to (Gustafsson, 2019) and Dowlen (2012), the model applied in the programme had a positive effect on student's abilities to develop ideas, nurture a suitable environment for innovation, and introduce their ideas to the public. However, the author recommended that the programme be carried out over a longer period to achieve significant long-term benefits.

The Double Diamond model sets out a reiterative design process with four components (the "4Ds"):

1. **Discover**. Designers gain an understanding of the problem to be addressed via direct communication and experience, not by making assumptions.
2. **Define**. Deriving knowledge from the insights gained in the first step, designers define the challenge in a different way.
3. **Develop**. Designers seek multiple perspectives and actively explore potential solutions via experimentation.
4. **Deliver**. Different solutions are tested to eliminate unfeasible ideas and further improve viable solutions.

Method

A mixed-methods approach was adopted for the study in both quantitative and qualitative measure in data collection. To gather quantitative data, a questionnaire was designed on the teachers' demographic profiles and professional backgrounds. The questionnaire consisted of 11 questions and was administered online, with the teachers accessing the URL through a QR code provided in the introductory session of the project. The questions are listed in Appendix 1. In additional, to collect rich qualitative data about the current STEM teaching situation of each school, semi-structured interviews were conducted in each secondary school. Open-ended questions were used to encourage in-depth discussion that might yield insights into the situation of each school. The interviews were conducted face to face at the end of the workshop programme. All of the interviews lasted for between 30 and 60 minutes and took place at the workshop venue. The teachers were interviewed by one of the authors and a research assistant. Three interviews were conducted in English and six were conducted in Cantonese. Secondary school teachers in Hong Kong are required to hold either a Bachelor of Education, or a Bachelor's degree in any subject from a Hong Kong university (or equivalent) and a Postgraduate Diploma in Education (or equivalent). English was not the native language of the interviewed teachers but was the primary language for communication at their schools. The teachers had attained professional competence in English during their tertiary education. All of the interviews were recorded and transcribed, and the Cantonese interviews were translated into English to facilitate further analysis.

In terms of sampling, participants were recruited via email invitations sent to secondary schools in Hong Kong. The invitation email provided details of the research project, and upon confirmation of participation all of the schools were provided with a copy of the full programme. The sample for this study was originally made up of 38 teachers at 10 secondary schools. However, after providing initial consent, one school and its seven teachers opted out of the study, leaving a sample of 31 teachers working at nine schools. Each school was represented by three or four teachers. The research was approved by the Human Research Ethics Committee of the lead author's institution and all of the participants signed consent forms prior to the study. All data collected over the course of the study were treated as strictly confidential and stored securely. The participating schools were assigned codenames for the data analysis, and are referred to as School A, B, C, D, E, F, G, H, and J (with the letter "I" excluded due to potential confusion).

A thematic analysis was made of the interview data, using a semantic approach to identify the extracted codes within the explicit or surface meanings of the data in terms of themes and sub-themes (Braun & Clarke, 2006). The identified themes included school-based experience, workshop expectations, and workshop experience. The interview transcripts were analysed by two researchers working independently, with discussions held to resolve discrepancies.

The D-STEM Programme

The 15-month programme ran from September 2020 to November 2021 and consisted of practice-based workshops for teachers and students conducted by cross-sector collaborators. This study focused on the investigation of Hong Kong secondary school teachers' responses to D-STEM via the teachers' workshops.

The workshops offered a hands-on approach that permitted the participants to co-design and create simple prototypes using artificial intelligence (AI) and e-textiles. The provided materials

had application opportunities in fashion, wearables, environmental management, and services. The rationale for using AI and e-textiles is that these are likely to have an increasingly significant impact on products and services.

The academic partners in this research project were The Hong Kong Polytechnic University and the Royal College of Art, with industry support from Fabrica, the Mills, and the Hong Kong Design Centre. The academic partners were responsible for developing the guidelines, content, activities and delivering the programme in the form of workshops, tutorials, and critiquing sessions. International staff trainers from the Royal College of Art conducted the workshop, tutorials, and critiquing via video conference, together with the project members in Hong Kong. Fabrica is an incubator for design and technology start-ups in Hong Kong and supported the research by participating in expert critiquing and sharing sessions and offering their prototyping lab as the workshop venue.

D-STEM Programme Activities

There were five phases to the overall programme: (1) context, (2) demonstration and coaching, (3) reflection, (4) implementation, and (5) review and dissemination. As this study focused on investigating teachers' reactions, the data were derived from activities that took place in Phases 1–3, which are summarised in Table 1.

Phase	Content
1: Context	Pre-workshop introduction: Introduction to project rundown, personnel and collaborators, D-STEM, materials, and technology to be used during workshops. Sharing session with collaborators about current D-STEM applications in industry and their value. Focus group with teachers.
2: Demonstration and coaching	Workshop 1 with teachers: Introduction to AI, intelligent textiles, and soft switches. Challenge and target group identification Storyboard. Exploration and experiments with technology and materials. Workshop 2 with teachers: Prototyping with materials. Presentation boards. Group presentation.
Phase 3: Reflection	Post-workshop focus group and user feedback questionnaire.

Table 1: *Summary of Activities in Phases 1–3*

Phase 4 involved organising workshops in which teachers guided their students by applying what they had learned in the earlier phases, and Phase 5 evaluated the whole programme and disseminated the findings.

Results and Discussion

Demographics and Teaching Experience

The results of the questionnaire survey are summarised in Table 2 and 3. Most of the participants (70.96%) were experienced in teaching who had 11 or more years of teaching

experience, and the list of subjects they were teaching covers most of the core and elective subjects in the Hong Kong secondary school system, revealing that the responsibility for delivering STEM is broad-based and that schools appoint a range of staff members to the task.

Characteristic	*n* (%)
Sex	
Male	17 (54.84)
Female	14 (45.16)
Age (years)	
25–35	8 (25.81)
36–45	14 (45.16)
46–55	7 (22.58)
56–65	2 (6.45)
Teaching experience (years)	9 (29.03)
0–10	9 (29.03)
11–20	11 (35.48)
21–30	9 (29.03)
31+	2 (6.45)
Subjects	
Design and Technology	4 (8.33)
Home Economics	5 (10.42)
Information Technology	8 (16.67)
Mathematics	4 (8.33)
Science	7 (14.58)
Visual Arts	8 (16.67)
Others	12 (25)

Table 2: Characteristics of Participating Hong Kong Secondary School Teachers

Characteristic	*n* (%)
School type	
Boys (School A)	1 (11.11)
Girls (Schools B, G, H, and I)	4 (44.44)
Coeducational (Schools C, D, E, and F)	4 (44.44)
School region	
Kowloon	5 (55.56)
New Territories	4 (44.44)
Medium of education	
Cantonese	6 (66.67)
English	3 (33.33)

Table 3: Characteristics of Participating Hong Kong Secondary Schools

Thematic Analysis of the Interview Data

To address the four research questions, the results were analysed by the thematic approach, with the analysis divided into two main parts: an investigation of the current practices in STEM education (addressed in research question 1 and 2) and a study of teachers' expectations and experiences of D-STEM (addressed in research question 3 and 4). In terms of current practice of STEM education in Hong Kong secondary schools, there were six key themes identified in relation to current STEM education practices: (a) The integration of STEM in schools; (b) Staff Development for STEM education; (c) Internal Collaboration and School Support; (d) Project-based learning; (e) STEM teaching and learning environment; and (f) Challenges faced in delivering STEM. The interview data indicated that there are four main ways in which the secondary schools integrate STEM into their curriculum, as follows.

Simultaneous Delivery. It used a common project theme and subject-relevant content across core and elective subjects. School A integrated STEM in multiple key subjects: "We have Information and Communications Technology (ICT), visual art, design and technology; they complement each other and the complementary subjects sometimes involve Chinese, Information Technology (IT) and Mathematics." Each teacher delivers knowledge relevant to their specialist subject to contribute to the STEM programme.

Synchronised Delivery. Four schools (D, E, G, and J) adopted the synchronised approach of delivering STEM content using a common project across different subjects. A teacher from School D explained that relevant knowledge is taught to the students in the Mathematics lesson first, and then in the ICT lesson similar teaching steps are applied. The same goes for Design & Technology (D&T). D&T may help students go through the whole project by integrating what they have learnt. An ICT teacher from School E reported that "we extract content related to ICT from STEM and apply it in different classes and explore ways in which we can cooperate with other subjects. For example, to see which subject should start STEM and which should follow." Teachers from School G reported that they were teaching different subjects separately, normally with a project-based approach. School J had integrated STEM into different subjects: according to one teacher, part of it was in the science curriculum and another part was in IT, in which students learn about AI and robotics.

Extra-Curricular Delivery. STEM content can also be delivered through extra-curricular activities and competitions. School D had five STEM teams, one of which was focused on the Internet of Things (IOT).

Separate Delivery at Different Levels. School H tailored STEM content according to students' levels, with strategic emphasis on the foundational and application-oriented subjects appropriate for each level. As noted by a teacher from School H, "Mathematics teachers are in charge of Form 1 STEM education since the planned focus is on mathematics, while in Form 2 Science teachers deliver STEM." The multiple ways in which STEM content is delivered supports the findings derived from the literature review that schools in Hong Kong are afforded flexibility in the co-ordination, planning, and implementation of STEM content. This enables schools to adjust content according to the school schedule, availability of teaching expertise, and specific needs of their students.

Teachers' Overall Feedback

In terms of teachers' expectations and experiences of D-STEM, the interview data indicated that there are five main ways based on the teachers' feedback, as follows.

Teacher Development. The teachers all acknowledged that staff training for STEM education was a crucial bridge for knowledge transfer. A teacher from School D noted that "it is easier when the teacher gains knowledge and students can learn through us." Every participant reported having actively sought resources for staff training, with teachers from eight of the nine schools having previous experience of STEM-related training. A teacher from School C responded that "there are some workshops organised by the Education Bureau that focus on curriculum design and the integration of STEM into daily school life"; another noted that "since higher form students are preparing for public examinations, seminars from the Education Bureau also discuss the relationship between public examinations, assessment and STEM education." Teachers from School D had attended STEM workshops organised by local universities and local design organisations, such as the Unleash Programme of the Hong Kong

Design Centre. These teachers also reported that they had participated in STEM seminars on design thinking, in which the approach was to offer teacher training at the first stage and for knowledge transfer to students to follow.

Internal Collaboration and School Support. STEM education integrates knowledge derived from different subjects, and collaboration among teachers is a necessary. All of the participating teachers indicated that their schools encouraged cross-disciplinary teacher collaboration and teachers including STEM education as part of their teaching duties. A teacher from School D expressed the view that teachers are not supposed to be expert in all disciplines, so they go and look for help and collaboration because STEM activities are not limited to one subject. A teacher from School G noted that before the introduction of STEM it was difficult for teachers to collaborate, because different teaching strategies were adopted in different disciplines, but STEM now provides opportunities for teachers to operate collaboratively. All schools are motivated to seek interdisciplinary collaboration, but the scale and, to some extent, success of this collaboration is determined by resources and timetables.

Project-Based Learning. Six of the nine schools in this study had integrated STEM into the curriculum through project-based learning. School A was running an interdisciplinary project for students, and a teacher from School H stated that "there are some parts of STEM taught or conducted in the Key Learning Areas (KLAs). We extract those parts and reconstruct them into a study or project." School G was asking students to do project-based work based on what they had learnt in several KLAs. School F had conducted two STEM projects with junior students based on project themes, such as the design of electric cars and hydraulic arms, which require the students to combine science, technology, and mathematics.

The STEM Teaching and Learning Environment. Due to the interdisciplinary nature of STEM, the content is often not delivered through traditional texts but instead makes use of special equipment and materials to facilitate research, experimentation, prototyping, and presentation. A traditional classroom in which most knowledge is transferred by textual and verbal explanation is clearly not the ideal environment for STEM teaching and learning. Three of the nine participating schools had a STEM room on their campus. The STEM room in School A was shared with the associated primary school. The teachers from School B described their STEM room as having been built in late 2019 and equipped with 16 high-specification computers to support 3D applications.

Preconceptions About STEM

Although schools and teachers welcome staff of different disciplines to cooperate on STEM, teachers of certain disciplines may have a preconception that their subjects are not relevant. Whereas educators regard only science, technology, engineering, and mathematics as relevant to STEM, the teachers from School D took a holistic approach and regarded all subjects as relevant to content delivery. For example, language teachers may feel that STEM is not relevant to their subjects, but language is communication and language teachers can help students to present their projects and write scripts.

Expectations and Experiences of D-STEM. The second part of the thematic analysis was focused on the teachers' expectations prior to the workshops and their experience of the workshops and subsequent application of what they had learned to the secondary school curriculum. The themes identified in relation to the teacher's expectations of the workshops were (a) guidelines and teaching resources; (b) collaborative learning and using STEM to

solve real-world problems; (c) exposure to advanced technologies and materials; (d) practice-based workshops; and (e) studio-lab environments. While, the themes identified in relation to teachers' experiences of the workshops were (a) exposure to advanced technology, (b) provision of flexible ideas and guidelines; (c) use of practice to instil interest in STEM; and (d) opportunities to collaborate with cross-sector contributors.

Expectations Prior to D-STEM Workshops. The teachers' interview responses indicate that they expected the programme to provide insights and support in the following areas. With regard to the guidelines and teaching resources**,** schools G and J wanted concrete guidelines and specific teaching content that they could adapt for their students. The schools were attracted to the AI and e-textiles elements of the programme and wanted to gain knowledge in these specific areas. Although the teachers from School J had experience with textiles-related STEM content, they were only able to integrate the technology and design elements by directly applying LEDs on fabric, and thus were not able to deliver content involving more advanced materials and technology. The teachers also expressed a keen interest in a comprehensive programme with guidelines, content, and feedback and support from experts across different sectors. In the collaborative learning and using STEM to solve real-world problems, teachers from eight of the nine schools commented that applying STEM in the context of real-world problems faced by students was one of their motivations for engaging in the workshops. These teachers believed that the workshop's interdisciplinary approach would provide opportunities for students to learn from each other's strengths. In terms of exposure to advanced technologies and materials, teachers from five schools (A, B, C, D, and J) expressed their hope that the workshop would help them to introduce students to technologies, such as illuminative polymeric optical textiles and AI, for which resources are not readily available in their respective schools. In practice-based workshops, some of the teachers expressed a specific interest in the practical nature of the programme, especially given that previous STEM seminars or workshops had usually targeted public examinations or been otherwise achievement-oriented. A teacher from School A stated that "Students like to experience different workshops where they learn to create things. They gain confidence through the process of making." In their view, crafting and creating nurtures students' interests and thus encourages them to be more engaged with learning. Under the studio-lab environment, most of the participating teachers had no access to a specific STEM classroom as the STEM content was integrated into the core and elective subjects within the school curriculum. Teachers thus expressed their eagerness to explore how a studio-lab environment, with immediate access to equipment such as computers, 3-D printing, laser cutting, and sewing machines would enable students to experiment and create in a seamless manner.

Experience of D-STEM Workshops. The programme gave the teachers access to technology and materials that would enable them to help students build on their existing knowledge in developing prototypes with advanced capabilities. With the D-STEM programme's introduction to e-textiles, the teachers felt confident about pushing the boundaries of students' knowledge. They noted that the use of e-textiles, such as polymeric optical fibre, obviates the need to launder each component of a garment after use. In terms of provision of flexible ideas and guidelines, teachers from four schools (D, G, H, and J) stated that they would adapt the D-STEM programme for their students. Teachers from Schools G and H noted that the guidelines and content of the programme had given them material that they could "tailor a little bit to fit [their] students" and that would help them integrate design and STEM into the formal curriculum. The teachers from School A, which is a special education boys' school, noted that their students lacked confidence in their abilities in STEM, which predisposed them "to pursue vocational training after S3, because they think they are not capable of attaining their Diploma

of Secondary Education." However, these teachers believed that the design-oriented and project-based approach of the workshops could be adapted to the students' interests, allowing them to build confidence in their ability to pursue university education by "seeing the similarity (in work processes) between secondary school and university in terms of the workshop project." The teachers felt that the workshop could help to develop students' problem-solving skills and improve their chances of getting into university. Teachers from School J, an all-girls school, felt that the delivery of D-STEM with e-textiles and AI would enable students to identify applications of the knowledge in aspects of daily life, such as the living environment and fashion. The teachers clearly appreciated the hands-on activities offered at the multidisciplinary workshops. When used in the classroom, these practical activities provide opportunities for students to work together to craft and create. Engagement with this process has the potential to trigger students' passion for STEM and affect their future career paths. With regard to the opportunities to collaborate with cross-sector contributors, three schools (C, H, and J) stated that they valued the opportunity to collaborate with international and local academics and with the local design community. The teachers felt that it would be helpful for students to have early exposure to different sectors to obtain a detailed and realistic understanding of the creative industries beyond the scope of the Visual Arts and Design and Technology subjects offered in school. This collaboration of International staff trainers from the Royal College of Art created a teaching and learning community with a wide range of perspectives and maximised the opportunities for teachers and students to explore, experiment with, and apply their newly acquired D-STEM knowledge. They believed that these insights would help them to strengthen the STEM curriculum in their schools and better prepare their students for tertiary education and work.

Limitations of the Study

One of the limitations of the study is that this was a one-off programme involving teachers and students from a limited number of secondary schools. For the continued evolution of STEM education, a study of the programme conducted with a larger group of secondary school teachers and students would be beneficial. Further studies could also take a more scholarly approach to exploring the influential factors of teacher training for STEM education. A larger study could also expand the scope of the present study by tracking the effectiveness of the teacher training and the effects on student performance over a longer period, with the impact evaluated from the perspective of teachers and students based on their achievements in the programme. A limitation of the interviews conducted in this study is that Cantonese is the main language for communication in most Hong Kong secondary schools, and the interviews were conducted in Cantonese and translated into English for analysis. Cantonese is mother tongue, Chinese and English are mediums of instruction for secondary schools.

Conclusions

This study examined secondary school teachers' responses to a design-led approach to STEM in Hong Kong. Our programme addressed teachers' concerns by providing guidelines, content based on advanced technology and materials, and a teaching toolkit with materials and activities. The project took a discovery-based approach to learning, in which engagement in the experimentation, design, and application of technology precedes analysis and the internalisation of underlying concepts and principles.

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SCIFARI: Exploring the Effectiveness of Team Teaching in Science on Middle School Students

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Abstract
In the Middle School Science department at Mallya Aditi International School, Bangalore, India, a team of teachers designs and delivers course content to enhance learning experiences. The pedagogy of the Middle School departments includes deliberations among the team regarding lessons, hands-on activities, experiential learning opportunities and evaluation processes before and during implementation. This has been a positive experience for teachers who came in from conventional teaching models, with high student teacher ratio and limited support for students. We believe this practice has benefitted students. However, we were curious to understand how Science team teaching was perceived by our students in the academic year 2022-23 (post 2 years of virtual learning during the pandemic). 133 of our Middle School learners completed an anonymous survey to describe the effectiveness of science team teaching. Students' responses were recorded quantitatively and qualitatively. Largely, the emergent themes were a positive attitude towards team teaching (122 responses), the opportunity to clarify doubts individually (95), an appreciation of different teaching styles (71) and engagement in well-organised collaborative learning activities (125). Nonetheless, 17 students feel intimidated and overwhelmed in relating to multiple teachers, and 39 students reported being constantly observed, but acknowledged improved class management. We concluded team teaching can enhance learning by lowering students' emotional barrier to communicate freely, meeting individual needs in the classroom, and catering to different learning styles. Combining our study of student perspectives and our teacher experiences, we have compiled suggestions for teachers looking to implement team teaching successfully in their classrooms.

Keywords: Team Teaching, Science Pedagogy, Student Perceptions, Resolving Conceptual Doubts, Supportive Learning Environment

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Introduction

In the ever-evolving world of education, innovative approaches to teaching have gathered significant attention. Among these approaches, team teaching stands out as a method that involves the collaborative efforts of multiple educators working together within a single classroom. This change from the traditional model, where a single teacher addresses a diverse group of students, has generated interest due to its potential to revolutionise the learning experience.

Team teaching comes in various models, each offering distinct advantages. One such definition, as quoted by Johnson and Lobb (1959), characterises team teaching as "a group of two or more persons assigned to the same students at the same time for instructional purposes in a particular subject or subjects." Helms et al. (2005) reported that students who were lacking communication abilities such as "interpersonal, oral, and written skills," contending that these students benefit from team-teaching methods as a way of addressing these problems.

Vogler and Long (2003) presented diverse models of team teaching such as faculty from various departments presenting cross-disciplinary classes, several faculty who are teaching a particular section teaching one course together or each member of a team of faculty teaching one area of a specific course.

Another model, as proposed by Cunningham (1960), introduces the 'Associate type' of team teaching. In this arrangement, there is no designated leader; rather, leadership emerges from interactions among individuals and within given situations.

However, the implementation of team teaching has faced challenges, ranging from a shortage of teachers to issues stemming from defunding. Despite these obstacles, the merits of team teaching have compelled educators to explore its potential benefits further. To this end, our research delves into the realm of team teaching, with a specific focus on its applicability within the middle school context.

Recognizing the need to explore this method from a fresh perspective, our study centres on the perceptions of one of the most important stakeholders: the students themselves. By engaging directly with students, our aim is to uncover insightful perspectives that impact team teaching on their learning journey. Through this exploration, we seek to provide valuable insights that shed light on the advantages of team teaching as perceived by middle school students.

In the following pages, we will present a comprehensive analysis of the benefits that team teaching brings to middle school students. Our discussion will encompass how this approach enhances comprehension of intricate concepts, amplifies engagement within the classroom, cultivates a nurturing learning environment, and facilitates the integration of diverse teaching methodologies. Drawing from the results of an anonymous survey conducted among middle school students, we reveal a compelling narrative that underscores improved learning outcomes and enriched educational experiences.

This study not only contributes to the body of research on effective teaching practices but also serves educators and educational institutions striving to optimise their pedagogical strategies. By embracing the voices of our students, we empower ourselves to construct

classrooms that genuinely resonate with their needs and hopes. In this academic paper, we invite you to begin a journey that sheds light on the symbiotic relationship between team teaching and student advancement. Join us as we navigate the details of collaborative education, utilising its advantages to transform them into real educational success.

Research Objective and Methodology

Our school's history of team teaching can be traced back to the 1980s when a group of visionary educators recognized the potential benefits of collaborative teaching. With a steadfast commitment to innovation, team teaching has gradually evolved into a well-established and widely adopted practice across our educational institution.

As devoted educators, we have personally borne witness to the remarkable effectiveness and multifaceted advantages of the team teaching model. Supported by extensive academic research, team teaching has been shown to greatly benefit teachers by enhancing classroom management, deepening subject understanding, providing individualised support, fostering collaborative learning opportunities, and encouraging the implementation of diverse teaching approaches.

“Team teaching assumes that the ’whole’ of the participants, working together, will make a greater contribution than the ‘sum’ of the participants working alone” (Davis, 1966,p. 2).

However, while there is robust evidence supporting the benefits of team teaching from a teacher's perspective, there has been a notable lack of comprehensive information regarding how students perceive team teaching instructional approach.

To address the lack of comprehensive information regarding how students perceive team teaching, we conducted a survey to gain invaluable insights into their experiences. Our endeavour involved the implementation of an anonymous survey among 133 middle school students, specifically targeting those in grades 6, 7, and 8.

The survey's design was meticulously crafted to delve into various dimensions of team teaching from the students' unique perspectives. We sought to provide a comprehensive understanding of their thoughts and feelings about this instructional approach. To achieve this, the students were encouraged to participate candidly, expressing their honest opinions and experiences.

The survey comprised a series of thoughtfully crafted questions that enabled students to rate their classroom experiences with multiple teachers on a carefully calibrated spectrum, ranging from 'strongly agree' to 'strongly disagree.' This rating system allowed for nuanced responses, offering students the flexibility to express the extent to which they agreed or disagreed with each statement.

The questionnaire explored several key aspects of team teaching, aiming to gauge its impact on the students' learning journey. In particular, we sought to understand whether team teaching facilitated a more comfortable and conducive environment for students to ask questions and seek clarification. We were eager to discover if the collaborative teaching approach contributed to their better comprehension of challenging concepts and if it aided them in making meaningful connections between different subject areas.

To gain a comprehensive understanding of their experiences beyond mere quantitative data, we also incorporated open-ended questions into the survey. These open-ended questions allowed students the freedom to share their personal experiences, provide additional insights, offer suggestions, and voice any concerns they might have had regarding team teaching.

With the data collected, we adopted a comprehensive analysis, combining both quantitative and qualitative methodologies. The quantitative aspect allowed us to discern statistical trends and gain an overall overview of the students' responses. At the same time, the qualitative analysis involved a meticulous examination of the open-ended responses, skillfully coding them to uncover emergent themes and gain profound insights into the students' specific experiences, thoughts, and opinions.

The implementation of the survey provided us with a diverse range of perspectives and reflections from the students, ensuring a well-rounded assessment of their experiences with team teaching. Through their participation and candid responses, we aimed to uncover valuable insights that would enable us to further enhance and refine our team teaching practices to better cater to the students' needs and create an even more enriching learning environment.

Upon examining the survey outcomes, a myriad of themes emerged, showcasing the students' genuine appreciation for the team teaching model:

1) Enhanced Learning Environment: Students conveyed their delight in the positive and collaborative classroom atmosphere, which significantly contributed to an engaging and enjoyable learning environment.
2) Amplified Understanding: Many students expressed how team teaching facilitated their comprehension of complex concepts through the diverse explanations and perspectives offered by multiple teachers.
3) Personalised Support: The students found solace in knowing they could approach different teachers, each with their unique strengths, for personalised support and guidance.
4) Cultivation of Collaboration and Interaction: The team teaching setup fostered greater student-to-student and teacher-to-student interaction, leading to increased participation in group activities and meaningful academic discussions.
5) Embrace of Varied Teaching Styles: The students appreciated the diversity in teaching approaches, catering to their individual learning preferences and ensuring a well-rounded educational experience.
6) Building Positive Teacher Relationships: Witnessing educators collaborating harmoniously, students felt a strong sense of rapport with their teachers, contributing to a positive and nurturing learning environment.

Data Analysis

The following findings present a comprehensive analysis of the data gathered from the survey conducted. As this survey was designed to elicit valuable insights and perceptions from a diverse group of students, by employing both quantitative and qualitative research methods, we sought to gain a holistic understanding of the student’s perspective of team teaching and uncover nuanced patterns and individual perspectives.

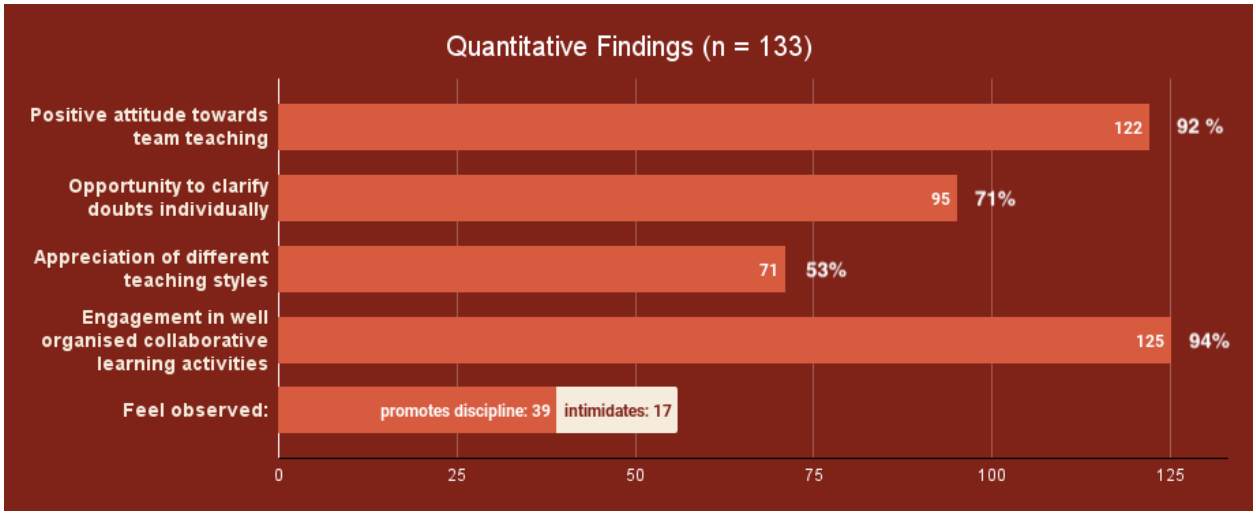

Fig 1: Qualitative findings of the survey

Fig 1 represents the qualitative findings of our survey. It is clearly evident from the graph that 92 percent of the surveyed students exhibited a positive attitude towards team teaching. These students perceived this practice as a favourable approach to teaching. 71 percent of the students considered team teaching as a valuable opportunity to clarify doubts as it helps them gain a better understanding of a concept. 53 percent students emerged as open-minded and understanding that each teacher has their unique strengths and approaches to teaching. These students appreciate the expertise of each teacher and acknowledge the diverse perspectives they bring to the classroom. The forefront of the findings – 94 percent of the students agreed that collaborative activities are well-organised when multiple teachers conduct them as opposed to a single teacher. Activities provide an excellent opportunity for all students to actively participate, observe and reflect, although sometimes it can present challenges that lead to chaos. However, team teaching facilitates the implementation of small workstations, enabling the majority of students to stay engaged, giving them less scope to get distracted. The study by Wellington (1998), identifies three main domains that justify the implementation of practical work or hands-on activities in education: the cognitive, affective, and skills and processes domains. Within the cognitive domain, practical work serves as a powerful tool to illustrate, verify, and affirm theoretical content. By engaging in hands-on activities, students can 'visualise' scientific laws and theories, leading to an enhanced understanding of scientific concepts and promoting their overall conceptual development. Transitioning to the affective domain, Wellington argues that the motivating and exciting nature of practical work can ignite students' interest in science. This heightened interest not only contributes to better lesson retention but also cultivates improved memorization abilities. Lastly, practical work resides within the skills and processes domain, offering the potential to develop transferable skills essential for future scientists as well as students pursuing diverse career paths. Wellington emphasises skills such as observation, measurement, prediction, and inference that are honed through active participation in hands-on activities. Despite the potential challenges that practical work might pose, such as occasional chaos, collaborative teaching techniques, including team teaching and small workstations, can effectively manage these issues, ensuring a focused and engaging learning environment for all students. While the results of this study aligned with the perceptions of the teachers, it is worth noting that 56 percent of students held a different perspective regarding team teaching. Among them, 36 responses were positive to the feeling of being observed, whereas a noteworthy 17 responses indicated the feeling of being intimidated by the presence of many teachers in the classroom.

With the qualitative findings of our survey, we sought to capture the unique insights, benefits and challenges students associate with team teaching. The qualitative responses were gathered, systematically analysed and carefully organised. For this analysis, we identified eleven keywords from the responses given for open-ended questions. Thematic analysis was employed to identify patterns, concepts and meanings within the data to be able to build meaningful codes.

The coding process revealed several prominent themes that emerged from the analysis, encapsulating the students' perspectives on team teaching.

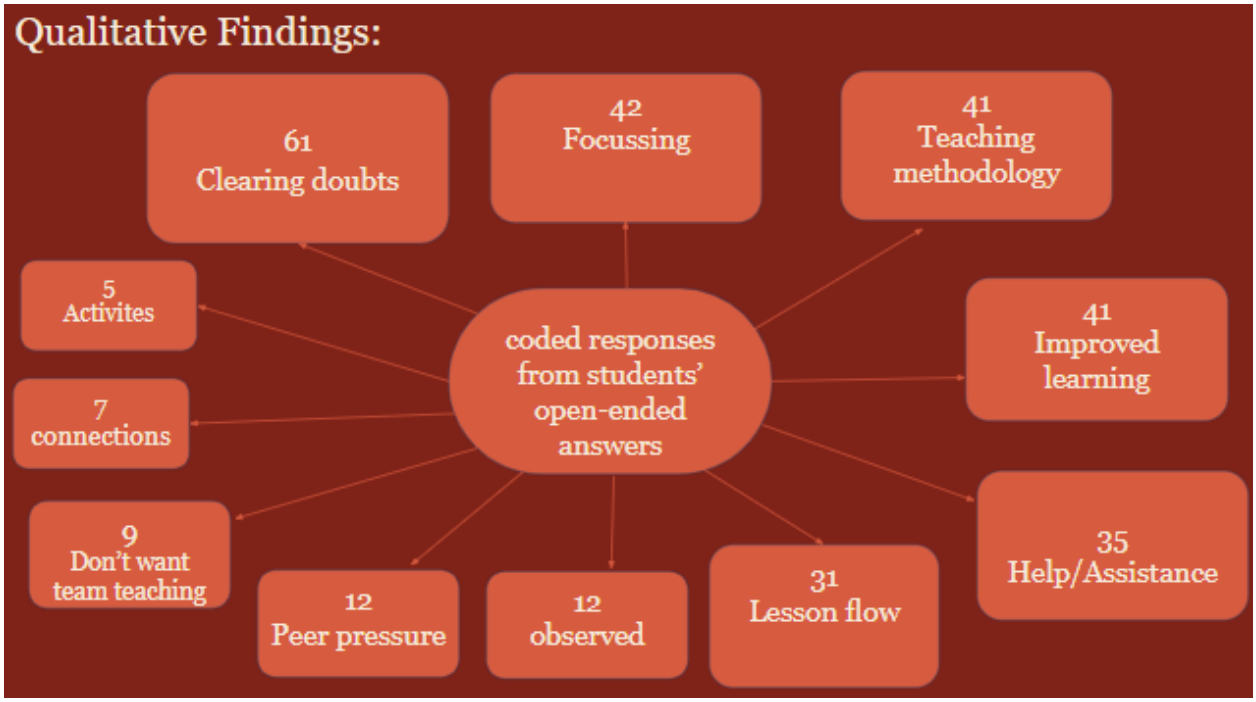

Fig 2: Qualitative findings with the coded keywords

It was clearly evident that there were remarkable similarities between the quantitative and qualitative findings. Many students emphasised the increased availability and support they received through team teaching. They reported feeling comfortable seeking assistance and clarification, without having to worry about peer reactions to their questions. They also mentioned benefits of receiving personalised attention and feedback, leading to improved learning. According to John Hattie and Helen Timperley (Hattie, J., & Timperley, H. (2007), feedback is information provided by an agent (e.g., teacher, peer, book, parent, experience) regarding aspects of one's performance or understanding. It occurs typically after instruction that seeks to provide knowledge and skills or to develop particular attitudes. In the view of Locke and Latham (1990), feedback plays a pivotal role in enabling individuals to establish realistic goals and monitor their progress towards these objectives. This ongoing assessment allows individuals to make necessary adjustments in terms of effort, direction, and even strategies to ensure goal attainment (p. 23). In our survey, students also recognised the importance of team dynamics between the teachers to maintain an organised and cohesive classroom environment which allowed them to focus better, by avoiding distractions. They appreciated the diverse teaching styles brought by teachers in a team-taught class. They acknowledged the benefits of different instructional techniques, engaging activities, catering to their individual learning preferences and needs. Students also highlighted their challenges

with the team teaching model as presence of multiple teachers made them feel anxious and expressed their interest in other teaching models.

These findings have the potential to make a meaningful impact on how team teaching can be tailored to meet the unique needs of the student groups and encourage further exploration of this intriguing area of research.

Theme 1: Clearing Doubts

In examining the themes that emerged from student responses, our primary finding was that students are able to ask questions and clear any doubts they may have as they are learning when in a class taught by a team of teachers rather than a singular teacher. This response is highlighted in 121 of 133 likert scale responses and in 62 individual qualitative responses. The strength of agreement among the students across grades, classes and science classes allowed us to conclude that this theme was perhaps the most important and interesting finding of our survey.

Students marked their agreement to the statement "I get my doubts clarified/extra questions answered, without having to ask in front of the entire class and disturbing the flow of class discussion."

In their qualitative responses to open-ended questions they describe a class experience where one teacher is leading class discussion, lecturing or facilitating an activity while the others are moving around the room to support students and answer their questions. Students make specific reference to this arrangement allowing them to feel "more comfortable" in class, and "get help" when struggling. Students connected the experience of being able to clear doubts to three specific phenomena. 31 students said that they were able to ask questions in class while a teacher was lecturing or leading an activity without disrupting the rest of their classmates. 12 students said that they appreciated being able to ask questions without the scrutiny of their peers. 7 students said that the presence of teachers of other subject areas in the room facilitated their making connections between science subject areas.

Since students are asking more questions and clearing more doubts within a team teaching model, we must explore possible benefits to students in the process of asking questions. Chin and Osborne (2008) highlighted three key benefits to students as they ask questions. They studied the role of student-questioning in the science classroom, and were able to document students' experiences of a learning opportunity that encourages questioning. They found that when students are developing their questions, they activate their prior knowledge. Students must connect knowledge they already have to the content being presented to them in the lesson to ask questions. Very often this process involves students being able to make connections between areas of the subject, different subject materials entirely and between their lives and the classroom. These connections are valuable as they centre the pedagogical principles of 'constructivism' (Dewey, 1966) which places student interests and needs at the center of their educational experiences. Chin and Osborne also found that the process of asking questions requires students to focus their attention on the primary themes being taught. Finally, in asking questions students are practising the beginning stages of critical scientific questioning. These phenomena evidence the strength of questioning in the classroom. As the teachers in a room both teaching and supporting classes, students' questions about the content being taught provide us very valuable data about the extent of student understanding, their

application of learnt concepts and the connections they are making inside and beyond the classroom.

When students have asked a teacher a question, the teacher answers the question immediately- building up, and adding to students' content knowledge, and confidence in their knowledge and skills. All the sciences are interconnected, as are the topics within each of them. When a students' understanding of a topic is hampered by a miscommunication, a misunderstanding or a challenge faced by the student in the moment of learning, this seemingly small tear in the fabric of learning grows exponentially with the passage of time. Everytime the class makes reference to, relies on or connects new content to a missing piece of content from a students' understanding- that student's understanding of the subject, interest in it, and connection to the subject matter reduces.

The formative information collected during this process of being asked and answering questions is used by our team of teachers to inform the need for individualised student support through scaffolding and additional learning opportunities, and future lesson planning. Being in conversation with our students this closely allows us to receive constant feedback about their understanding and any challenges they might be facing. These conversations with our students allow us to forego the traditional exit and entry ticket system as well. We are able to check understanding, and also check-in with students who might be struggling to keep pace with the class. Teachers will also often use these fleeting opportunities to ask students how they're doing- emotionally, mentally and academically, building consistent and strong channels of communication between the team of teachers and each student.

Theme 2: "Feeling Watched"

Another interesting and prominent theme that demanded attention was the feeling of being watched in presence of multiple teachers in class. The mention of the feeling occurred both in qualitative and quantitative responses frequently.

The quantitative question, "I do not learn effectively in the presence of two or more teachers because," was responded to 56 times, with multiple choices available for participants to select from. Out of 56 responses 39 emphasised on the feeling of being watched in a team taught class and 17 of them clearly expressed their discomfort with this arrangement as they felt intimidated. Further using the open ended questions in the qualitative part of the survey, valuable insights were gained on dynamics of this feeling.

The qualitative findings revealed a diverse range of emotional responses among students regarding the feeling of being watched in the classroom. While 42 students reported that the perception of being observed by team teachers helped them stay focused and motivated, 12 expressed feelings of anxiety and self-consciousness in their descriptive response.

Those who perceived the presence of multiple teachers as supportive advocated its capacity to instil a sense of responsibility among students. The study discerned that within a team of teachers, students perceived a heightened level of accountability for their learning progress and contributions. The students' awareness of being observed by multiple teachers appeared to have a positive influence on their ability to engage effectively, prepare, complete and maintain the overall quality of the work assigned.

> "I think that science is more engaged at more focused when a team of teachers is there. I feel like we also get more work done."

> "It's very rare when there is only one teacher during science classes it's about the same but I don't think that we get as much work done."

They reported a compelling correlation between the presence of multiple teachers in the classroom and heightened student focus. The responses collected through the survey significantly indicated that the feeling of being observed contributed to improved student concentration during middle school science lessons. The presence of more than one educator appears to reduce the potential for student disengagement and encourages them to remain attentive throughout the class. The collaborative teaching approach facilitated by team teaching not only captured students' attention but also encouraged their active participation in discussions and activities.

> "With a team of teachers, I am always more concentrated because I am being observed at all times and the entire class is also less distracted which helps make learning a little more efficient and productive. When there is only one teacher teaching a topic, it is often hard for them to teach and make sure the class isn't distracted at the same time and my focus also goes much lower."

They expressed that knowing someone was watching them led them to experience an additional level of pressure to their advantage. This made them pay closer attention to their actions, and stay on task. They also mentioned the utility of this feeling in reducing peer distraction and being mindful of their class behaviour. For some students individualised attention was reassuring and aided them in gaining more confidence in the ways they chose to complete the task.

> "With a single teacher you understand a little less because there is more talking but when there are two or more teachers you are under more pressure and feel like your always being watched so you do your work."

> "I feel without a teacher I feel more free but when I do different things instead of doing the assigned work I also feel more confident when there is a teacher around me."

Sari,et.al. (2020) have shed significant light on the intricate relationship between students' learning concentration and their academic performance. The authors state that "Learning concentration is a concentration focus of thoughts and deeds on a certain object to reduce or set aside things that are not related to the object studied. The poor quality and learning achievement of students are mostly caused by the weak ability to concentrate while studying. The common problem of the students is having a branched mind while learning." These insights closely resonate with our own research findings, fortifying the notion that sustained attention within a team teaching model positively impacts learning outcomes. The corroborating findings of the mentioned paper provide a broader context to the significance of our study and emphasise the consistent influence of concentration on learning achievements.

In contrast, some students expressed feelings of being observed and scrutinised was intimidating and amplified their self-awareness. The feeling of self-consciousness hindered

their ability to freely express themselves and participate or contribute to discussions, as they felt their responses were being closely monitored. It was reported that these emotions led to increased anxiety levels among some students as the presence of multiple teachers was perceived as an added layer of evaluation, which influenced their behaviour and engagement. For some students this arrangement was a plausible source of confusion as well as distraction while learning. Moreover, students' comfort levels varied depending on their familiarity with the team teachers. Those who had established rapport with the instructors were generally less affected by the feeling of being watched.

> "With a team of teachers I fell a bit anxious and nervous but the good side is that they give us each individual attention and I'm sure some people would not want teachers to see secret things they do during a class. I bet most of the people will like one teacher to teach because he won't give individual attention and they will not see some misbehaviours we do. So I think a team of teachers is beater even if some people feel like me."

The different feelings expressed by students highlight that the influence of being observed in team-taught classes is personal and changes depending on individual traits and learning styles. These results emphasise the significance of acknowledging and dealing with students' distinct emotional requirements within team teaching settings. This aims to establish a harmonious and encouraging environment that promotes both participation and mental wellness.

Building upon the discoveries of this study, several avenues emerge for potential future research endeavours. One such avenue involves delving into the correlation between the increased student engagement observed within the team teaching framework and the subsequent improvements in their overall learning outcomes. A prospective approach to this could encompass a longitudinal study, thus facilitating an exploration of the enduring impacts of team teaching on students' academic progress.

In an effort to alleviate feelings of unease, we embarked on the academic year by elucidating the concept of team teaching to our students, underscoring our primary intention of augmenting their support. This proactive measure offers an opportunity to scrutinise how students' learning predilections align with team teaching methodologies. This alignment can be further probed through the judicious application of well-structured surveys. Furthermore, an intriguing trajectory for future research lies in the exploration of the intricate interplay between students' emotions and their subsequent learning and academic performance. Research in this direction could encompass an in-depth investigation into how various emotional states, such as motivation, anxiety, or enthusiasm, influence students' learning outcomes. By employing a comprehensive research design that amalgamates quantitative assessments with qualitative insights, a nuanced understanding could be unravelled regarding the ways in which emotional experiences either catalyse or impede students' cognitive engagement, knowledge assimilation and effective learning.

Conclusions

In conclusion, the survey provided valuable insights into the students' experiences with team teaching, affirming its positive impact on their learning journey. The themes that emerged underscored the significance of team teaching in creating an engaging and enriching educational experience for our students. The comprehensive analysis of their perspectives has

empowered us as educators to further refine and enhance our team teaching practices, ensuring that we continue to meet the diverse needs of our students while nurturing their curiosity, creativity, and passion for lifelong learning. By embracing the principles of collaboration and innovation, we endeavour to cultivate an environment where students thrive academically, socially, and emotionally, preparing them to be informed, compassionate, and capable leaders of tomorrow's world.

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Exploring the Dynamics of Ice Hockey Strategies Using YOLOv8 and Gephi in Sports Education

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Official Conference Proceedings

Abstract
In modern fixed-field team sports, computer vision techniques have been commonly applied in analyzing team strategies and tactics. This research presents a combination approach using object detection, multi-object tracking, and social network analysis (SNA) to investigate the dynamics of ice hockey strategies. Specifically, we utilize YOLOv8 object detection algorithm to detect players and ByteTrack to track their movements. The passing information between players is used to construct a network representation of the team's strategy. By using weighted-edges and modularity network community detection, this research demonstrates the team roles of each player in community analysis and captures the impact of team strategies. The goal of this research is to promote teamwork, strategic analysis, and the development of innovative knowledge of sports rules and strategies in sports education.

Keywords: Object Detection, Social Network Analysis, Community Analysis

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Introduction

With the development of science and technology, the field of sports' analytics has made remarkable progress in recent years. Particularly in group fixed-field team sports, such as football, basketball, ice hockey, badminton which are characterized by teams that play in a fixed-field with a specific set of regulations. Analyzing these sports has traditionally been challenging because of the complexity of interactions between players (Jana & Hemalatha 2021; Weber et al. 2022).

With using the latest computer vision techniques and social network analysis (SNA), this research provides new opportunities for analyzing fixed field team sports in weighted edges and modularity network community analysis. In this chapter, we will explore the concepts of fixed-field sports, YOLOv8, and SNA in computer vision.

Group fixed-field sports are sports which are played on a field or court with fixed boundaries and a set of rules, with more than two players. With these fields, group fixed-field sports are characterized by the interactions between players and their movements across the playing fields. Nowadays, there are multiple popular group fixed-field sports, for instance soccer; American football; basketball; ice hockey (Figure 1 indicates the size of ice hockey rink); and volleyball. The unique character of the group fixed-field sports is with multiple players participate in it that takes place on a static or unchanging field of playing area. Analyzing group fixed-field sports is challenging due to complex player interactions, the fast-paced nature of the games, limited observability of player movements, large volumes of data, and contextual factors (Raabe, Nabben, & Memmert 2022). However, advances in computer vision and SNA have made it possible to analyze these sports in a new and exciting way.

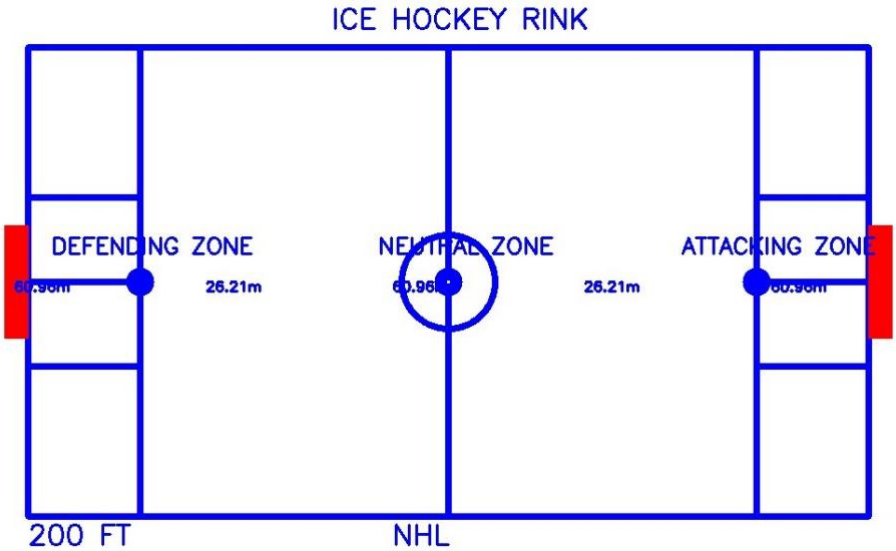

Figure 1: Ice Hockey Rink

YOLOv8 (You Only Look Once version 8) is a stage-of-the-art object detection model used in computer vision tasks (Jocher, G., Chaurasia, A., & Qiu, J, 2023), such as instance segmentation, classification, post estimation. It is designed to detect objects in images and video streams. YOLOv8 is particularly useful for analyzing group fixed-field sports as it can accurately detect players on the playing field.

After the detection of plays, ByteTrack is used to track the historical movement, ByteTrack is a multi-object tracking (MOT) algorithm which developed to estimate the and optimize bounding boxes selection (Zhang et al. 2022). ByteTrack aims to overcome the limitations of traditional MOT methods by introducing a simple and strong tracking approach. ByteTrack is designed to track objects in challenging conditions such as occlusion, scale variation, and fast motion. The combination of YOLOv8 and ByteTrack provides a powerful tool for analyzing player movements.

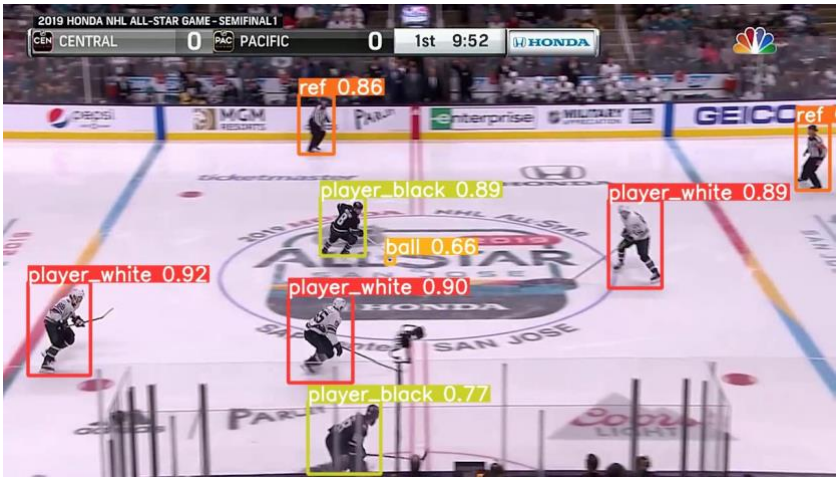

Figure 2: YOLOv8 object detection

Social network analysis (SNA) is a method for studying social structures by analyzing the relationships between individuals or groups (Abbasi, Altmann, & Hossain 2011; Grandjean 2016; Otte & Rousseau 2002). In modern sports analytics, SNA can be used to analyze the interactions between players on a team or between teams in a league. By using SNA, coaches can identify the key players on a team and how they interact with each other (Zhang et al. 2017). They can also analyze the strategies used by teams and how they change over time (Wäsche et al. 2017).

Overall, the use of YOLOv8 and ByteTrack provides accurate players detection and tracking, SNA is built based on the object detection and passing information. SNA can be used to analyze team strategies and tactics.

Theoretical Background

Social network analysis (SNA) can be a valuable tool for analyzing the structure and dynamics of sports teams (Clemente, Martins, & Mendes 2016; Serrat 2017; Wäsche et al. 2017), such as in ice hockey team strategies. By applying various measures and techniques, coaches can gain insights into the network relationship and interaction between players (Fransen et al. 2015). The SNA can be used to understand the factors that influence team performance (Yang & Tang 2004), and to identify potential leaders or influencers not only within a team, but also in between other teams. Overall, social network analysis can provide a unique perspective on sports teams and can help coaches to make decisions about team selection, training, and strategy, particularly in group fixed-field team sports (Fransen et al. 2015; Vick, Nagano, & Popadiuk 2015; Yang & Tang 2004).

Weighted edges are a concept that to assign numerical values to the edges of a certain network in graph theory (Liu et al. 2014), which can be in the form of directed or undirected

edges to represent relevant measures (Háznagy et al. 2015) such as capacity, distance, passing information. In ice hockey, the passing direction frequency between players can provide valuable insights into team strategies and tactics. The weight of the edge represents the direction of the pass with frequencies. The factor of weighted degree centrality measures the weights of edges connected to a node. Nodes with high weighted degree centrality are those that receive or make accurate and direct passes more often than other players.

Community detection defines clusters that aim to identify communities of nodes in a network that are more densely connected to each other than to the rest of the network (De Meo et al. 2011; Fortunato & Barthélemy 2007; Liu et al. 2014). In ice hockey, community detection can be used to identify groups of players that tend to pass to each other more often than to other players. The modularity algorithm, as introduced by De Meo et al. (De Meo et al. 2011), has proven to be a practical and widely adopted approach for community detection. Among the various methods available, the Louvain method stands out as the most utilized one. The modularity algorithm maximizes the modularity score by assigning nodes to communities that are more densely connected within the community than expected by chance, while considering the directionality of the edges (De Meo et al. 2011). The directed modularity score can range from -1 to 1, with higher values indicating a better community structure (De Meo et al. 2011).

$$Q = \frac{1}{2m} \sum_{i,j} \left[A_{ij} - \frac{k_i k_j}{2m} \right] \delta(c_i, c_j)$$

Figure 3: The modularity formula identifies cohesive communities in a network by measuring the deviation of observed edges

In the formula (Figure 3), Q represents the modularity of the partition in Figure 3, which measures how a given partition of a network graph in which captures its inherent community structure by comparing the actual number of edges within communities to the expected number of edges (De Meo et al. 2011). And, m denotes the total number of edges in the network, reflecting the size of the network. A_{ij} stands for the weight of the edge between nodes i and j, representing the strength of the connection between two nodes in the network. K_i corresponds to the degree of node i, which is the number of edges that connect to it. The c_i signifies the community to which node i belongs, where a community is a subset of nodes that are densely connected to each other but sparsely connected to nodes in other communities. $\delta(ci, cj)$ is the Kronecker delta function, serving to return 1 if nodes i and j belong to the same community (Murniyati et al. 2023).

Methodology

In this chapter, the dataset collation and annotation method are discussed. The McGill Hockey Player Tracking Dataset (MHPTD) is used to perform object detection (Zhao, Li, and Chen 2020). The dataset contains 25 NHL ice hockey video clips, and it follows the format of the MOT challenges (Multiple Object Tracking) which is a widely used benchmark dataset for evaluating computer vision algorithms for player tracking, which is available at https://github.com/grant81/hockeyTrackingDataset.

The MHPTD dataset has been annotated by an open-source image and video annotation tool called Computer Vision Annotation Tool (CVAT) to facilitate analysis. This tool enables

users to label and tag specific objects within a video clip to create a comprehensive and annotated dataset for further analysis. From this data, we set up 6 different classes which are available in below Table 1:

Class	Description
player_color1	Represents a player on the team with color1.
goalie_color1	Represents the goalkeeper of the team with color1.
player_color2	Represents a player on the team with color2.
goalie_color2	Represents the goalkeeper of the team with color2.
ref	Represents the referee or officials in the video frames.
ball	Represents the hockey ball

Table 1: Object Classes and Description in Ice Hockey

In the next step, we convert the CVAT annotation which is XML format in to corresponding yolo format. The yolo format is comprised of a text file for each image, containing one row for each object detected in the image. Each row comprises of the object's class label and normalized coordinates of the object's bounding box in the image. The converted YOLO format files are utilized to train a YOLOv8 object detection model using YOLOv8x frameworks. We split the dataset into training, validation, and testing datasets. After the training, we chose the best model based on the evaluation results using mAP (mean average precision) and confusion matrix. And after that, we fine-tune the model by adjusting hyper-parameters to improve its performance. In the next stage, we extract the detection results of video clips. After the detection, a directed network is built based on that nodes represent individual players and edges represent interactions between them (the pass from player A to player B).

To create the network using the MHPTD dataset, it is vitally significant to identify the nodes and edges. The nodes are the individual players, and the edges are the passes made between players during games. In object detection, there are 6 different classes, in the class of "ref" was not included in building the network. The player_color1 teams are divided into 2 groups, which includes defensemen and forward. There are 6 players in each team, which are defined as, for example in team A, A_goalie, A_forward1, A_forward2, A_forward3, A_defencemen1, A_defencemen2; in team B, there are B_goalie, B_forward1, B_forward2, B_forward3, B_defencemen1, B_defencemen2. A directed network is created between all the players and the ball.

The use of the MHPTD dataset provides a rich dataset that allows for the creation of a detailed network of player interactions in ice hockey. By using this dataset and applying SNA techniques, we can gain insights into the network structure of ice hockey, also the roles of individual players within the network, and how the network changes over time. The software Gephi is used for network building.

Findings and Discussion

This chapter delves into the findings from the analysis of weighted edges and community detection. This chapter aims to shed the light on the significance of player interaction in the social network analysis perspective, and the overall game play dynamics.

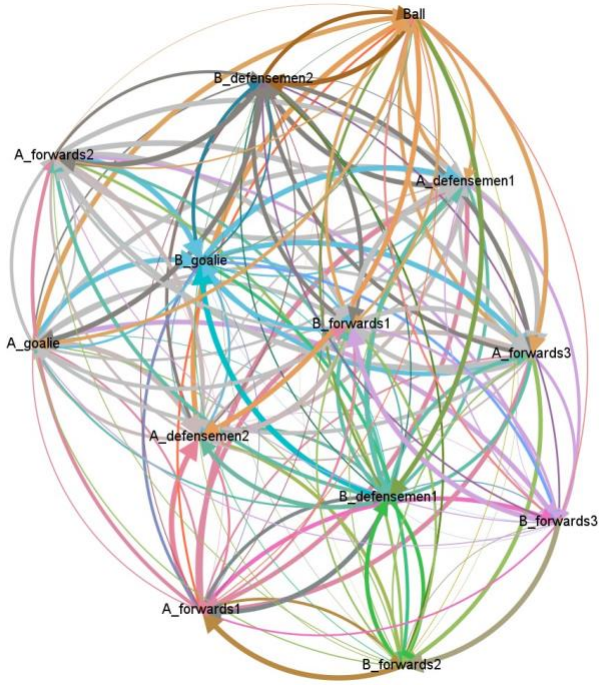

Figure 4: Over-all of the Weighted Network of One Match

In object detection, YOLOv8 performs player detection towards the MHPTD dataset. Individual players are detected with a specific classID, and because of the class are divided by two colors, for example. After the detection of individual plays in different teams and the ball detection, the ball possessor is defined as which player is in the possession of the ball by comparing the proximity of each player to the ball's distance. If the ball is within the proximity range of a player longer than a specific time range, not too short of time in some passing cases, the one player with unique classID is the ball possessor. In the next step, the ball passing is defined as a ball moving from one possessor to another possessor with different classID, which can be in the same team or different team.

After extracting the passing information, a Gephi network is built based on the direction of passing in one match. As shown in Figure 4, it is an example of the over-all weighted network of one match, colors represent different weights in passing. Nodes indicate the position of the players. Moreover, we can set different edge weight selection for further analysis, for example, in below Figure 5, we select the edge weight filter between 221 to 298, to analysis different passing frequencies.

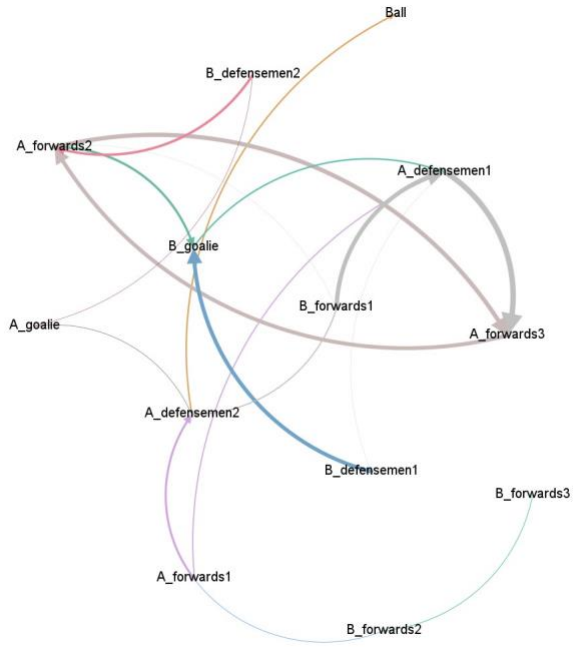

Figure 5: Different Weighted Edges Setting Selection

By exploring the distribution of weighted edges' values across the team, coaches can gain insights into the dynamics of player interactions and identify key players responsible for orchestrating offensive plays. For example, in Figure 5, the connection between B goalie and B_defensemen1 has a strong tie which means that the defensive strategies work well between the two players. On the other hand, A_forwards2 and A_forwards3 have a strong tie for offensive strategies. With more in-depth analysis, coaches can identify players who are particularly important for facilitating the flow of playing in building up both defensive and offensive strategies. Furthermore, the changes in weighted edges over time can provide insights into team strategies and play performance, because of the changing of players in the same position.

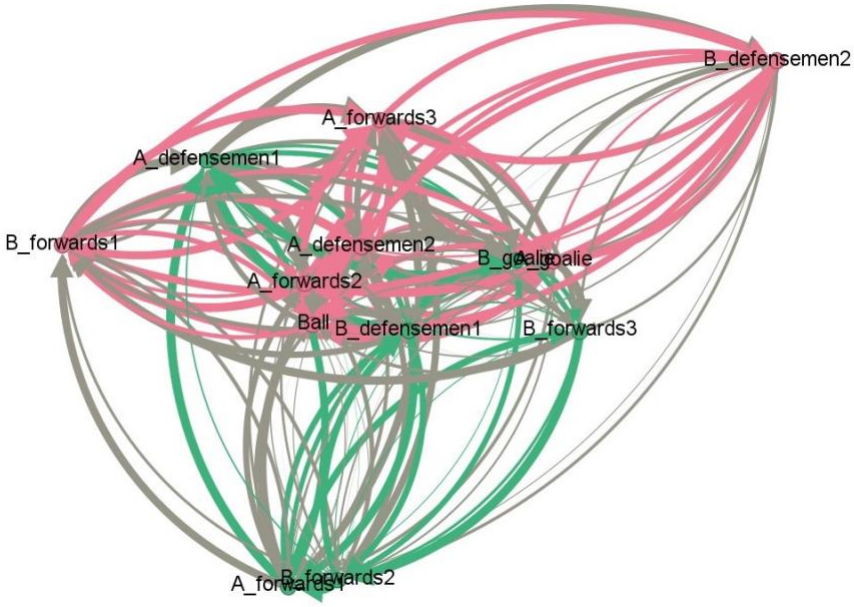

Figure 6: Community Detection by Louvain Method in the Context of Ice Hockey

By using Louvain's modularity algorithms (Blondel et al. 2008), the communities can be detected as the passing patterns and strategies which are available in Figure 6, different colours represent different detected communities. The Louvain algorithm identifies clusters of nodes that have more edges within the cluster with directions (Murniyati et al. 2023). In the context of ice hockey, community detection can be used to identify groups of players who tend to pass to each other more often than others from. Moreover, players with strong connections in both the same team and same community perform better defensive strategies. From the perspective of offensive, the players in different teams but placed within same community demonstrate noteworthy in the gameplay dynamics. Because it is in the passing network, weak ties can be utilized to locate novelty (Aral 2016; Granovetter 1973) which might be the points for fluid offensive transitions, or breakpoints to launch rapid attacks.

One advantage of utilizing modularity for community detection is that it provides a quantitative measure of the quality towards the detected communities, in the game of ice hockey, it indicates the players who pass more actively to the others and form the passing community structure. Interpretation of the communities' structure can help coaches to deeply understand the team strategies and tactics, also with concerns of the community structure changes to the tactic changes over time.

Conclusion and Future Research

Computer vision techniques have become increasingly prevalent for investigating team strategies and tactics of group fixed-field sports. This paper presents a novel combination of YOLOv8, ByteTrack, SNA, and community detection. The social network is built based on the players' on-ice interactions, which helps coaches to interpret team strategies by weighted edges and modularity. The overarching goal of this research is to foster teamwork, promote strategic analysis, and advance knowledge of sports rules and strategies in sports education. By employing cutting-edge computer vision techniques and social network analysis, this study contributes significantly to the understanding of ice hockey strategies, offering valuable insights for coaches, analysts, and players seeking to optimize team performance.

Future research can be conducted in multiple perspectives. From the network-based approach, not only weighted edges, and community detection, but also other factors. Such as, degree centrality and betweenness centrality for players' passing connections and key offensive players identification; clustering coefficient for team coordination with competitor team; PageRank analysis for identifying influential players; directionality for progression and evolution of the games; node attributes for player positions and shooting abilities; cluster analysis for goalkeepers' role. By exploring various network-based approaches, coaches can gain insights into the team strategies with understanding from passing network perspectives, and more approaches can be investigated in the passing network. From the object detection perspective, player re-identification can be used to research individual player's performance like passing accuracy, offensive and defensive role; motion capture and movement tracking can offer valuable understanding of player behavior, like shooting position, offensive position; our research is using video clips, the multiple camera fusion can help to explore motion capture and re-identification with more accurate result.

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Scaffolding Teacher Talk in Face-to-Face vs. Online EAP Contexts: Teachers' and Students' Views

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Abstract
Despite growing research evidence on the facilitative role of scaffolding strategies in enhancing students' learning outcomes, scaffolding L2 learners in hybrid EAP contexts has been an under-researched area. The aim of the present study is twofold: 1) to explore how English language instructors use teacher talk to scaffold language learning during online and face-to-face EAP lessons, and 2) to find out instructors' views on their scaffolding strategies and students' regarding the effectiveness of these strategies. The study was conducted in the English preparatory program of a foundation university in Istanbul, Turkey, and data were collected from four English instructors and 61 students through video recordings and stimulated recall interviews. Analyses revealed that instructors' scaffolding included similar metacognitive, cognitive, and affective strategies in both face-to-face and online lessons. Instructors used various cognitive, metacognitive, and affective scaffolding strategies to cater to students' language learning while preparing them for the academic requirements of the English program and future studies without considering the differing needs of the instructional contexts. Finally, although students generally benefited from the scaffolding strategies used by their instructors, individual differences were observed. The findings shed light on the effective scaffolding strategies of teachers used in hybrid contexts and students' ideas about to what extent they can benefit from them.

Keywords: Scaffolding, Teacher Talk, English for Academic Purposes, Hybrid Education

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Introduction

Inspired by the Vygotskian sociocultural theory, scaffolding describes how a teacher constructs or guides learners' uptake of knowledge and skills through interactive and intentional support. Teacher support is modified based on learners' current performance, slightly declined over time, and the responsibility of learning should be gradually passed on to the learner (Van de Pol, Volman, & Beishuizen, 2010). In language classrooms, teachers provide learners with experiences in which they engage in communicative activities through collaborative talk. Thus, they can perform better than they could individually. Such supportive dialogue between a learner and a teacher or a more proficient peer is critical as linguistic support and negotiation of meaning have a significant place in learners' language development (Kayi-Aydar, 2013).

In EAP settings, scholars have mainly focused on the role of scaffolding strategies employed in face-to-face lessons. Wilson's (2016) study indicated that delicate scaffolding is significant in allowing students to make their meaning and become critical readers as they proceed with their academic studies. Other researchers point out that contextual support in the form of making connections between activities and both short-term and long-term objectives might scaffold students (e.g., Barnard & Campbell, 2005; Heron & Webster, 2019). Besides, the scaffolding strategies identified by Hammond and Gibbons (2005) in the ESL context can also be adopted in EAP settings, such as linking current learning to past and future activities, correcting errors through appropriation of student contributions, and prompting to elicit the expected answer (e.g., Heron & Webster, 2019; Mannion et al., 2021). In hybrid settings, only a few attempts to scrutinize scaffolding EAP goals have been observed (e.g., Du & Zhou, 2019; Meri-Yilin, 2019; Santoso, 2008). Despite their contribution to the investigation of scaffolding in hybrid EAP contexts, these studies focused on applying a specific framework or an implementation rather than observing the scaffolding strategies adopted by teachers.

Although there have been studies on scaffolding classroom talk in different L2 contexts (e.g., Kayi-Aydar, 2013; Li, 2012), few attempts have been made to investigate scaffolding classroom talk in face-to-face EAP settings (e.g., Heron & Webster, 2019; Mannion et al., 2021). Therefore, there is a need to extend the existing literature by exploring teacher talk to support EAP objectives in hybrid education, which has become prevalent in tertiary education worldwide, including Turkey. Furthermore, to the researchers' knowledge, no study thus far has identified both instructors' and students' views on scaffolding teacher talk strategies and their effectiveness in EAP contexts. To address these gaps, the current study attempted to explore the use of classroom talk to support EAP objectives in online and face-to-face lessons and to collect teachers' views on the scaffolding strategies they use and students' opinions on the effectiveness of these strategies. Hence, the research questions that guided the study were as follows:

1. How do English instructors use teacher talk to scaffold the objectives of online and face-to-face EAP lessons?
2. What are English instructors' views regarding their scaffolding strategies in online and face-to-face EAP lessons?
3. What are students' views on the effectiveness of scaffolding classroom talk in online and face-to-face EAP lessons?

Method

Setting and Participants

The study was conducted in the spring semester of the 2021-2022 academic year in the preparatory program of a foundation university in Istanbul, Turkey, with four English instructors and 61 students in their classes. Both instructors and students were given pseudonyms to protect their anonymity and confidentiality. The profile of the participating instructors is shown in Table 1.

The English preparatory program adopts a content-based approach that assists students in learning the content to perform various academic tasks and develop such academic skills as notetaking and paraphrasing to deal with the demands of their future academic studies. Since the beginning of the academic year, a hybrid mode of education has been implemented. Students have been given online instruction twice a week and face-to-face instruction on campus three days a week.

	Hazal	Adil	Sinem	Farah
Age	32	34	42	39
Nationality	Turkish	Syrian	Turkish	Iranian
Bachelor's degree	English Language and Literature	English Language and Literature	English Language and Literature	English Translation and Interpreting
Master's degree	English Language Education (in progress)	English Language Education	English Language Education	English Language Education
Certificate		TESOL	DELTA	CELTA
Level	Track 2 (Elementary)	Track 3 (Pre-intermediate)	Track 4 (Intermediate)	Track 5 (Upper-intermediate)
Years in the institution	5	3	14	3
Teaching experience	9	12	17	16

Table 1: The profile of the instructors.

Procedure and Data Analysis

First, permission was granted from the administration of the preparatory program, and ethics clearance was obtained from the university's Ethical Board. Four English instructors agreed to participate in the study. Before data collection, the first researcher visited the instructors' classes and informed students about the study. Signed informed consent forms were taken from both the instructors and their students. Data were collected through video recordings of 4 online and four face-to-face lessons, each of 50 minutes. Online classes took place on Zoom and were recorded to the cloud or on the computer by the instructors. The first researcher recorded face-to-face lessons by placing a camera at the back of the classroom to have a clear view of both the instructors and the classroom, including the whiteboard and another camera in front of the class to identify students unobtrusively. Lesson materials such as worksheets, reading texts, and texts on the chat box were also compiled as documentary evidence.

After lesson recordings, videos were transcribed verbatim, and transcripts were read iteratively to identify the excerpts that contain the scaffolding strategies employed by the instructors through teacher talk based on a framework taken from Van de Pol, Volman, and Westhuizen (2010), which consists of three scaffolding purposes (see Table 2).

Scaffolding purposes		Examples
Supporting metacognitive activities	Direction maintenance: The maintenance of the students' focus on a specific objective	"Now, we are going to watch a video about 3d printing."
Supporting cognitive activities	Marking critical features: The teacher draws the student's attention to the correct forms and compares the students' current knowledge with the desired level	"What do we call it, Ayşe, instead of pictures? What is it called?"
	Reducing the degree of freedom: The teacher's simplification of the task for students	"So, for the gist part, what do we normally do? Do we read fast? Quickly? Do we pay attention to details?"
Supporting student affect	Recruitment: Engaging the students in the activities	"In Istanbul, for example, there is too much traffic congestion, right? If you had a flying car, would it be good for you?"
	Frustration control: Keeping students motivated by praising	"Good, two correct answers in a row."

Table 2: The framework used in the study.

Following the analysis of the video transcripts, reflection questions adapted from Heron and Webster (2019) were shared with the instructors to identify the EAP objectives of their lessons and allow them to reflect on their lessons. Later, stimulated recall interviews with each instructor were conducted in English on Zoom, which took approximately 50 minutes each. During the interviews, they were provided with specific excerpts from their lessons selected based on the framework and asked why they used those strategies in their lessons. To help them recall the incidents, they were also shown the relevant parts in the videos. They were recorded to the cloud by the first researcher, transcribed, and analysed.

Finally, to collect students' views on the effectiveness of scaffolding teacher talk, certain students from each class (17 in total) were chosen purposefully and shown the same excerpts as in the stimulated recall interviews with their instructors. They were asked how effective each strategy used by their teacher was for their learning. All interviews were conducted online in Turkish except one in English with an international student, transcribed, and analysed.

Findings

This section reports how instructors used teacher talk to scaffold the objectives of online and face-to-face lessons (see Table 3) derived from the analysis of the lesson transcripts based on the framework above.

Objectives	Hazal	Adil	Sinem	Farah
Face-to-face lesson	"To identify advantages and disadvantages of three new inventions."	"To learn vocabulary and practice skimming and detailed reading."	"To understand key vocabulary, use them in a sentence, and practice scanning."	"To practice reading skills, i.e., skimming and exploiting the main ideas of the text."
Online lesson	"To plan to write by analysing advantages and disadvantages."	"To practice detailed reading using an outside material to check reading comprehension."	"To familiarize the students with the topic of art and design."	"To practice reading skills, i.e., skimming and exploiting the main ideas of the text."

Table 3: Lesson objectives.

Scaffolding Metacognitive Activities

Online. Instructors maintained direction by focusing on the short-term objectives of their lessons. For instance, Hazal asked students to choose one of the inventions covered in the class and write a letter to a friend describing the advantages and disadvantages of the invention. However, they also referred to long-term academic goals. Adil associated the current activity with the institution's assessment requirements by explaining the activity's importance. Besides, Farah connected the current task and an academic requirement (e.g., paraphrasing). Hazal and Sinem referred to the other assessment requirements of the preparatory program, such as avoiding writing personal ideas and using a particular pattern for writing definitions.

Pointing backwards (e.g., "We watched a video in the last lesson. What was the video about?") and forwards (e.g., "When you come back, it's time to go to a breakout room again to complete the outline and then prepare yourself for the presenting.") helped students make connections between and across the lessons. All instructors set time for activities to keep students focused on the tasks and organized interaction patterns (e.g., "Think about the answers to these three questions with your partners in breakout rooms").

Face-to-Face. Instructors used direction maintenance scaffolding by referring to the short-term goals. Adil stated: "In this lesson, we're going to do three things. First, we're gonna finish the vocabulary work in groups… After that, we will do one skimming activity, … then we're going to do detailed… reading using this layout." Nevertheless, Hazal also addressed long-term academic objectives by pointing out an assessment requirement of the institution while correcting a student's mistake. Moreover, Farah explained the characteristics of academic tasks (e.g., summary) and, as in Sinem's lesson, linked the current activity to an academic requirement, i.e., paraphrasing.

Instructors referenced past and future learning to allow students to make links between and across lessons. Farah reminded students of what they had learned in the previous class (e.g., cryptocurrency) to activate their schema. Additionally, they set time for activities (e.g., "You have 5 minutes to skim the last seven paragraphs.") and organized interaction patterns to keep students on task.

Scaffolding Cognitive Activities

Online. All instructors were supportive while correcting student mistakes and eliciting student responses. They marked critical features through recast, clarification requests, intonation, explicit feedback, and echoing correct answers for confirmation. Hazal and Sinem sometimes used the "yes, but" type of expression to imply an incorrect answer by avoiding discouraging students. Other strategies were eliciting and asking students to justify their responses (e.g., "Where is it [this information] in the text?").

They simplified activities by providing examples, asking questions, prompting, and modelling before a new activity (e.g., "You're writing a letter to your friend. How would you start?"). Hazal also accepted student answers in L1 to encourage participation. Furthermore, Adil broke down the activities into stages and checked students' understanding of the activity by asking instruction check questions (ICQs) (e.g., "Let's have a look at our detailed reading questions, …, there are two parts."). Finally, unlike other instructors, Sinem occasionally used L1 to ease students' comprehension of the target vocabulary.

Face-to-Face. The instructors' positive attitude was apparent while providing feedback and eliciting student answers. They all used diverse error correction techniques such as recast, intonation, elicitation, and explicit feedback and echoed correct answers for confirmation. They asked students to justify their answers to check their comprehension. Only Adil used choral practice to ensure students could correctly pronounce the target vocabulary.

They reduced the degree of freedom by giving examples, prompting, asking questions, and modelling a new activity (e.g., "Mess… which is not easy to clean. You know the gum? … It is sticky. So, this is a big mess."). As observed in her online lesson, Hazal accepted answers in L1 to motivate students to express their ideas. Adil broke down activities into manageable chunks, and Sinem used L1 to explain certain target vocabulary to ease students' comprehension. All instructors used ICQs to ensure students' understanding of the activities.

Scaffolding Student Affect

Online. Hazal utilized recruitment scaffolding by discussing shared experiences and helping students personalize the content (e.g., "You need to talk about it like an influencer."). Nomination was common among instructors to involve students in the activities and make them feel recognized and appreciated. Positive adjectives such as "Very good" were used for praising. They also maintained momentum to avoid distraction. Finally, they preferred "we" over "you" and positioned themselves as learners to remind students that they were a learning community.

Face-to-Face. Hazal used recruitment scaffolding by personalizing the lesson content and referring to shared experiences such as traffic congestion in Istanbul (e.g., "In Istanbul, …, there is too much traffic congestion, right? If you had a flying car, would it be good for you?"). All instructors nominated individual students to keep them immersed in the activities.

They used student names to demonstrate their recognition and appreciation (e.g., "Fatma, you're a nurse, right? Think about these robot suits. What can be the medical benefits?"). Moreover, Hazal approached a student and asked if she needed help because she was a weaker student. Unlike other instructors, Adil gamified checking answers to keep students engaged and motivated. They all maintained momentum and praised students using positive adjectives (e.g., "Very good. … continue with the third question, but be a little bit quick."). Finally, they used "we" and positioned themselves as learners to indicate that they were a team and to build a good rapport with students (e.g., "Now we are going to… check the advantages and disadvantages of these inventions.").

Instructors' Views on the Scaffolding Strategies

The following section presents the views of each instructor regarding the scaffolding strategies obtained through stimulated recall interviews. The strategies were similar in both online and face-to-face classes. Hence, they were reported regardless of the educational context.

Hazal. Concerning direction maintenance, Hazal explained that reminding students of the previous lesson's content and activating their schemata would ease students' understanding of the text to be covered in the current lesson. Therefore, she pointed backwards. Moreover, she set time for students not to get distracted and preoccupy with other activities, such as checking their mobile phones. Furthermore, she arranged interaction patterns so students could collaborate and learn from each other. They also would not feel isolated in the class or nervous because of missing the instructions. Finally, she reminded a student to answer a question according to the text, as in their institution, students were not allowed to write their personal opinions in the writing exam. They had to remember the book's content.

As for supporting cognitive activities, she gave examples to elicit the correct word from the students to make it more memorable, as they would match the word with the example. Besides, she accepted answers in L1 and continued the dialogue in English because students were worried about making mistakes in front of their peers. She ignored L1 utterances when her aim was students' content comprehension. Similarly, she modelled activities to assist students in completing them due to their low proficiency level. Moreover, she echoed the correct answer to indicate approval and for other inattentive students to hear it. Furthermore, checking instructions before starting an activity enabled everyone to listen to them again. Specifically, she asked distracted students to get their attention to the task and make others more alert. Finally, she gave feedback through recast to make students focus on the correct answer. She also used "yes, but" not to demotivate students and appreciate their effort.

Regarding supporting student affect, personalization kept students on the topic, fostered creativity, and allowed them to speak in English. She used nomination to engage distracted or silent students in the lesson. Besides, she referred to a shared experience since it would be easier for students to relate to and understand the content. As for the use of "we," she indicated that they were a team and wanted to create a learning environment where everybody supported each other. Regarding frustration control, she liked appreciating her students through positive adjectives, as they were lower-level students and needed more encouragement from their teacher.

Adil. Relating to direction maintenance, Adil shared the lesson objectives at the beginning to provide students with a structure to follow to increase their concentration. He also referred to

the previous lesson to build on their background knowledge. Besides, he arranged interaction patterns because weaker students could benefit from peer support and enjoy activities more. Finally, he mentioned the usefulness of the activity for the upcoming exam to catch the attention of disengaged students.

Regarding supporting cognitive activities, he used choral practice to strengthen students' pronunciation, as some students might mispronounce the words. Moreover, he used ICQs to ensure their comprehension of the task because some students were not focused when he first gave the instructions. Besides, he echoed the correct answer for confirmation. Furthermore, he reminded the use of new vocabulary in context because there was a gap in students' study habits. They focused on translating new words into Turkish instead of writing examples. Besides, he used recast not to discourage students from attempting to use the target language. He maintained momentum since some students were not engrossed in the task. He also asked questions about skimming to refresh students' memory about the activity and ensure they knew how to do it. Moreover, he asked students to justify their answers to ensure they answered knowingly and that other students could learn from their peers. Finally, he broke down the task into two parts so that students would not feel overwhelmed and manage the task efficiently.

As for supporting student affect, he used "we" to create a supportive learning environment and personalization as a way of comprehension check. He believed using student names made the classroom atmosphere friendlier so they could talk freely. Additionally, he gamified the answer check part and praised students for giving them a sense of achievement and a challenge to motivate them. Finally, he assigned responsibilities to some students because they were silent and would participate more if they had a duty.

Sinem. Regarding direction maintenance, Sinem referred to the previous lessons to activate students' schemata so that they could better understand the current lesson's content. She arranged interaction patterns so students could support and learn from each other. They would also feel more confident while sharing their answers with the class. Besides, setting time for activities aimed to prepare students for the exams in which they had limited time. Furthermore, she implicitly reminded them of some academic requirements due to assessments (e.g., writing exams). Finally, she told students what to do in the next lesson to create a lesson thread to reduce stress.

As for supporting cognitive abilities, she used L1 to help weaker students comprehend the target vocabulary. Recast was used not to discourage students and to prevent fossilization. She also echoed correct answers to ensure their understanding. Besides, she asked questions and prompted students to create an interactive classroom and facilitate their understanding of the tasks. Moreover, she asked students to justify their answers to make them explain the rationale behind their answers. Furthermore, she used "yes, but" to appreciate the student's effort while indicating an incomplete answer. She wanted students to realize their mistakes by raising intonation and offering an explanation if students did not understand the clue. Finally, elicitation helped students remember what they had learned.

Concerning supporting student affect, she gave an example based on a shared experience to help students internalize the target word. Additionally, she used personalization to connect students' background knowledge and the target vocabulary and nomination to engage distracted students with the lesson and alert others. She praised students for showing her

satisfaction with their answers and motivating them. Finally, she used "we" to create a friendlier and non-hierarchical atmosphere.

Farah. Regarding direction maintenance, Farah set time for activities to familiarize students with completing tasks in limited time, as in the exams. She also organized interaction patterns for students to correct their answers and interact with each other. Improving their critical thinking and teamwork skills was also significant, as the topics they covered at this level were more abstract. They would also be expected to be critical thinkers in their faculties. Besides, she focused on study skills since some students needed help with exam timing. Moreover, she referred backwards and forwards to create a lesson thread and facilitate learning. Finally, she emphasized some academic requirements in the institution (e.g., paraphrasing) to prepare students for their departments.

As for supporting cognitive activities, she asked questions about the skimming activity to check students' understanding of the task. Besides, she broke an activity into two parts to facilitate students' text comprehension. However, she also explained if the task was challenging or if students were confused. Moreover, checking instructions ensured that students knew what they should do. In addition, she used raising intonation to imply an incorrect answer and elicitation to help students remember what had been taught previously. Furthermore, explicit feedback was given if there was a misconception in students' minds. She also echoed correct answers for confirmation or to correct their pronunciation. She modelled activities to ease students' understanding and reduce teacher talking time. Finally, she asked students to justify their answers to ensure they were not simply guessing.

Regarding supporting student affect, she nominated individual students because they were distracted or sometimes knew the student could answer the question. During text exploitation, she mainly selected distracted students because it was essential for all students to see the content for the assessment. Furthermore, she kept the momentum to remind students to complete the activity faster. She also situated herself as a learner to show interest and guide students. Besides, she designed a jigsaw activity and assigned responsibilities to individual students to keep them involved in the lesson. Finally, she praised students for motivating them.

Students' Views on the Effectiveness of the Scaffolding Strategies

The current section reports the students' views regarding the effectiveness of the scaffolding strategies used by their instructors. They were presented holistically as the strategies were similar in both educational contexts and among the levels.

Concerning direction maintenance scaffolding, several strategies were found effective at all levels. Pointing backwards helped students link past and current learning, engage with the lesson content better and come to the class prepared. Thanks to pointing forwards, they could get ready for the next lesson. Setting time kept them on task and was good practice for the exams and their departments. Besides, all students knew the academic requirements in the institution and their significance for their exams and future studies. Therefore, even when their instructors implicitly referred to long-term academic goals, they were aware of the rationale behind those activities. Moreover, they believed organizing interaction patterns was an excellent opportunity to learn from their peers. However, some people did not focus on the task or spoke in L1, which impeded their learning. It could also be time-consuming since they started chatting with others. Furthermore, Track 3 students believed that setting goals for the

lesson at the beginning helped them get mentally ready to handle the activities efficiently. Focusing on study skills was found effective by Track 5 students.

Relating to marking critical features, students at all levels indicated that their instructors used elicitation to check their engagement and make them use the target language. It helped them focus on the lesson content and made learning memorable as they were mentally involved. Besides, they believed that their instructor echoed the correct answer for confirmation. It was also a good opportunity for other students to hear the answer in case they missed it and correct their pronunciation. Additionally, checking instructions allowed them to understand the task better, clarified misunderstandings, and helped them concentrate on the activity if distracted. Moreover, intonation as a feedback technique was considered adequate because it allowed students to think more critically and find the correct answer independently. However, one student from Track 4 indicated that it could be stressful for the student due to their low self-confidence. Besides, students believed that explicit feedback should be provided if a student struggles to find the correct answer after receiving some clues from the instructor. Nevertheless, one Track 5 student stated that students could easily forget the feedback or get stressed. Furthermore, recast motivated them to speak as their mistake was not explicitly pointed out in front of the class. However, one student from Track 4 indicated that the effectiveness of this strategy depended on students' concentration level. Similarly, when the instructor said "yes, but", students could self-correct without being discouraged or offended. Besides, asking for justification prevented cheating, particularly in online lessons, and challenged them to do the tasks properly. Finally, Track 3 students found choral practice helpful as they could correct their pronunciation errors.

As for reducing the degree of freedom, students at all levels believed that examples assisted them in recalling the target information by making associations. Modelling made students more confident in performing tasks and helped them focus on the activity. Furthermore, asking questions and prompting helped them understand activities better and kept them on task. However, if it was a familiar task, it could lead to time waste. Additionally, breaking an activity into parts allowed them to manage the task and avoid distractions efficiently. Finally, Track 2 students stated that when their instructor allowed them to use L1, they felt less stressed. Similarly, Track 4 students believed that Turkish translation helped them grasp complex vocabulary.

Regarding recruitment scaffolding, personalization and referring to shared experiences were effective at all levels because they made learning permanent, relatable, and memorable. Similarly, being nominated by their instructor meant they could answer their question. However, some believed that it indicated they could have been more attentive. Thus, they became more alert and interested. It was particularly beneficial for online lessons. Besides, using "we" built a bond between the instructor and students and created a sense of community. Moreover, maintaining momentum kept students focused on tasks, but could be considered pressure by some students. Furthermore, assigning responsibilities in breakout rooms kept them on task during activities in Tracks 3 and 5. Finally, Track 3 students believed gamification motivated them. Regarding frustration control, all students found positive adjectives helpful as they encouraged them to participate more, improved their concentration, and boosted their self-esteem. They also emphasized the importance of a stress-free learning environment.

Discussion

The current study attempted to identify how English instructors used teacher talk to scaffold the EAP goals in a hybrid context. One unexpected finding was that the face-to-face and online lessons regarding scaffolding talk were similar. A recruitment scaffolding strategy was utilized in the online classes (e.g., assigning responsibilities) to keep students immersed in the activities, which the students found compelling. Besides, students believed that asking for justification prevented cheating, particularly in online lessons.

The analysis revealed that all instructors supported the EAP objectives of their lessons by using metacognitive, cognitive, and affective scaffolding strategies. Metacognitive scaffolding through direction maintenance focused on the short-term goals of the lessons and academic requirements in the institution, which derive from future academic expectations. The instructors connected the current lesson with previous and future learning (Hammond & Gibbons, 2005), set time limits, and arranged interaction patterns. Besides, they used modals of obligation. These findings concur with the study of Green (2015), who recommended that EAP instructors should explicitly refer to future academic objectives and extend their classroom activities to future academic procedures. Furthermore, they also support Lee's (2016) study in that EAP instructors contextualize classroom activities and explain the rationale behind the tasks. However, the findings contrast with Heron and Webster (2019), who suggested that in pre-sessional courses, instructors used scaffolding talk for micro-goals of the lesson. The study demonstrated that even in an English preparatory program, instructors referred to the broader goals related to the curriculum. Besides, in the stimulated recall interviews, the instructors and their students linked certain direction maintenance strategies with future academic practices.

The instructors in the study scaffolded cognitive activities by marking critical features through error correction, asking for justification, echoing student answers, which are commonly used in non-EAP contexts (Hammond & Gibbons, 2005), and simplifying the activities for students by breaking them down, asking questions, and prompting. In line with Heron and Webster's (2019) study, the instructors in the program elicited the requirements of an academic task or skill from the students in both face-to-face and online lessons primarily for preparation and comprehension check purposes, as supported by the stimulated recall interviews with the instructors. Overall, students found the strategies used by their instructors effective, with some individual differences. Thus, it is recommended that instructors adapt their scaffolding talk based on students' needs and expectations.

The participating instructors supported student affect through praising and recruitment strategies such as personalization, referring to shared experiences, nomination, and establishing a sense of community. They also adopted a positive attitude while providing students feedback by accepting partial answers and confirming their correct responses. These findings resonate with several studies in the literature (Alexander, 2012; Heron & Webster, 2019; Wilson, 2016). Furthermore, in the stimulated recall interviews, the instructors and their students discussed the significance of a stress-free classroom atmosphere and motivation.

Conclusions

To conclude, the study revealed that instructors scaffolded metacognitive, cognitive, and affective activities using various strategies. Besides, the stimulated recall interviews with

instructors demonstrated that they used scaffolding teacher talk purposefully, focusing on institutional and academic requirements and student needs while disregarding differing needs of instructional contexts. Finally, although students primarily benefitted from the scaffolding strategies, several individual differences were observed.

It should be noted that some interactions with students during the instructors' monitoring were inaudible due to the cameras' positions. Thus, they could not be transcribed and analysed. Overall, the present study contributes to the existing literature in several ways. First, it highlights how teacher talk is used to achieve EAP objectives in a hybrid context. Secondly, reporting their perceptions regarding the scaffolding strategies creates awareness in EAP instructors and provides an opportunity to reflect on their practices. Finally, students' views on the scaffolding strategies offer insights into their effectiveness and inform practitioners regarding students' needs and expectations. Future studies might compare student achievement with the scaffolding strategies used by instructors.

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Art and Sports Images as an Approach for Teaching and Learning in Art and Physical Education Curricula

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Abstract
Art and sports are two domains that have traditionally been considered separate entities within educational settings. However, by combining these disciplines, educators can create a more holistic and interdisciplinary learning experience for students. This paper examines the potential benefits of using art and sports images as educational tools, including enhancing creativity, fostering critical thinking, promoting cultural understanding, and improving physical literacy. By embracing this approach, educators can provide students with a comprehensive and engaging learning experience that nurtures both their artistic and physical abilities. Therefore, the current research project aims to investigate the perceptions of in-service art and physical education teachers' knowledge and benefits of integration between the plastic arts and school sports curricula, as well as the challenges that impede its achievement in the Sultanate of Oman. The researchers used descriptive-analytical as a research methodology in order to achieve the objective of this paper. As a result, this research demonstrated the examples of successful forms of integration between art and sports images into art and physical education curricula. It shows that the art and sports images gives both Art and Physical teacher's great opportunities to extend and share their disciplines experiences and skills in teaching and learning processes. It also confirms that this relationship can be seen in terms of Aesthetics, Ethics and Emotion, Olympic Art, Sport and Art, Contemporary Art and Contemporary Sport and other aesthetic potential of both discipline. Furthermore, the integration can be expanded not only on school setting but also at the higher education level and the community wild large. Therefore, Art and Sports Images can be used as an approach for teaching and learning in Art and Physical Education Curricula. Final, this research is an ongoing investigation where the empirical and experimental study will be addressed in coming stages of this funded research project.

Keywords: Art and Sports, Artistic Images, Physical Education, Art Education, Interdisciplinary Teaching and Learning Approach

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Introduction

In recent years, a growing body of research has emerged that examines the potential benefits and challenges of integrating art and sports. As this field continues to evolve, it offers educators, practitioners, and researchers' valuable insights into creating innovative and holistic approaches to teaching, learning, and athletic performance, where the integration of across subjects and disciplines in education has gained recognition as a powerful and effective approach for enhancing teaching and learning (Snyder, 2001).

Various literature review examines the benefits of using art and sports images in education, including fostering creativity, promoting critical thinking, enhancing cultural understanding, and improving physical literacy (Garcia-Puchades & Chiva-Bartoll 2020; Edgar 2020; a2013; b2013 & c2013; Wildman & Archer, 2019; Shorkend 2018; da Costa & Lacerda 2016; Ilundáin-Agurruza, 2014; Borge, 2012; Lacerda, 2011). However, investigating the relationship of Art and Physical Education are limited in the Middle East, where this relation in the Western countries is obvious and in advance position not just in the school setting but also in the higher education and in the community wild-large. An improvement was noticed in both discipline, as well as changes in research directions and in teaching and learning processes. The current published researches forced on new possibility to explore and examine this relationship with no adopt that this knowledge integration has resulted a major effect in student's academic achievements in both disciplines. Researches such as (G investigate this relationship in terms of Aesthetics, Ethics and Emotion, Olympic Art, Sport and Art, Contemporary Art and Contemporary Sport and other aesthetic potential of both discipline.

In his Book, Taylor (2021) provides a comprehensive comparative study about the relationships between the philosophy of sport and art with references to relative merits of both discipline including the challenges facing this relation. Wildman & Archer (2019) argue that "some games essentially involve aesthetic engagement with artworks. One type of game that seems to do so is dual-natured games, works that are both games and artworks. If utopians were to play such games, then they would be engaging with artworks" (p.456).

As C.L.R. James, cited in Edgar c2013, argues the possibility that sport can be appreciated as one of the art forms from aesthetic perspective. Edgar (c2013) "primarily concerned with the aesthetic attitude, and thus the sort of stance one must adopt to art, or to any other object or event, in order to appreciate it aesthetically" (p. 80). In this study, he aims to provide an initial review of the idea of an aesthetics of sport, and in particular to assess the ideas of the aesthetic attitude and the content of an aesthetic experience with respect to sport. He concluded that "I have sought to distinguish a trivial sense of aesthetic judgement – whereby anything experienced can be assessed from an aesthetic point of view – and a more profound aesthetics that responds to sport as sport may be taken to support much of James's argument (p.96).

On the other hand, Al-Amri et al. (2021) further explored the forms of integration between visual arts conducted previous research in Oman and physical education from student is prospective. Outreached data showed high positive desire towards integration approaches between the two disciplines especially on the cognitive concepts and aesthetics domains, and impress its importance on the educational process as a whole. Also, Sanajla (2013) investigates the relationship between physical activities and fine arts from the perspective of teachers of physical education and fine arts in the schools of Irbid in Jordan. His study showed that there was a high relationship between the activities in both disciplines and on

statistical significant differences in their perspectives in terms of gender, experience and qualification. In addition, Al-Kuwari (2007) aims to design a program based on sport and art to measure its impact in developing communication and social skills among autism children in Qatar. The results showed high effectiveness in developing these skills with significant differences between the pre and posttests.

Murad (2013) conducted a study aimed to measuring the effectiveness of educational activities based on the integration between artistic materials and vocational training in developing practical skills and achieving industrial security and occupational safety for students of the industrial secondary school. In light of this, the results showed the effectiveness of the activities based on integration approach contributing effectively in developing both the knowledge and practical skills among female students, as well as achieving industrial security and occupational safety.

Moreover, El-Shazly et.al (2013) also conducted an integrative study between sports, health, tourism, culture and the arts, with the aim of reaching integrative creativity between those disciplines. This study used the descriptive approach to concepts related to sports, health and happiness of the human body. Where this study indicated that there are many studies in various branches of health that exercise mainly affects the body's secretion of many hormones that work together for human growth in a healthy and balanced way, including the growth hormone associated with the arteries and activities as a source of energy in the muscles. This study indicated positive impact on the nervous system as a result of exercise, activation of neurons, and the development of sensory perceptual abilities, which include sight, hearing, touch, sensation and balance, all of which work to adjust the internal kinetic rhythm of the human being. The results of this study showed positive relationship between art and sport in relation of tourism, and one of the most important findings is that historical studies of sports, health, tourism and art contribute to understanding and understanding the different phases that accompanied it throughout history until it reached what it is. The creative relationship between sports, health, tourism and art is all a manifestation of the civilization of nations.

Mohamed (2012) aims to measure the effectiveness of using the learning of style for perfection and caricatures drawings on learning some handball for students of primary schools. The result of this study shows that the learning by using caricatures drawings and learning for perfection style have a positive effect on developing hand ball skills for students in the experimental group. Some recommendations were formulated to adopt this learning strategy in the primary schools.

Adding to previous, Ishiguro et al. (2023) conducted a longitudinal study aimed to investigate whether engagement in extracurricular arts activities and corresponding performance in art classes demonstrate a favorable connection with overall academic achievement. The study involved 488 seventh-grade students (259 boys and 229 girls) and spanned a period of over two years. Data encompassing their involvement in extracurricular music and visual arts activities, as well as their academic performance in various subjects (Japanese, Social Studies, Mathematics, Science, and English), music, and arts were gathered at the conclusion of both seventh and ninth grades. The outcomes of the study revealed a positive link between participation in extracurricular music and visual arts activities and advancements in general academic performance between seventh and ninth grades. Moreover, this association was found to be connected with shifts in scores for music and visual arts. These findings emphasize the potential of arts education to enhance overall academic achievement.

Hence, this present study has the potential to clarify a more reflective understanding of the integration of artistic images as an approach to teaching and learning. As a result, the interplay between art and sports transforms into a lively and interactive exploration. This strategy supports creativity, fosters critical thinking, enhances cultural consciousness, and promotes physical literacy. Ultimately, it provides a complete educational experience that goes beyond the limitations of conventional classroom disciplines.

Statement of the Study

The integration of art and sports images in education has gained recognition as a powerful and effective approach for enhancing teaching and learning. This literature review examines the benefits of using art and sports images in education, including fostering creativity, promoting critical thinking, enhancing cultural understanding, and improving physical literacy. By incorporating these visual elements as stimuli, into educational contexts, educators can create engaging and interdisciplinary learning experiences for students (Hammond et al., 2020). It provides them with deeper opportunities to look, to talk, to write, and to think deeper as part of the process of teaching and learning (Swindlehurst, 2008). Art and sports images serve as powerful tools that engage students and provide meaningful contexts for learning, ultimately enriching educational experiences and preparing students for a diverse and interconnected world (Snyder, 2001). However, in Arab countries, the case is quite different; integration and relationships between art and sport in teaching and learning environment are limited, even missing and/or no implementations for such teaching model by any teaching institutions.

On the other hand, the relationship between art and sports might be evident for the professional parties in society, especially in terms of art-sport images, which are represented in different forms and concepts such as movement, rhymes, harmony, aesthetics, and unity. The art-sport images can be seen easily in Olympic sports events and the different formats such as posters, sculptures, designs, paintings, and multimedia forms. Through these images, artists bring a strong relationship between art and sport, and this relationship must be introduced to educators, researchers, teachers, and students in both disciplines.

Certainly, the integration of artistic images as an approach to teaching and learning in both Art and Physical Education (PE) curricula offers an enriching way to explore the relationship between art and sports. This approach capitalizes on visual engagement and creative expression, fostering a deeper understanding of both disciplines while promoting holistic development. Therefore, the main aim of the present study is to investigate the relationship between art and sports using artistic images as an approach to teaching and learning in Art and Physical Education Curricula. However, through this investigation, the following aims are expected to be achieved:

1. Introducing the relationship between art and sports as it indicated in the literature of both discipline.
2. Identifying the possible art and sports images, which can be used in Art and Physical Education Curricula.
3. Providing art and physical teachers within instructional method in systematic terms to introduce the art and sports images as an approach to teaching and learning in Art and Physical Education Curricula.

Methodology

The descriptive-analytical method will be used as a research methodology in order to achieve the aims of the current study. It will be used to analysis and interpret the potential of Art and Sports Images for teaching and learning approach in Art and Physical Education Curricula. Different levels of relationship were discussed in this study using artistic images from posters, sculptures, designs, paintings, and multimedia forms.

Art and Sports Images

Art and sports images provide a rich source of inspiration for creative expression. By engaging with visual representations of artistic and athletic endeavors, students are encouraged to think imaginatively, explore new ideas, and experiment with different artistic techniques and physical movements. This process stimulates their creativity and allows them to develop their unique artistic and physical abilities. The integration of art and sports images encourages students to think beyond conventional boundaries and fosters a sense of innovation and originality.

In service teachers will use those art samples to encourage students to observe and discuss the visual elements, such as color, composition, and movement, in both artworks and sports photographs. In addition, teachers will use it to guide them in interpreting the meaning, emotions, and messages conveyed by the images. This strategy develops critical thinking skills and encourages students to articulate their observations and interpretations.

The following Art and Sports Images are to examples of interdiscinary relationship including concepts such as movement, balance, rhymes, harmony, aesthetics, and unity. The Content, style, techniques and media are also examined in order to show this aesthetics relation. Another approach is to invite students to create art inspired by sports images. Provide students with a range of sports photographs, action shots, or team logos as visual references. Students can then create their own artwork, such as paintings, drawings, or collages, incorporating elements of sports imagery. This strategy encourages creativity and allows students to explore the intersection between arts and sports (figures, 1, 2& 3)[1].

[1] All artworks were taken from open sources in the internet.

Artwork (1), Fitness social relationship sport people logo
Vector Art-I

Artwork (2), Fitness social relationship sport people logo
Vector Art-II

Artwork (3), Fitness social relationship sport people logo
Vector Art-III

Artwork (4), Art & Sport logos

Figure 1: Art and Sport loges

On the other hand, integrated physical activities that are inspired by art into physical education lessons are quite common. For example, students can engage in movement exercises that mimic the shapes, lines, and patterns found in artworks. They can explore dance or perform choreography inspired by paintings or sculptures. This strategy connects the visual and physical aspects of learning, reinforcing the interdisciplinary nature of art and sports.

Artwork (5), High quality Greek Marble Sculpture

Artwork (6), Female Player Sculpture

Artwork (7), Olympians Sculpture by Michael Alfano

Artwork (8), The Chase 2, Sculpture by Michel Tizzano

Artwork (9), " i-got-it,-no,-i-got-it", Sculpture by Richard Stravitz

Artwork (10), Sculpture of Sir Stanley at different stages of his football career by Sculptors Julian Jeffrey, Carl Payne and Andy Edwards

Figure 2: Art and Sport Sculptures

Artwork (11), I found it

Artwork (12), Modern Sports

Artwork (13), Poster for Sport

Artwork (14), Deposit photos Lustration Sport

Figure 3: Art and Sport Design

Conclusions

The current study demonstrated the examples above as a successful form of integration between art and sports images into art and physical education curricula. By engaging students in activities such as creating art inspired by sports, analyzing sports images, studying sports advertisements, analyzing movement in sports photography, and artistically interpreting sports moments, teachers can foster creativity, critical thinking, and interdisciplinary connections. These examples highlight the potential of art and sports images to enhance student engagement, deepen understanding, and create meaningful learning experiences in both art and physical education. It shows that the art and sports images gives both Art and Physical teacher's great opportunities to extend and share their disciplines experiences and skills in teaching and learning processes. It also confirms that this relationship can be seen in terms of Aesthetics, Ethics and Emotion, Olympic Art, Sport and Art, Contemporary Art and Contemporary Sport and other aesthetic potential of both discipline. Integration can be expanded not only on school setting but also at the higher education level and the community wild large. Therefore, Art and Sports Images can be used as an approach for teaching and learning in Art and Physical Education Curricula.

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Using Technology at Community Colleges to Equip Adult Learners for Employment: Digital Divide a Challenge

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Abstract
The world has entered the fourth industrial revolution (4IR) and South Africa is no exception. In order not to be left behind, everyone needs to embrace 4IR. This study emanates from the Adult Community Education and Training (ACET) programmes that are offered at community learning centres in the rural area of Limpopo Province whereby, facilitators (practitioners/adult educators) have raised concerns on how they can incorporate technology in their teaching and learning. These community learning centres cater for those who are not in employment, education or training (NEET) and serve as the safety net for this group of people. The purpose of the study was to establish whether technology is used in the teaching and learning of ACET programmes. Qualitative approach was adopted with case study design. Individual interviews and focus groups, were used for collecting data. The findings of the study were that technology is not used in the teaching and learning of ACET programmes due to the digital challenges. In conclusion, this study indicates that ACET practitioners should use technology in their teaching and learning in order to equip adult learners for employment. Therefore, adult educators at community learning centres need to be empowered with technological skills.

Keywords: Adult Learners, Facilitators, Technology, Digital Divide, ACET Programmes, Employment

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Introduction

The fourth industrial revolution (4IR) has begun in the world, and South Africa is no exception. Everyone must adopt 4IR if they do not want to fall behind. This study was inspired by the Adult Community Education and Training (ACET) programmes that are provided at community learning centers in Limpopo Province's rural areas, where facilitators (practitioners/adult educators) have voiced concerns about how they can use technology in their teaching and learning. The production of qualified teachers who can provide online education and high-quality training has long been a difficulty for South Africa (Hofmeyr & Draper, 2015). According to Zoch and Myers (2017), professional development is a crucial tool for assisting in-service teachers in incorporating technology into their daily interactions with students. Since community learning centres (CLCs) provide as a safety net for persons who are not currently enrolled in any type of job, education, or training (NEET), it is imperative that adult educators be empowered in the use of technology in their teaching and learning of ACET programmes. This can assist them in equipping adult learners for employment through using technology in their daily teaching and learning. The study's goal was to determine whether technology is employed in ACET programme teaching and learning in order to equip adult learners for employment in the digital era. The study is a component of the 2022 thesis. The importance of technology literacy in enabling teachers to apply a blended learning approach throughout their teaching and learning has been highlighted in a significant amount of literature (Goodwin-Jones, 2000; Blau & Shamir-Inbal, 2017; Mutohar, 2012). Mhlanga and Moloi (2020) noted in their study the detrimental effects on teaching and learning brought on by the incapacity to employ technology, particularly in the face of unforeseeable events like the Covid-19 pandemic. In addition, Brown-Martin (2017) noted in his research the significance of digital literacy in assisting students in growing their capacity for adaptation to engage in the global digital society.

The examination of technical gaps at community colleges and the methods used to bridge such gaps have received less attention in the literature. By examining how community colleges use technology to prepare adult learners for work and how a digital divide might be a difficulty, this study aims to fill that gap in the body of literature. The study can assist adult education practitioners, academics and government representatives in realising how crucial it is to use technology at community colleges to prepare adult learners for jobs in the digital era. This study is indirectly a response to a call for research (Kayembe and Nel, 2019) that encourages the creation of online training programs, particularly in Community Learning Centers (CLCs) that are located in areas of extreme poverty.

The research question formulated for the study was:

How is technology employed in community colleges to equip adult learners for employment?

The sub-questions for this study were:

- Which technology tools are employed at community colleges to prepare adult students for employment?
- What difficulties do community colleges have in using technology to prepare adult learners for the workforce?
- What approaches may be used to solve the problems with technology use at community colleges?

Aim

The purpose of the study was to establish whether technology is used in the teaching and learning of ACET programmes and to seek suitable approaches that can be used in mitigating the challenge of digital divide at community colleges.

Objectives

- To conduct research and data collection to identify the barriers faced by adult learners in accessing and effectively using technology, with a focus on the digital divide.
- To establish partnerships with technology companies to secure funding, equipment donations, and software licenses for community colleges.
- To advocate for policy changes and funding initiatives at the local, state, and national levels to support technology integration efforts in community colleges.

The article below is outlined as follows: the theoretical framework, the literature review, which are followed by the outlining of the sample and methods of collecting data. There is a discussion of the findings and as well as a summary with recommendations.

Theoretical Framework

The study is about using technology at community colleges to equip adult learners for employment. It is therefore, underpinned by digital divide framework for online learning of Mathrani, Sarvesh and Umer (2021). They drew from digital divide framework from Pachler, Cook, and Bachmair's (2010) socio-ecological framework that separates out three analytical perspectives, namely structure, cultural practices and agency. Mathrani et al (2021) agree with Bannan, Cook, and Pachler (2016), that learning as a social phenomenon, does not take place in one location but also across communities, locations, time, social context and sites of practice. Figure 1.1 below shows Digital Divide Framework at Community Colleges.

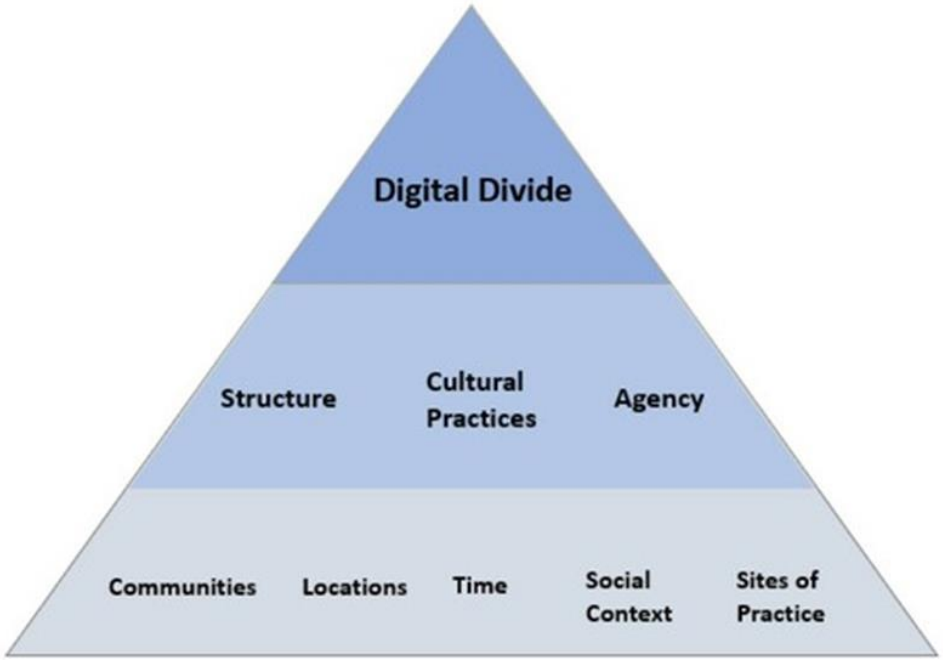

Figure 1.1 Digital Divide at Community Colleges
(adapted from Mathrani, Sarvesh, and Umer, 2021)

Digital divide framework examines the disparities in access to and usage of technology among different groups (Chowdhury, G., McLeod, J., Gillet, V., & Willett, P. (Eds.). (2018). The first layer in the figure1.1 above, shows that the community college exists in a community with its challenges regarding the resources available in the community, for instance limited or none existence of computers. The location of the community learning centres (as delivery sites) influences the connectivity in the sense that remote areas are hard to reach. The time of the day and the load shedding schedule of power supply affects the access to internet. The sites of practice, which are community learning centres without technology resources, for example, not a single computer can be found let alone for administrative purposes.

The next layer of challenges has the structure, which poses the risk of limited technological infrastructure. Community colleges in rural areas can experience unstable infrastructure whereby users can only opt for basic phones for network connectivity (Mathrani, Umer, Sarvesh and Adhikari, 2023). On the other hand, the socio-cultural norms can have influence in digital literacy whereby individual has to make choices in terms of learning. This study agrees with Pachler et al.'s socio-ecological outlook and Bannan, Cook, and Pachler's (2016) view that learning is framed within communities, locations, time, social context and sites of practice.

In the context of community colleges, this framework recognizes that adult learners may face various barriers such as limited access to technology resources, lack of digital literacy, and socio-economic factors. Addressing the digital divide requires interventions that promote equal access to technology, provide training and support for digital literacy, and consider the unique needs and challenges of adult educators.

Literature Review

The application of technology in the teaching and learning environment and the teachers' successful integration of technology in their classrooms has been the center of vigorous debates in the field of teacher education (Lee, & Lee, 2014). This study agrees with the existing literature (Vongkulluksn, Xie, & Bowman, 2018; Zheng, Warschauer, Lin, & Chang, 2016; Gray, Thomas & Lewis, 2010) that there is increasing use of computers by teachers and students in European countries.

Digital Divide in Community Colleges

The digital divide refers to the unequal distribution of technology resources and access among different groups. Studies have shown that adult learners in community colleges often face barriers such as limited access to computers, internet connectivity, and lack of digital literacy skills. The digital divide can exacerbate existing socio-economic disparities and hinder adult learners' ability to acquire the necessary technological skills for employment.

In South Africa, there is an increase in the use of digital devices amongst the haves than the have nots (Chisita, Enakrire, Durodolu, Tsabedze, Ngoaketsi, 2021). The truth is, at community colleges that are in remote areas just like in the rural schools of developing countries, technology is less practiced due to the digital divide caused by lack of infrastructure and access to Information Communication Technology (ICT) facilities (Koirala, 2019).

Integration of Technology in Community Colleges

Researchers have explored various approaches to integrating technology in community colleges to enhance adult learners' employability. These approaches include implementing computer-based instruction, online learning platforms, and mobile applications. Studies have found that technology integration can provide flexible learning opportunities, improve engagement, and foster digital literacy skills among adult learners.

Concerns about unsuccessful practice of teacher education programs for technology integration were raised (Lee, & Lee, 2014). The reason being that traditionally teacher training courses for the use of technology dealt with mastering technical skills of using computer software and neglected how to link these technology skills to curriculum and teaching methodology and this left many teachers with lack of confidence to apply technology in their day-to-day teaching (Ertmer & Ottenbreit-Leftwich, 2010; Goktas et Yildirim & Yildirim, 2008).

Benefits of Technology Usage for Employment

The literature emphasizes the potential benefits of technology usage for employment outcomes among adult learners in community colleges. Technology-enhanced learning can equip adult learners with relevant digital skills, enhance their problem-solving abilities, and improve their overall employability. Studies have reported positive correlations between technology usage and job attainment, career advancement, and higher earnings.

The United Nations Educational, Scientific and Cultural Organization (UNESCO) 2014, sees the application of ICT as one way of reaching students with poor or no access (especially those in rural and remote regions) by providing them with new skills sets to enhance learning. The ICT skills acquired, not only make teaching and learning activities more meaningful and efficient (Koirala 2019), but they also help students relate school experience to work practices and create economic viability for tomorrow's workers (Dulal, 2019). Dulal (2019) further postulated that technology use of technology helps achieving the following namely, linking the learning to information and education, help the learners to visualize the problem, link the learner to learning tools and track the progress, increase the productivity of teachers in terms of time management, acquire the accurate information quickly, produce materials and keep the record. According to Assche, Rifon, Griffiths, Liwin and McNicol (2015), all the above advantages of using technology will be made possible only when pedagogical innovation exists that is, when teachers modify approaches in teaching and learning.

Challenges and Barriers

Researchers (Vongkulluksn, Xie, & Bowman, 2018, Ertmer, Ottenbreit-Leftwich, Sadik, Sendurur, & Sendurur, 2012, Ertmer and Ottenbreit-Leftwich, 2010) have identified several challenges and barriers associated with using technology to bridge the digital divide. These include limited infrastructure, inadequate funding, lack of technical support, and resistance to change. Additionally, studies have highlighted the importance of addressing digital literacy gaps, ensuring accessible technology, and addressing socio-cultural factors that may affect technology adoption among adult learners.

On the other hand, Dulal's (2019) findings indicated that most teachers from developing countries are not familiar with the use ICT tools, something that warrants capacity building and development by ICT experts.

Strategies, Policy and Institutional Support

Research (Danai, 2022; Bruno, 2019) affirms that educational institutions and organizations are resorting to the use of mobile technologies for an example use of cellphones as the new learning medium. This suggests that incorporating technology into pedagogical practices can enhance adult learners' motivation, engagement, and knowledge acquisition. A wide range of literature (OECD, 2004, 2005; Tomte & Hatlevik, 2011) affirms that the governments of developed countries are investing in ICT integration in their schools in order to improve the education quality of their teaching systems. This study advocates for comprehensive policies that prioritise technology infrastructure development, funding initiatives for technology resources, professional development for instructors, and collaboration with industry partners can assist in addressing the digital divide at community colleges especially in rural areas.

The capacity building initiatives will help adult educators at community colleges to keep abreast of changes in their profession by adopting modern technological means, such as computerization, multi-media devices, mobile phones, audio-visual applications, and social media, to optimize their teaching instruction (Alqahtani, 2019). Educators will then start to plan more effective lessons, provide learning opportunities and prepare students to compete in communication, collaboration, critical thinking, and creativity with the help of ICT (Bhandari, 2020).

Methodology

This study employed a qualitative case study research design to gather comprehensive data on the use of technology at community colleges for equipping adult learners for employment. This approach used qualitative data collection and analysis techniques to provide a more holistic understanding of the digital divide challenge and potential solutions.

A group of 10 participants was purposefully selected 10 from four community learning centres (CLCs) in the rural village of Limpopo Province. The semi-structured individual interviews as well as focus group discussions were used to harness data and the two methods allowed adult practitioners as well as adult learners to provide the facts of the matter as well as their opinions about the integration of technology (Yin, 2009).

An interview guide was prepared before conducting the interview. The individual interviews took place telephonically and lasted between 35-40 minutes each. We conducted one face-to-face interview with ten participants. A focus group discussion took place in one of the centres and lasted for an hour each. Before commencing with the focus group discussion, participants were given a paper to list all technological tools they employ in their teaching and learning of ACET programmes. They were also asked to list the challenges they are faced with regarding using technology in their daily teaching and learning. There after discussions commenced based on what was on the list. Probing questions were asked to get more information. Data were analysed using a thematic data analysis approach from Bricki and Green (2007). Using this method, the researcher looked across all the data and identified the common issues that recurred, thereafter, the main themes that summarise all the data collected were summarised.

Themes that emerged from this study were: Lack of access to technology resources infrastructure, Lack of digital literacy, and socio-economic factors.

Limitations

It is important to acknowledge potential limitations of the study. The findings may be influenced by the specific context of the selected community colleges and may not be generalizable to all community colleges. The sample selection may introduce bias, and the self-reported nature of data collection methods may be subject to response biases. However, efforts were made to mitigate these limitations through rigorous data collection, analysis, and triangulation of findings.

Research Ethics

This study was part of the thesis produced by the researcher in 2022. The ethical clearance certificate was obtained from the institution, as well as from the Department of Higher Education and Training (DHET), from principals and managers of the selected Community Education and Training (CET) colleges and Community Learning Centres (CLCs), respectively, before the research project commenced. The participants were informed about the purpose of the research study (Nijhawan, Janodia, Muddukrishna, Bhat, Bairy, Udupa, & Musmade, 2013) and also requested to voluntarily sign consent forms. They were informed that their willingness to participate in the study was voluntary and they were free to withdraw from it at any time they wished to do so.

Participants provided written informed consent to declare their voluntary participation. For anonymity purpose, especially of facilitators and l managers, I did not use the names of the selected colleges. Furthermore, I used pseudonyms to label all participants. I maintained the principles of confidentiality, trust, and protection from harm for my participants (Surmiak 2020).

Findings

Technological Devices Employed by Adult Educators

Adult educators (facilitators) were given a paper to list technological devices that they used during their teaching and learning, and it became evident that only a few devices were used namely, computer, data projector, and cell phones. Out of the ten participants only five reported to have used technological tools and the other five did not use them.

When those who were using the technology devices were asked, what they used them for:

Participant A said: The centre does not have computers and I use my personal laptop to do lesson preparations, set monthly tests and record learners test marks.

Participant B added: we have no computer lab at this centre. I sometimes visit the clinic to ask the nurse for clarity on certain topics of Ancillary Health Care. Some of the topics are challenging.

Participant C remarked: I use my computer at home download videos and will play such videos using the data projector. Learners like the videos and they understand better.

Participant D supported participant C: I compile notes using my personal laptop on topics that have many diagrams e.g. Mathematical diagrams Using a projector makes my teaching easier because I am not good in drawing.

The findings indicated that WhatsApp was commonly used by almost all educators, out of ten eight of them used it for various purposes namely.

Participant E declared: I use WhatsApp for communication and information sharing. Participant B on the other hand remarked: I use WhatsApp for sharing knowledge and giving the learners activities. I also use it for revision- sending learners question papers for revision. During the lockdown, the use of WhatsApp was so important because I gave learners work while they were at home.

The use of the technology devices was not frequent- educators used the tools once in a while. When participants were asked how often they used the tools, this is what **participant D** said. I only use projector to teach some topics which have more diagrams- I use it once per quarter.

Participant C indicated: I like learners to watch the videos, but we have only one projector, so I use it twice in a year. Another thing is that these videos are too long and our periods are 45 minutes.

Educators who use WhatsApp, used it regularly and indicated this:

Participant F comment: I give learners extra activities almost every week via WhatsApp, but they do not do it because they do not have data.

Barriers to the Use of Technology in Institutions of Learning

Participants presented several challenges which hinder them from integrating technology into their teaching ranging from lack of resources, lack of skills and knowledge, inadequate time allocation, to no training.

Some of the participants indicated that they have lost interest in applying technology in the classroom because of a number of challenges they faced.

Participant G commented: I do not use technology because of even if I would want to there are no computers. My centre has few leaners, the government does not allocate enough funds to allow the Centre Manager to buy computers.

Participant H added: I always use my personal computer. The problem I face is that I run out of data and our centre do not have WIFI. So I normally avoid engaging in activities that require internet.

Participant I: shared the same sentiments with Participant H: At my centre we have internet, but the network is very poor. Sometimes I try to use data projector to teach learners, but network will fade and I stop in the middle of the lesson.

Findings indicated that some Centres have resources, and some do not and participants responded differently as far as resources are concerned. Those that have the resources indicated, **Participant J**: at our Centre, there are computers in the host school, WIFI and data

projectors but I do not use them because I do not have the know-how. The same sentiments were shared by **Participant E**: I want to use the computer, but I was not trained to use it at the college, our professional development meetings do not include computer training there is one educator who have the basic computer skill, but he is always busy, he cannot attend all of us. It has appeared from these findings that online tools such as emails and using TEAMS and or Zoom were not used by adult educators.

Participant B said I always hear principal in the host school asking the clerk to write emails, I did not have an idea of what they entail. I once asked the clerk to show me how it works but he is always busy and kept on promising me.

Participant J added. During the lock down it was difficult for me to connect to the link for TEAMS meeting, I was helped by my son at home.

Strategies to Mitigate the Digital Divide

Participant D suggested: I wish our government can supply us with computers.

Participant A supported: We also need training.

Participant F added: I think training us on computer literacy will be beneficial.

Participant C indicated: at our centre we do not have WIFI and the network is down most of the time and that made me not to attend some of the training.

Participant I added: First of all these, I think the department together with government should see to it that connectivity is sorted in our area.

Discussion

The data collected in response to the question about which technology tools were used by participants, revealed that prior to the intervention by the university team, participants have been using computers/laptops, data projectors and WhatsApp in their teaching and learning. But the three tools were used minimally, for an example computer were used for setting tests, planning lessons, recording marks, downloading videos and using them for projecting lessons. Even though these tools were not maximally used, participants affirmed that the use of technology enhanced their teaching. Participant C and D indicated that they use their computers at home to download videos and. The use of videos and data projectors which saved participants' time to draw sketches some as they used to do. This finding supports Dulal's (2019) study that the use of technology increased the productivity of educators in terms of time management. The results also confirmed that the use of WhatsApp was an efficient way of cascading information as well as sending learners content, activities, and questions in preparation for the final exam. The full use of WhatsApp by educators agreed with current research (Danai, 2022, Bruno, 2019, Yurdagül & Öz, 2018) that the use of WhatsApp, not only increased the use of technology but also promoted teaching outside the classroom as confirmed by participant B whose learners responded to activities on line away from school building.

While good experiences were reported by participants who integrated technology in their teaching, the findings indicated that all those who applied technology and those who did not

apply it experienced a variety of challenges. The results show that participants experienced challenges outside their control and some which were internal what researchers refer to as first order and second order barriers to the application of technology (Vongkulluksn, Xie, & Bowman, 2018, Ertmer, et al 2021, Ertmer, and Ottenbreit-Leftwich, 2010). The top challenge as mentioned by participant G was lack of support from the government to provide resources and create a conducive teaching and learning environment for the integration of technology. Generally, all centres where the 10 participants were teaching had few or no computers/laptops, data projectors, Wifi/internet and other essential tools to use technology. Data collected indicated that the government intervention was lacking to provide infrastructure as well as incorporating technology in the curriculum as posited by participant G who alluded to the fact that the use of ICT was not enforced in the CAPS policy document and that there was no professional development to empower them with technology skills.

The minimal application of technology in schools in this study differs from what the current literature reports about the use of technology by developed countries where there is a high utilization of technology (Vongkulluksn, et al, 2018; Zheng, et al 2016 et al 2010). To a larger extent the study agrees with Dulal's (2019) findings which posited that teachers from developing countries are not familiar with the use ICT tools, something that warrants capacity building and development by ICT experts. Lack of clear rules about how to teach using technology in the teaching and learning of ACET programmes (DBE, 2011) created a gap where only those that believed in technology could pursue it while those who did not see the need for applying it did not apply it. This gap was also widened at community colleges level where principals did not bother to buy technology tools (computers, data projectors, data etc.) or afford adult educators time to use technology in their daily teaching. Participant C's comment about lack of enough time to watch the videos also add to the fact that the school environment was not conducive for the application of technology. This also mean that the Department of Higher Education and Training did not prioritise the acquisition of skills on how to use technology as indicated by participant E and F- they said that they did not receive training and or professional development to use technology.

In as far as second order barriers are concerned which refers to the extent to which educators believe that technology can help fulfill instructional goals (Ottenbreit-Leftwich et al., 2010; Yu, 2013), findings of this study did not provide clarity since all educators hide behind lack of conducive environment for that practice.

Yet when participants responded to the question on how the challenge of digital divide can be mitigated, their fingers pointed at the government forgetting to mention other barriers such as being technophobia. The results of this study indicated that generally, all participants acknowledged the challenges they are faced with and welcomed the training on digital literacy. The outcome of this study indicated how educators' quest for how to integrate technology in their teaching and learning.

Conclusion

This article shed light on how adult educators use technology in their teaching and learning of ACET programmes at Community Colleges. Findings revealed that digital divide is still a challenge at Community Colleges especially at Community Learning Centres as they serve as delivery sites. Digital divide could be seen in unequal access to technology, Lack of digital literacy as well as socio-economic factors.

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Scenarios as Means for Identifying, Developing, and Accessing Critical Thinking in Pre- and In-Service Teacher Education: A Preliminary Discussion on the Findings of an International Collaboration

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Abstract
Critical thinking is widely considered a vital aspect of education, necessary for comprehending concepts and solving problems. Compelling evidence from various studies indicates that even a significant number of university graduates lack the ability to think critically, despite its emphasis in education. Critical thinking involves a process of reasoning that is reasonable, reflective, and aimed at deciding what to believe, how to proceed, and what to do. This study presents findings from research conducted by an international team of researchers hailing from three distinct teacher training institutions situated in Mauritius and India. The primary objective of this study was to gauge the extent to which both pre-service and in-service trainees exhibited critical thinking capabilities when confronted with carefully crafted real-life scenarios. The study population included a representative sample of trainees (n = 130 for pre-test; n = 57 for post-test). The outcomes of the study found that critical thinking skills are lacking among pre-service and in-service trainees in both countries, mostly in the action phase, required for problem-solving, while limited critical thinking could be identified in the thinking and reflection phases. The findings also emphasised that critical thinking is a crucial skill that has the potential to benefit both trainees and students in solving complex real-life problems and that critical thinking should be incorporated into the curricula of educational institutions at all levels to develop a mindset in trainees who can think critically, solve problems, and make informed decisions, thereby contributing positively to teaching.

Keywords: Critical Thinking, Real-Life Scenarios, Thinking-Reflecting-Action

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Introduction

Critical thinking is a well-established concept within education, consistently featured in various curricula as a fundamental skill essential for comprehending complex concepts and effectively tackling problem-solving tasks. Despite its longstanding presence, critical thinking often remains elusive in the teaching and learning processes, often being dismissed as abstract or superficial (Ramma, et al., 2023). It has even been criticised as mere rhetoric, dogmatism, or ethnocentrism by scholars like Vincent-Lancrin (2023) and Wagner, Baum, and Newbill (2014). It is important to clarify that the term 'critical' in critical thinking originates from the word 'criteria' and should not be conflated with 'criticism' (Kasser, 2019). The skill of critical thinking holds significance not only within academic pursuits and professional environments but also plays a pivotal role in navigating day-to-day occurrences. Cultivating critical thinking demands deliberate attention and consistent practice, as emphasised by Byrne and Johnstone (1987).

Central to understanding critical thinking is the recognition that as human beings, we often instinctively uphold our own perspectives while shying away from introspection and alternative viewpoints. An integral aspect of personal development involves the willingness to acknowledge mistakes, rectify wrongdoings, and even alter one's course of action accordingly. This transformation towards becoming a well-rounded individual hinges on the capacity to embrace humility and openness to change.

This paper arises from an international collaboration involving researchers from four distinct teacher training institutions: one located in Mauritius and three situated in Maharashtra, India. Within this study, we have embraced the comprehensive definition of critical thinking advocated by Scriven and Paul (1987). In accordance with their perspective, critical thinking is delineated as follows: Critical thinking is the process of intellectual discipline characterised by the active and skillful conceptualisation, application, analysis, synthesis, and/or evaluation of information derived from, or generated through, observation, experience, reflection, reasoning, or communication. Its purpose is to serve as a guiding framework for belief-formation and decision-making.

The primary objective of this study is to ascertain the extent to which pre-service and in-service trainees demonstrate critical thinking within real-life contextual scenarios. Additionally, this research aims to investigate the influence of employing scenarios as pedagogical tools to nurture and perpetuate the development of critical thinking skills among learners.

Review of Literature

Although critical thinking is recognised as being an important educational objective, there is compelling evidence (Ramma, et al., 2021; Koklukaya & Demirhan, 2014; Herreid, Schiller, & Herreid, 2012) which demonstrates that a significant number of university graduates, on conferment, do not possess the ability to think critically. Such a claim has important ramifications, not only for the graduates themselves, but also for the faculty and the university. In a recent article, Burton, Faller, Haniki & Ntshoe (2022, p. 24) found from respondents that “our students are not well-prepared …, and we must ask whether our institutions are providing appropriate support, to address this challenge”. The latter also point out that we can have graduates with strong technical skills but with inadequate critical thinking ability. The ability to think critically entails a process whereby the thinking should

be reasonable, reflective, and should be aimed at deciding what to believe and what to do (Ennis, 1987). In short, critical thinking is "goal-directed, aimed towards an end, and purposeful" (Davies, 2015, p. 45). According to Davies (2015), critical thinking entails skills as well as dispositions and attitude. Thus, for completeness, critical thinking encompasses the cognitive, psychomotor, and affective domains. Any logical decision has to be accompanied by a set of arguments, justifications or reasons.

Thinking is subject/content specific, geared towards a particular situation and thinking critically is linked with something. McPeck (2017, p. 4) argues that "thinking is always thinking about X, and that X can never be 'everything in general' but must always be something in particular". The author further persuasively maintains that critical thinking must also be related to something and that the adjective 'critical' refers to a kind of thinking and that someone who has the ability to think critically in one area might not necessarily be able to do so in another area. There are a number of factors associated with this situation. Snyder and Snyder (2008) explain that much emphasis is laid on transfer of knowledge (content) rather than on the process of how learners assimilate the lesson. More weight has to be placed on teaching learners how to think rather on what to think (Clement, 1979) as it is the application of the content through instructional strategies that engages learners in critical thinking (Snyder & Snyder, 2008). In addition, students should be intrinsically and extrinsically motivated in their teaching-learning environment to develop the propensity to exercise critical thinking in whatever tasks they are engaged in. Bryne and Johnstone (1987) concur that propensity can be instilled in learners when teachers harmonise a course with practical problems which are directly related to application of the concept to real life.

Everyday life occurrences are complex in nature and require someone to identify links between ideas or concepts in a wholistic manner to be able to solve a problem. As mentioned by Bloom (1956) and Wiggins & McTighe (1998), just memorising concepts will not be enough, we need to move to other levels above knowledge, and these are aspects of critical thinking. Learning concepts in a segregated manner will not only complicate matters but also cause confusion in the mind of learners. Similar concepts, for instance, the science concept 'Power' when discussed in the English and in science lessons, if not dealt with, may lead to confusion in the mind of learners. Chrzanowski et al. (2018) argue that any discrepancy between language concepts and similar science concepts taught to students can cause difficulties and eventually impede teaching and learning. Similar situations are observed in other areas as well. Though it is an undeniable fact that critical thinking is important in the school curriculum, it, however, does not form part of the teaching-learning strategies adopted at the elementary and secondary levels of education (Kurfiss, 1988, p. xv). Furthermore, the evaluation of critical thinking poses a formidable obstacle, a challenge acknowledged by Burton, Faller, Haniki & Ntshoe (2022).

Learning outcomes, classified in the form of taxonomy, involve three distinct areas - cognitive, psychomotor and affective domains. The cognitive domain refers to a conscious intellectual activity while the psychomotor domain relates to motor action following a mental activity. On the other hand, the affective domain which relates to feelings, values, attitude, behaviour and emotions is the least considered domain on learning during lessons (Tan, Heng, & Tan, 2013; Shephard, 2008; Ennis, 1987) and assessments (Saxon, Levine-Brown, & Boylan, 2008; Oppong, 2014; Forrest & Blick, 2017). The dismissal of the affective domain is not new as claimed by Noddings (1996) that affect has been neglected in education and this neglect reduces the engagement of both students and teachers in their studies. Furthermore, Shephard (2008, p. 88) emphasises that the affective domain: "… includes, in a

hierarchy, an ability to listen, to respond in interactions with others, to demonstrate attitudes or values appropriate to situations, to demonstrate balance and consideration, and at the highest level, to display a commitment to principled practice on a day-to-day basis, alongside a willingness to revise judgement and change behaviour in the light of new evidence". The dynamic interplay between critical thinking and social skills assumes a pivotal role in the realm of education. This significance is underlined by the fact that successful learning frequently necessitates collaborative endeavours among students, enabling them to manifest creativity collectively. Additionally, it is imperative to recognise that critical thinking assumes a central role in shaping affective control (Esmaeili & Bagheri, 2015; Bareviciute, Dadelo, & Asakaviciute, 2023) thereby providing a foundation for fostering creativity.

Methods

Design Framework

A framework, initially formulated by Ramma and colleagues (2021; 2023), and subsequently refined in their later works has laid the groundwork for identifying and assessing participants' intrinsic critical thinking skills within their reasoning processes. This framework employs scenarios as a conduit to encapsulate the essence of critical thinking. Within these scenarios, tangible real-life problematic situations are presented. Participants are then tasked with applying the conceptual knowledge they have acquired from the subjects they have engaged with, in order to effectively address these challenges. The assessment of critical thinking is guided by a set of criteria closely aligned with factual, conceptual, and procedural knowledge (Table 1), as well as the ability to draw meaningful conclusions (Braithwaite & Sprague, 2021; Antharjanam, 2021).

Knowledge Category	Key Criteria
Factual Knowledge The basic elements that must be known about a discipline. It includes isolated pieces of information.	Based on verifiable information and empirical evidence. Can be easily checked for accuracy and correctness. Generally accepted as true within a specific domain or discipline.
Conceptual Knowledge The interrelationship among the basic elements within a broader context that enables them to function harmoniously as a whole.	Understanding of abstract concepts, principles and theories. Comprehending underlying frameworks and structures. Recognising and identifying patterns and generalisations.
Procedural Knowledge (*Logical and Analytical*) The ability to perform tasks using skills, algorithm, techniques and methods.	Knowing how to perform specific tasks, actions or procedures. Following established rules or algorithms. Identifying cause-effect relationships and drawing logical inferences. Applying critical thinking and problem-solving strategies.
Metacognitive Knowledge Knowledge of cognition as well as awareness of one's own cognition.	Awareness and understanding of one's own thought processes and biases. Ability to monitor and regulate cognitive processes. Being conscious of one's own learning strategies and approaches.

Drawing Conclusions	Synthesising information from various sources and perspectives. Evaluating the credibility and reliability of sources. Applying logical reasoning and critical thinking. Considering potential implications and consequences.

Table 1: Knowledge Category and Key Criteria

Procedure

The revised Bloom's Taxonomy (Krathwohl, 2002), in conjunction with Figure 1, serves as a tool to meticulously identify components of critical thinking within participants' cognitive processes as illustrated in Figure 1.

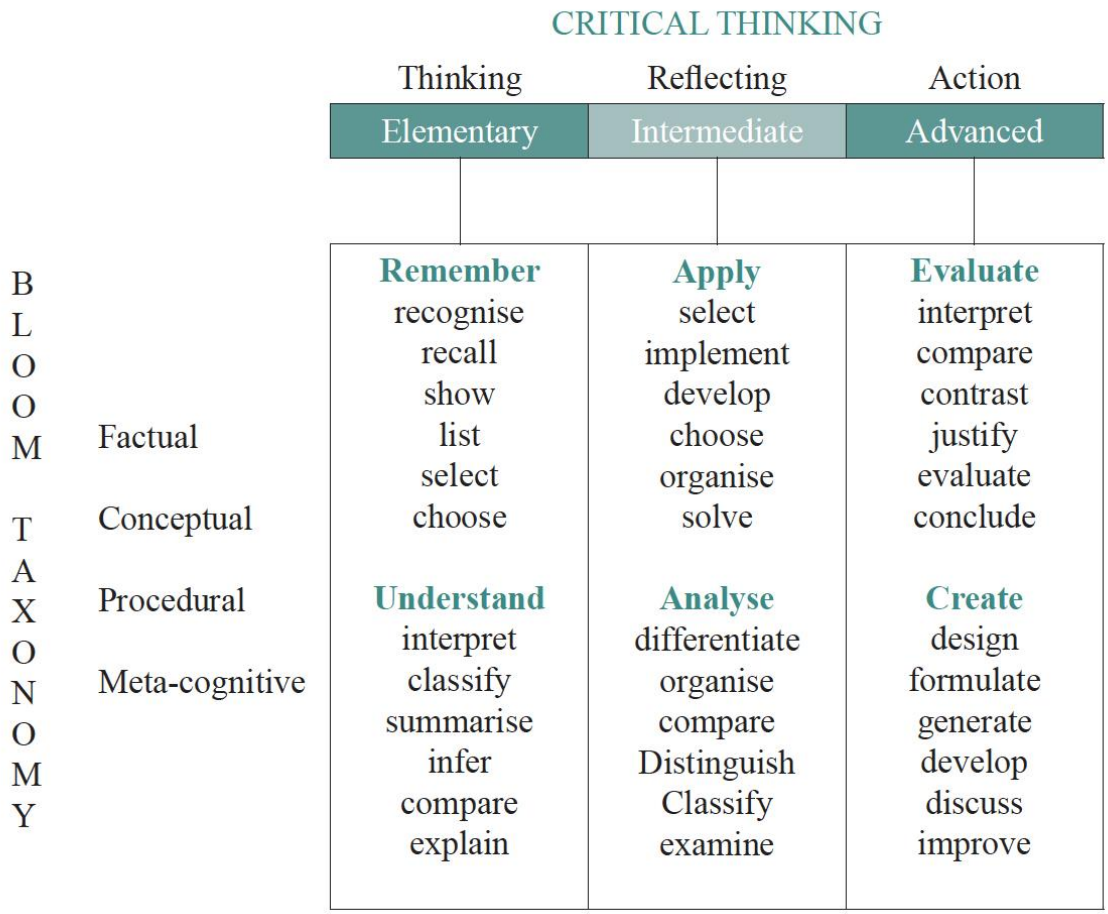

Figure 1: EIA-CT[1] Framework for Assessing Critical Thinking

As an example, the scenario depicted below encompasses three elements: Thinking, Reflecting, and Action (adapted from Barnett, 1997). In the pursuit of identifying critical thinking, these elements are segmented into *elementary*, *intermediate*, and *advanced* stages, forming a comprehensive and interconnected framework:

[1] Elementary-Intermediate-Advanced Critical Thinking

At night, you wake up suddenly, feeling thirsty. However, you realize that there is no power, and you are surrounded by total darkness. You cannot locate your mobile phone to use its flashlight, and regrettably, there is no other source of light in the room. You decide to tread carefully to the kitchen in search of a matchbox, aiming to find some light that will enable you to pour water into a cup for drinking. While entering the kitchen in darkness, you unexpectedly slip and fall onto the floor. What crosses your mind at that particular moment while you lie on the floor? Enumerate all the thoughts that occur to you. For each of these thoughts, how do you endeavour to verify their validity, if at all? What actions do you envision taking to be better prepared for facing such a situation in the future?

Participants

The participants comprised pre- and in-service trainees who were enrolled in Postgraduate Certificate in Education and Bachelor's in Education programmes from Mauritius and India. A comprehensive assessment, consisting of a pre-test and a post-test, was conducted among the participants in the two distinct countries: designated as Country X (with a sample size, n = 75) and Country Y (with a sample size, n = 55). The use of the placeholders X and Y ensures the anonymity of the respective countries involved in the research. The post-tests were conducted after three-day workshops on critical thinking and its assessment held in both countries. All necessary ethical protocols were adhered to before collecting data. Furthermore, the participants were informed of their option to withdraw from the study at any time without facing any repercussions on their studies.

Tools for Data Analysis

An illustrative power outage scenario was initially introduced, following the model by Ramma et al. in 2021. Subsequently, an in-depth workshop was conducted to foster comprehensive discussions encompassing all components of the framework and what information in relation to critical thinking were expected. The data collection process involved utilising Microsoft Forms within the Office 365 suite to gather information from both pre- and post-test stages. For data analysis, Microsoft Excel was employed. In terms of participants' feedback, the primary author was responsible for assigning scores based on the identification of critical thinking elements, as depicted in Figure 1 and elaborated in Table 2. Subsequent to this initial scoring, a meticulous review was undertaken, and the scores were further refined. Validation of these scores was then carried out collaboratively by the remaining co-authors. To provide a concrete example, Table 3 showcases a representative participant's response alongside the corresponding assigned scores.

Process of Criticality	**Critical Thinking Stage**	**Description & Rubrics [an insight]**	**Assessment Rubrics [some examples]**	**Marks**
Thinking	**Elementary** [What is the issue/dilemma?]	Am I hurt? How do I confirm that I am not hurt?	• Yes I'm hurt • No I'm not hurt; If so, I call for help etc.	

Reflecting ***(During the reflection phase, ideas from thinking phase may be reviewed.)***	**Elementary** [What course of action to follow?] **Intermediate** [How to confirm the premises? What to conclude?]	What do I do after confirming that I got/did not get hurt? What is the cause of this mishap? How do I confirm any premises?	• To confirm by using the sense of sight/touch and to proceed depending on the outcomes. • I have fallen most probably because of water spillage; worn out slippers; I've not worn out slippers at all and the floor was slippery. The sense of touch may be helpful. • If not injured, to look for a source of light or to seek help?	0 – not present ½ – partially present 1 – adequately present
Action ***(During the action phase, ideas from reflection phase may be reconsidered)***	**Intermediate Advanced** [If the issue is within my reach, how to proceed to solve it? If not, what alternatives exist?]	What can I do to avoid such a situation in the future? What other alternative(s) exist to minimise such incidence? Where do I get help if necessary?	• To ensure that the floor is clean and dry before going to sleep. • When waking up, to use a source of light. • To walk carefully.	

Table 2: Key Elements for Assessing Critical Thinking

Stages of Critical Thinking	**Thinking**	**Reflecting**	**Action**
i) *I wonder if I have been injured and how did I slip as I was walking carefully.* *ii) I tried to get up and check if there is any part of my body that has been hurt then I noticed it was a leaking roof that led to a slippery floor.* *iii)To always keep my phone near my bed so as to have the flashlight and also I can bring a bottle of water in my bedroom so that whenever I'm thirsty it will not be necessary to go to the kitchen.*	1	1	0.5

Table 3: Response and Subsequent Marking

Data Analysis & Discussions

In this section, we present and analyse the outcomes of the Friedman tests, which were conducted to examine variations in three distinct categories of critical thinking: "Thinking," "Reflection," and "Action," between Country X and Country Y. These tests were conducted using pre-intervention and post-intervention data. The initial data collection involved obtaining pre-test data from participants in two different countries: Country X (n = 75) and Country Y (n = 55). Specifically, for the post-test data, the sample sizes were: Country X (n = 27) and Country Y (n = 30). This discrepancy in sample sizes can be attributed to the non-participation of some individuals in the workshop, leading to their exclusion from the post-test analysis. The Friedman test was employed to assess the existence of statistically significant differences among dependent samples within each location. For both Country X and Country Y, the test aimed to confirm or refute the null hypothesis (H_0) that there were no significant differences among the three dependent categories ("Thinking", "Reflection" and "Action").

Results: *Pre-test Analysis*

The pre-test results indicate that both Country X and Country Y displayed statistically significant differences among the critical thinking categories of "Thinking," "Reflection," and "Action." The low p-values (<0.0001 for Country Y and < 0.0025 for Country X) (see Table 4) signify that at least one category significantly deviates from the others within each country.

Country	$\chi^2_{(2)}$	p value	Conclusion
X ($n = 75$)	11.95	0.0025	Reject H_0
Y ($n = 55$)	29.85	0.0001	Reject H_0

Table 4: Friedman tests pre-test results

When examining the critical thinking categories within the pre-test data, a nuanced interpretation comes to light as we delve into the medians of these distinct categories across participants from both Country X and Country Y (refer to Figure 2). The pre-test data collected from participants in Country X reveals a median score of 0.5 in the "Thinking" category, suggesting a well-balanced distribution of cognitive engagement in this aspect among the participants. However, in the categories of "Reflection" and "Action," both medians are recorded at 0, indicating that half of the participants from Country X demonstrated minimal inclination towards either reflective or action-oriented critical thinking during the pre-test phase. Conversely, the pre-test data gathered from participants in Country Y portrays distinctive medians across the critical thinking categories. Once again, the median score of 0.5 in the "Thinking" category suggests a well-rounded participation in this cognitive domain. Yet, in the "Reflection" category, the median score of 0.5 emphasises that half of the participants showcased a propensity for reflective thinking. Moreover, the median score of 0 in the "Action" category signifies that half of the participants displayed limited engagement in action-oriented critical thinking during the pre-test phase.

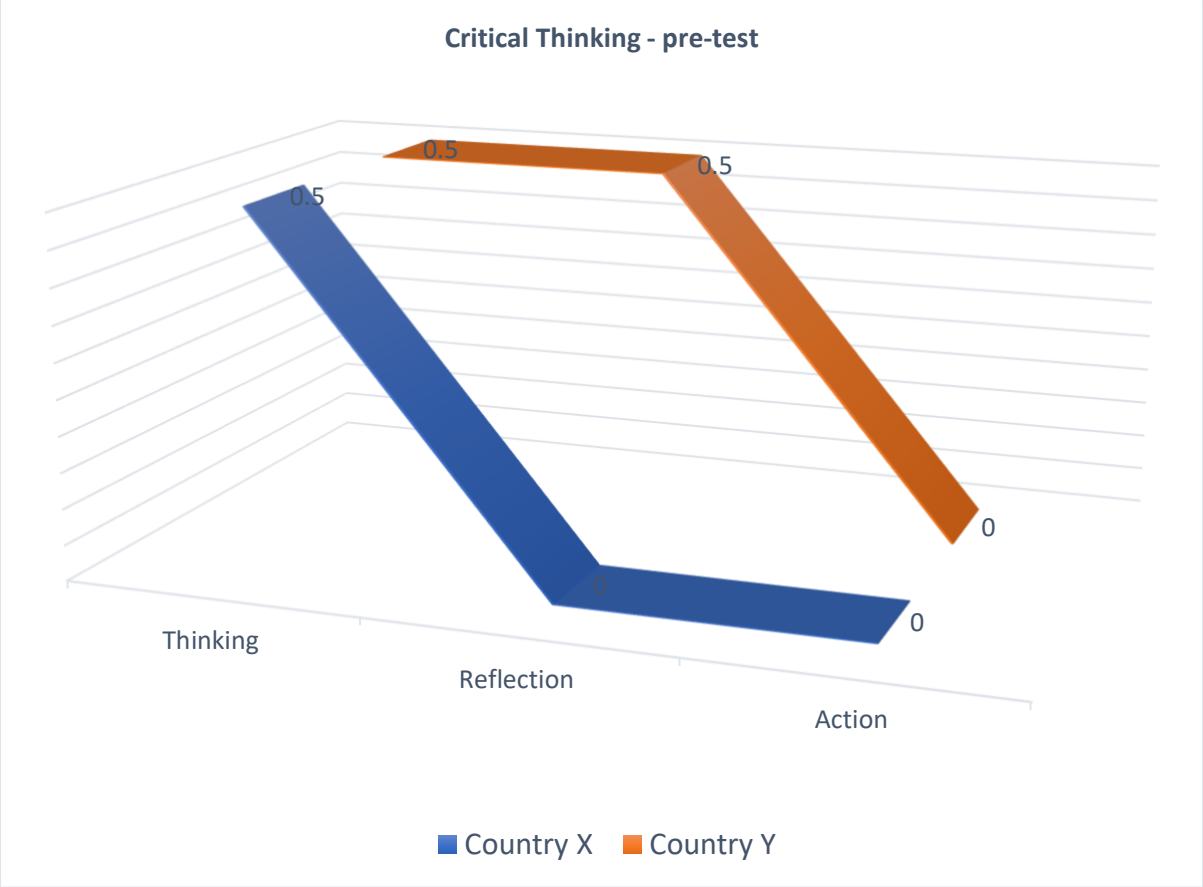

Figure 2: Pre-test median scores comparison

Post-test Analysis

In the post-test phase, both countries' critical thinking categories underwent evaluation for any significant changes (see Table 5). For both Country X and Country Y, the observed p-values exceed the significance threshold of 0.05. Consequently, in both cases, the null hypothesis (H_o) is retained, suggesting that no statistically significant differences were detected among the critical thinking categories after the intervention.

Country	$\chi^2_{(2)}$	p value	Conclusion
X ($n = 27$)	3.722	0.9272	Do not reject H_0
Y ($n = 30$)	0.15	0.1555	Do not reject H_0

Table 5: Friedman tests post-test results

In the post-test phase, the critical thinking categories of both countries were assessed for any notable changes, as outlined in Table 5. For both Country X and Country Y, the calculated p-values surpass the established significance threshold of 0.05. As a result, in both instances, we uphold the null hypothesis (H_o), indicating that no statistically significant differences were observed among the critical thinking categories after the intervention.

Notably, while the median score of 0 remains consistent in the "Action" category, it is important to emphasise that this suggests that half of the participants continued to display minimal engagement in action-oriented critical thinking even after the intervention. For Country Y, the post-test medians demonstrate significant consistency with the pre-test

medians across two out of the three critical thinking categories. The sustained median score of 0.5 in the "Thinking" and "Reflection" categories underscores a steady level of engagement in cognitive processes pertaining to these facets. Conversely, the post-test median score of 0.5 in the "Action" category highlights an encouraging shift from the pre-test, suggesting that a subset of participants from Country Y exhibited improved engagement in action-oriented critical thinking (see Figure 3) following the intervention.

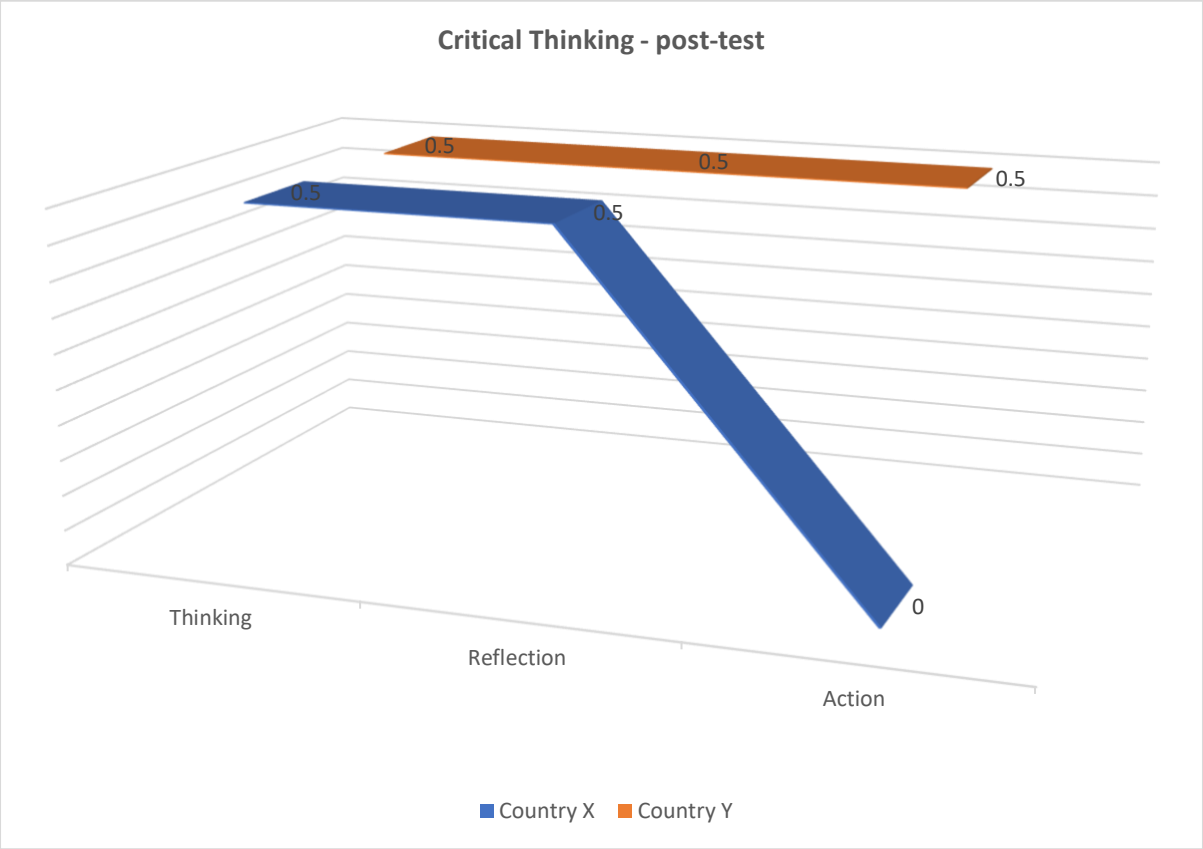

Figure 3: Post-test median scores comparison

Conclusion

This study has illuminated the intricate and nuanced nature of critical thinking within educational contexts. Through an examination of pre-test and post-test data collected from two distinct countries, namely Country X and Country Y, the study has uncovered diverse cognitive tendencies and the measurable effects of interventions on various dimensions of critical thinking. The results underscore a substantial disparity in the critical thinking abilities of trainees within both countries. Extensive research (e.g., Kurfiss, 1988; Ramma et al., 2021) consistently underscores the paramount importance of nurturing critical thinking skills among learners. This cultivation is best achieved by creating conducive learning environments that not only foster skill development but also minimise unnecessary constraints that could impede intellectual growth. The insights gleaned from this study underscore the pressing need for tailored educational approaches that account for the intricate interplay of cultural, cognitive, and contextual factors. Significantly, the findings from this study highlight the efficacy of targeted interventions in catalysing shifts in critical thinking profiles. Particularly noteworthy is the role of metacognitive skills in facilitating these transformative changes. As a result, educators and educational institutions are advised to

emphasise the cultivation of metacognitive abilities as a central tenet of their instructional strategies.

Thus, this study provides an in-depth comprehension of critical thinking within educational settings, shedding light on the impacts of interventions and the complexities of cultural and cognitive nuances. These implications extend beyond the confines of the study, urging a comprehensive reevaluation of pedagogical practices. Educators must prioritise not only the transmission of factual knowledge but also the fostering of critical thinking skills and metacognitive awareness. Curricula and teaching methodologies must evolve to encompass the multifaceted dimensions of critical thinking across diverse cognitive domains.

By championing a culture of active reflection, open-mindedness, and adaptable problem-solving, educational systems can significantly contribute to nurturing individuals who possess the acumen to navigate the intricacies of the modern world. Critical thinking transcends mere academia; it transforms into a lifelong skill that empowers individuals to make informed choices, engage in constructive discourse, and meaningfully enrich society. As educators and learners alike recognise the inherent value of critical thinking, it solidifies its place as an indispensable cornerstone of holistic education and personal growth.

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Dyslexia and Graphocentrism: Neuroscience Contributions

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Abstract
This study focuses on the lack of special scientific agenda of Brazilian education institutions regarding dyslexia as a Learning Disorder, which unfortunately leads not only to students' frustration, but also to a lack of interest and, consequently, it also leads to the false idea that successful reading and writing skills are the only actual proof of intelligence one may have. Interestingly, there are numerous scientific evidences showing that these atypical brains are distinguished by a visionary and entrepreneurial ability. Then, it would not be an overstatement to portray Dyslexia as a gift. Thus, we consider very important to review the supremacy of writing as a decisive assessment method, as widely adopted in Brazilian education institutions.

Keywords: Graphocentrism, Learning Disorder, Dyslexia

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Introduction

Although dyslexia is scientifically portrayed as a hereditary disorder, it is usually during formal schooling that it turns out to be a real issue, for understandable reasons. The sad part of this story is the usual lack of grounding of Brazilian institutions regarding this Learning Disorder (LD, henceforth), which unfortunately leads to these children's cruel labels and, as a consequence, progressive lack of interest in most school subjects. Interestingly, there are numerous scientific evidences showing that individuals with dyslexia are distinguished by a visionary and entrepreneurial ability (in addition to other notable skills) which stands out when compared to neurotypical individuals (cf. Mousinho and Martins, 2012; Holanda, Correa and Mousinho, 2020).

Therefore, for some scholars, this LD, which affects from 10 to 15 percent of the world's population, can be perceived as a gift (Davis, 2004). Thus, the present study aims to review the supremacy of writing (cf. Marcuschi, 2010; Lucchesi, 2015) as a decisive assessment method.

For that purpose, it relies on Neuroscience, more precisely on Neuroscientific Image Evidence (NIE) (cf. Wolf, 2008), to increasingly contribute to a less trivial, more humanistic and diverse view of teaching, once individuals with this LD have, indeed, a quite different but a remarkable intelligence ability.

Objectives

The main concepts regarding this preliminary study are outlined as follows: i) endorsing the human instinct for speech but not for writing (cf. Pinker, 1995; Wolf, 2008; Lucchesi, 2015); ii) claiming that it is not surprising that only around 10% of 4000 worldwide spoken languages are unwritten (Marcuschi, 2010); iii) pointing out that, although human beings have existed for over a million years, writing has only existed for around 6,000 years (Marcuschi, 2010; Wolf, 2008); iv) supporting the idea that writing is a cultural invasion and, for that reason, there is nothing natural about this act (Wolf, 2008).

Methodology

In this review of literature, we focus on how the graphocentric paradigm has impacted Western education system. For that purpose, we also analyse the fact that History of Civilization itself is officially considered as such after the invention of Writing. Therefore, we try to make a brief literature review to claim that this scientific model unfairly dismisses unwritten languages (which are the overwhelming majority of languages). In addition, we also argue that the state of knowledge is scientifically unfair to individuals with dyslexia, who correspond to what Science usually calls neuroatypical individuals. Curiously, this model of cognition, with an imagistic thinking architecture, have notoriously contributed with genius and innovation in the history of knowledge and, therefore, in History of Civilization.

The Drowning of an Intelligence Disconnected From the Reading Circuit

Different to what one might assume, the brain of a person with dyslexia is not hypofunctional but rather hyperfunctional. As Marianne Woolf (2008) beautifully points out "…unlike vision and speech, which are genetically organized, reading has no direct genetic program passing on to future generations" (p. 11). For that reason, neurotypical individuals create a circuit for

the act of reading. However, due to a "failure" in this reading circuit, what happens in the brain of an individual with dyslexia is an effort five times greater than reading in a neurotypical brain.

Therefore, there is more computation than a neurotypical brain, and when compared with typical brains, the Right Hemisphere (RH) is more developed than Left Hemisphere (LH). Another significant cognitive distinction is the prevalence of imagistic thinking over verbal thinking. Woolf adds "What is it about the dyslexic brain that seems linked with some people to unparalleled creativity in their professions, which often involve design, special skills, and the recognition of patterns?" (p.22)

Unfortunately, Neuroscience and neuroscientific findings and contributions are somehow disengaged with Pedagogy and teaching Course syllabus in Brazilian Institutions. Therefore, most teachers involved with reading and writing skills initiation lack the fundamental basis for understanding that there will always be neuroatypical children in their classroom, with a special brain architecture and cognition. Some neurotypical children may find it difficult to learn to read but they will eventually activate the brain circuit for that task. On the other hand, those children with LD such as Dyslexia, will always struggle with this task. Their LH occipital lobe does not engage on this reading journey as neurotypical children manage to do.

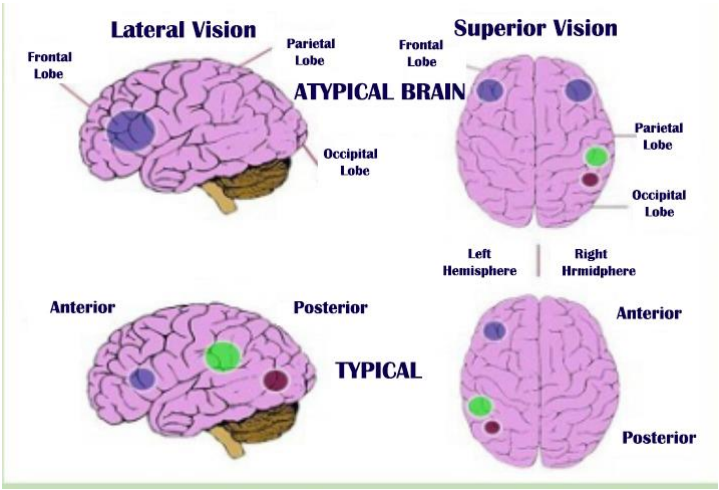

Image 1: Comparison of typical and atypical Brain activity while Reading
(Uzeda-Garrão, Catunda, Lins [in press])

While reading in a typical brain is mainly carried out by the LH, the brain of an individual with dyslexia requires the activation of areas not appropriate for the reading circuit, such as the RH (as revealed in Image 1). This neural effort produces a load of cognitive fatigue, which is largely unfamiliar to Brazilian educational institutions. Therefore, they usually follow not only a written form-dependent assessment protocol, but also a reading performance assessment protocol.

Mistakenly, reading and reading comprehension ability are still considered as normal and desirable intellectual conduct, even though this human task involves the activation of a network in neurotypical brains, particularly of the occipital lobe. Therefore, more than 10% of Brazilian students will feel "drowned by letters" without actually being part of their cognition, as portrayed by Binho Ribeiro's graffiti, specially made during the celebration of the 11th Dyslexia Week, in São Paulo.

Image 2: Graffiti by Binho Ribeiro, São Paulo, 2021

Final Remarks

If we analyse the terminology assumed for periods of History, everything that precedes the invention of writing is dismissed and assumed as Prehistory. Despite this, most of the world's languages continue to be unwritten (Marcuschi, 2015) which reveals human instinct for verbalization but not for reading and writing. Therefore, a clear cognitive supremacy of speech over writing. The graphocentric paradigm deceptively authorizes educational institutions to simplistically associate intelligence to writing skills. This framework perniciously invalidates what does not match the so-called neurotypicality. Interestingly, much of civilization history has been “written” by the genius of people who have admittedly struggled with reading.

Another significant theoretical gap in Brazilian institutions is the dialogue between neuroscience and formal education. It is more than clear that State of the art education cannot ignore neuroscientific evidence contributions. Unfortunately, Neuroscience is still viewed as a very complex and distant domain when it comes to Human Sciences, such as pedagogy. This misconception jeopardizes the intrinsic relationship between brain functioning, learning and schooling.

Acknowledgements

I would like to thank all the UFRRJ undergraduate students who have made me believe that Linguistics is a wide and gratifying domain of knowledge. As time goes by, I feel more than grateful to have chosen following language wherever it may take me. And the brain is, indeed, the most intriguing and fascinating journey of them all.

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Automated Classification of Student's Emotion Through Facial Expressions Using Transfer Learning

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Abstract
Emotions play a critical role in learning. Having a good understanding of student emotions during class is important for students and teachers to improve their teaching and learning experiences. For instance, analyzing students' emotions during learning can provide teachers with feedback regarding student engagement, enabling teachers to make pedagogical decisions to enhance student learning. This information may also provide students with valuable feedback for improved emotion regulation in learning contexts. In practice, it is not easy for teachers to monitor all students while teaching. In this paper, we propose an automated framework for emotional classification through students' facial expression and recognizing academic affective states, including amusement, anger, boredom, confusion, engagement, interest, relief, sadness, and surprise. The methodology includes dataset construction, pre-processing, and deep convolutional neural network (CNN) framework based on VGG-19 (pre-trained and configured) as a feature extractor and multi-layer perceptron (MLP) as a classier. To evaluate the performance, we created a dataset of the aforementioned facial expressions from three publicly available datasets that link academic emotions: DAiSEE, Raf-DB, and EmotioNet, as well as classroom videos from the internet. The configured VGG-19 CNN system yields a mean classification accuracy, sensitivity, and specificity of 82.73% ± 2.26, 82.55% ± 2.14, and 97.67% ± 0.45, respectively when estimated by 5-fold cross validation. The result shows that the proposed framework can effectively classify student emotions in class and may provide a useful tool to assist teachers understand the emotional climate in their class, thus enabling them to make more informed pedagogical decisions to improve student learning experiences.

Keywords: Classroom, Students, Facial Expressions, Education, Machine Learning

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Introduction

Emotions play a major role in guiding cognition and behavior. In education or learning contexts, emotions can affect students' attention, motivation (Skinner, Pitzer, & Brule, 2014), and their use of learning strategies (Pekrun, 2014). Measuring emotions in educational settings can also provide important information explaining (and possibly predicting) students' learning outcomes. For example, students' emotions in class can reflect their feelings about course content and indicate their engagement, which has been found to predict academic performance (Reyes, Brackett, Rivers, White, & Salovey, 2012). Feedback regarding students' emotional responses during class may also be used to develop and optimize the learner's experience. Hence, it is of great value to explore the emotions of students as they learn. Students' facial expressions can convey their comprehension of information and their emotions during learning and experienced educators can often adjust their teaching according to students' expressions. However, it can be difficult to monitor students continuously, particularly for less experienced teachers. Objective observational data is also needed to study and reflect on the role of emotions in different learning contexts, and for this to be developed into an accessible tool that educators may be able to use to improve teaching practice. Machine learning (ML) offers a promising method for monitoring student emotions by classifying facial expressions from video data (Hu et al., 2020; Zeng et al., 2020; Yuan, 2022). The present study builds on that by investigating an automatic classification system using ML to categorize students' emotions through facial expressions during class.

Several studies have investigated ML-based emotion recognition using video data recorded in real classes; however, those studies have mainly focused on classifying Ekman's basic emotions, including happiness, sadness, fear, anger, disgust, and surprise (Zeng et al., 2020; Yadegaridehkordi, Noor, Ayub, Affal, & Hussin, 2019). Few studies have aimed to recognize (classify) expressions of academic emotions, such as boredom, engagement, confusion, frustration, surprise, relief, sadness, and joy (Hu et al., 2020; Yuan, 2022; Gupta, D'Cunha, Awasthi, & Balasubramanian, 2016). Academic emotions are defined as emotions of a student experienced in academic settings such as class-related or learning related situations and have been associated to academic performance, motivation to learn, learning strategies, and self-regulation (Pekrun, Goetz, Frenzel, Barchfeld, & Perry, 2011; Pekrun, Goetz, Titz, & Perry, 2002). Considering the relevance of academic emotions in educational contexts, and the expansive literature exploring academic emotions relative to learning outcomes, it is important to develop methods for recognizing these emotions during learning, as opposed to recognizing the six basic emotions defined by Ekman. The present study aims to develop an effective ML algorithm for classifying academic emotions, adding to the limited research in this area.

The utility of several ML algorithms has been studied for video data classification, and deep learning, in particular, has been shown to greatly improve classification accuracy relative to other methods. For that reason, an increasing number of researchers are using deep learning for the classification of emotional expressions (Zeng et al., 2020; Yuan, 2022; Gupta et al., 2016; Pabba & Kumar, 2022). Moreover, of the various deep learning models available, Convolutional Neural Networks (CNN) is often found to provide strong classification performance in various applications (Bajpai, Yuvaraj, & Prince, 2021; Thomas et al., 2020; Oh et al., 2020). Regarding emotion recognition, Yuan (2022) proposed a CNN-based system for classifying students' emotions using videos recorded during class; emotions including focus, puzzled, distracted, silence, nervous, joy, exhausted, and bored were classified with an accuracy of approximately 78.3% (Yuan, 2022). Zeng et al. (2021) also applied CNN to

classify anger, surprise, happiness, neutral sadness, disgust, and fear in children and adults during learning, with accuracies reaching 64.8% and 68.5%, respectively (Zeng et al., 2020). Ashwin et al. (2019) also used a novel CNN model to classify student engagement levels with an accuracy of about 71% (Ashwin & Guddeti, 2020). The results across these studies show that CNN can provide reasonable classification performance. However, there are still limitations associated with CNN-based methods for face recognition: First, training an effective CNN model requires a large number of labeled facial images. Second, training a CNN model from scratch can be very time-consuming and computationally expensive.

Transfer learning has emerged as an effective approach to overcome the above-mentioned limitations and involves the process of taking a pretrained deep learning network and fine-tuning it to learn a new task (Raghu, Sriraam, Temel, Rao, & Kubben, 2020). Using this approach, a pretrained CNN model could leverage knowledge gained from a large dataset to classify similar information in a smaller dataset more efficiently. In other words, instead of training the CNN model from scratch, fine-tuning a pre-trained CNN model for a novel dataset can significantly reduce the training time and save computational resources. Several effective real-world examples of this technique are available, including pre-trained CNN models such as VGGNet, GoogleNet, ResNet, and AlexNet (Guo et al., 2016).

In this study, a transfer CNN framework based on VGG-19 is investigated for classifying student's facial expressions of academic emotions in classroom videos. The proposed framework consists of a pre-trained VGG-19 and configured VGG-19 model used for emotion classification. Emotional expressions were categorized according to the nine academic emotions, including amusement, anger, boredom, confusion, engagement, interest, relief, sadness, and surprise, which are pertinent in typical classroom environments and education research. To that end, we first constructed a broad dataset of facial expressions representing those emotions from three publicly available datasets (i.e., DAiSEE, Raf-DB, and EmotioNet) that were previously coded for certain academic emotions, as well as other classroom videos from the internet. The VGG-19 CNN model was then pretrained on ImageNet, before configuring its structure and parameters for application to this work. The configured CNN model was then fine-tuned for emotion classification of the constructed dataset.

The main contributions of the current study are the following: i) the construction of a broad dataset with coded academic emotions, and ii) the development of a deep transfer CNN framework for academic emotion classification, which can improve and accelerate future work utilizing this approach for emotion recognition. The rest of the paper is organized as follows: Section 2 briefly introduces the dataset construction and methodological details of this study, including data pre-processing and the development of the CNN framework. Section 3 presents the study results and discussion, and Section 4 provides a general conclusion, with limitations and directions for future work.

Materials and Methods

Figure 1 shows the methodological framework used in the present study, including dataset construction, video data preprocessing, CNN framework development, and emotion classification. All the analysis are carried out with the Kera's deep learning framework on a high-performance computer, which is equipped with an Intel Core i5-8265U CPU @1.60GHz (8 CPUs) 1.8GHz, 8 Gigabyte (GB) RAM, and 4 GB NVIDIA GeForce MX250 graphics card.

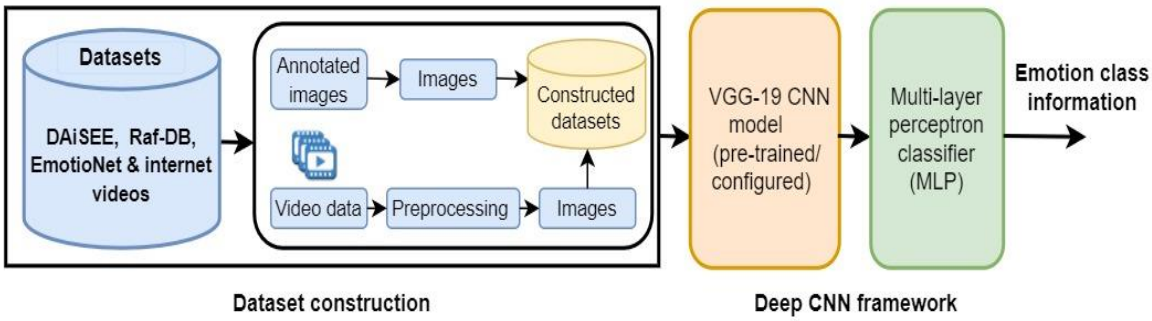

Figure 1: An overview of the proposed framework for classroom emotional climate classification based on students' facial expressions.

Dataset Construction

Dataset	Description	Dur.	Emotions	Environment
DAISEE	3935 images annotated from 9068 videos	10	Boredom, confusion, engagement, frustration	E-learning
Raf-DB	29,672 images annotated queried from the web	NA	Surprise, fear, joy, disgust, anger, sadness	-
EmotioNet	100,000 images annotated queried from the web	NA	23 emotions	In wild
Classroom videos from the Internet	1812 annotated images from 56 videos	10 to 30	Relief, amusement	In classroom

Table 1: Information about the datasets used in this study. NA-not applicable; "-"means that this information not available in the dataset. Dur.-Duration; Duration in seconds.

A comprehensive dataset of students' facial expressions reflecting the nine academic emotions (Pekrun et al., 2002) defined by Pekrun et al. (2002) was constructed using video data from multiple sources, including three publicly available and coded datasets (i.e., DAiSEE (Gupta et al., 2016), Raf-DB (Li, Deng, & Du, 2017), EmotioNet (Fabian Benitez-Quiroz, Srinivasan, & Martinez, 2016)), and other classroom videos available on the internet. Classroom videos were selected by query-based method using the key words 'classroom videos', 'classroom teaching', and 'students in the classroom' from the website https://www.istockphoto.com/. A summary of all sources used for the construction of this larger dataset is listed in Table 1. This study relies on static facial images (color) for recognizing students' emotion. Whereas some datasets listed in Table 1 contained video clips. By applying pre-processing techniques, we extracted static facial images from the video clips, explained in Section 2.2. Finally, a balanced hybrid dataset was constructed for all 9 academic facial expressions in a total of 8674 colour images of size 128 × 128 pixels were utilized. Table 2 provides details of the contribution of various sources in the dataset construction for this study. This constructed dataset is utilized for CNN model architecture to classify emotions during class.

Preprocessing

The classroom video clips undergo a set of pre-processing steps including frame sampling, face detection, extraction, and resizing. Each video contains a large number of frames and frames in close proximity are almost the same. According to a study by (Pabba & Kumar, 2022), the result obtained by processing four video frames/sec with a time interval of 0.25 sec is almost equal to the result which is obtained by processing 30 video frames per second. Therefore, in this frame sampling step, only four video frames are processed per second with a time interval of 0.25 seconds, thereby reducing computational overhead. Given the proximity of students to one another, many frames included several students; hence, it was necessary to detect and extract individual students' faces from each frame. To achieve that, a deep learning model called PyFeat was applied to detect individual faces in each sampling frame, before cropping the detected face form the whole image. All face images were then resized to 128 × 128 (width × height) pixels and then input to the CNN for training and evaluation.

Emotion	DAISEE	Rad-DB	EmotioNet	Int. videos	Total
Anger	-	705	222	-	927
Amused	-	-	-	1000	1000
Boredom	1000	-	-	-	1000
Confusion	1000	-	-	-	1000
Engagement	1000	-	-	-	1000
Interest	-	-	-	935	935
Surprise	-	700	300	-	1000
Relief	-	-	-	812	812
Sadness	-	1000	-	-	1000
Total	**3935**	**2405**	**522**	**1812**	**8674**

Table 2: Details of constructed dataset in this study. "-" means that this emotion is not listed in the dataset. The bold numbers represent the total number of images for each class across all datasets (rows), the total number of images from each dataset (column). Int.-Internet

CNN Framework for Emotion Classification

A transfer learning CNN framework was proposed to classify emotions from facial images. The architecture of the proposed framework is shown in Figure 2 and consists of a pre-trained VGG-19 CNN model and a configured CNN model, where the pre-trained VGG-19 CNN model is used to extract universal (generalizable) features for common image classifications tasks, and the configured CNN model is used to classify emotions from facial images.

Specific information about the pre-trained VGG-19 CNN, the configured CNN, and the training procedure of the proposed framework is detailed in the following paragraphs.

Pre-trained VGG-19 CNN: The deep neural network VGG-19 is a well-known CNN model with 19 layers, and it has achieved remarkable performance in various image processing tasks

(Raghu et al., 2020; Xu et al., 2019). VGG-19 replaces large-sized convolution filters with small-sized filters while increasing the depth of network. This is mainly because CNN with small filters will benefit the improvement of classification accuracy. Figure 2 shows the detailed configurations of all layers in VGG-19. The VGG-19 CNN model used in this paper is pre-trained on the ImageNet dataset, and the front-layers of the pre-trained CNN model can extract low-level universal features, which are appropriate for general image processing tasks.

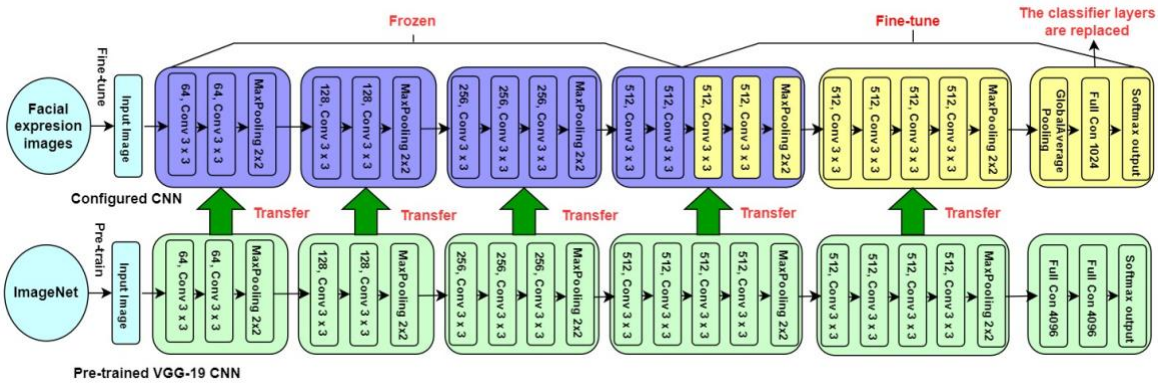

Figure 2: The proposed deep transfer CNN framework based on VGG-19

Configured VGG-19 CNN: Here, the original output layer is removed and then a new SoftMax layer is added, and it is used for emotion classification, there are nine 'neurons' in the new output matching the number of academic emotions. The hyper-parameters, parameters and structures of the pretrained CNN model are directly transferred to the configured CNN model to improve its classification performance. Then, the configured CNN model can be fine-tuned for the specific emotion classification without the need to train the whole network from scratch. The loss function for fine-tuning the configured CNN is categorical cross entropy and the epoch size is 50. In addition, we randomly drop 40% of the weights of the fully connected layer at each training iteration, to prevent overfitting on the training data and enhance generalizability. The adaptive moment estimation (Adam) optimizer (learning rate = 0.0001) was used for the training of the configured VGG-19 CNN model.

Training Procedure

After the structures of the pre-trained VGG-19 CNN and the configured CNN are successfully designed, the constructed dataset images were divided into 5-folds randomly. For each iteration step, the CNN model was trained on 4-folds to fine tune the configured CNN and we performed the testing on the remining fold (5th fold). This process is repeated five times until all the folds are used as a test set. As shown in Figure 3, the front- layers from layer 1 to layer 12 of the configured CNN are frozen. While the later layers after Layer 12 are set to be trainable, these layers are fine-tuned on the constructed dataset. The performance of the proposed framework is evaluated with the three parameters namely accuracy, sensitivity, and specificity, which are most commonly considered in the emotion recognition literature (Zeng et al., 2020; Yuan, 2022). The final results were obtained by averaging accuracies, sensitivities, and specificities of five folds.

Experimental Results and Discussion

Prominent CNN models like VGG-19 have tens of millions of parameters. If all those parameters are trained from scratch, millions of images would be needed to ensure that the network could select features properly. The demand for so many images could be almost impossible to meet when developing models for application in specific real-world contexts. However, considering images from ImageNet and our custom dataset images have common low-level features, it is possible to transfer parameters pretrained on ImageNet to our model designed for use in classroom contexts. This transfer approach was tested in the present study to develop a configured emotion recognition model that may be used to classify student emotions and classroom emotional climate. The configured model was more effective, relative to the pre-trained model, illustrating the successful application of this technique, which may be valuable in the efficient development of deep learning emotion recognition models in future research and applications.

Model	Fold	Accuracy (%)	Sensitivity (%)	Specificity (%)
Pre-trained VGG-19	1	71.07	69.28	96.02
	2	74.38	74.19	97.37
	3	70.02	71.05	96.08
	4	74.62	73.67	97.85
	5	71.72	70.83	96.61
	Average	**72.12±1.89%**	**71.85±2.21%**	**96.54±0.62%**
Configured VGG-19	1	81.36	84.23	97.42
	2	83.67	84.01	97.65
	3	83.89	85.904	97.78
	4	79.11	79.98	97.38
	5	85.62	87.37	98.21
	Average	**82.73±2.26%**	**82.55±2.14%**	**97.67±0.45%**

Table 3: Classification Performance of the pre-trained and configured VGG-19 CNN

Table 3 presents the performance of the proposed machine learning framework, including the pre-trained and con- figured VGG-19. As expected, the configured framework was more effective, showing higher accuracy, sensitivity, and specificity relative to the pre-trained model. The most notable improvements were in average accuracy and sensitivity, which increased by almost 11% after configuration. The configured VGG-19 model also delivered performance with the lowest SD of accuracy, showing greater consistency relative to the pre-trained model. Moreover, as shown in Figure 3, the superiority of the configured model is also evident when looking at performance for each facial expression category. Together, these results demonstrate the significant positive effect that transfer learning can have on CNN models, supporting the application of this technique to efficiently develop state-of-the-art deep learning models for specific classification purposes.

Table 4 shows the average computational time for each module block to process 100 faces using the pretrained and configured VGG-19 model. A sample video with a frame of 128 × 128 was used to compute the computational time. For both models, video acquisition takes an average of 3.39 seconds to capture a single frame, and single- face detection and resizing takes 8.78 and 0.10 seconds, respectively. The configured model was approximately 1-second slower in emotion recognition, taking an average of 1.4 seconds to label the emotion of a single facial image; this drop in speed is relatively trivial, but likely reflects the increased processing demand associated with the higher-order parameters in the configured model. In total, the proposed framework takes 13.72 seconds to process and label the emotion of a single face within one frame. This computational speed may be sufficient for online feedback of emotions during class, which may assist teachers in making in-class decisions to manage and improve students' learning experiences. The proposed model may also be utilized in identifying the emotional climate in classrooms by aggregating classification outcomes across students. However, it is likely that this group-level computation will take additional time, and researchers interested in developing continuous or online measurements of classroom emotions will need to consider how to increase the speed and efficiency of this model further. The present results contribute to the that by showing that transfer learning can greatly increase CNN model performance with a negligible impact on processing speed.

Module	Pre-trained VGG-19	Configured VGG-19
Video frame acquisition	3.39	3.39
Face detection	8.78	8.78
Face resize	0.10	0.10
Emotion recognition	0.52	1.44
Total	**12.80**	**13.72**

Table 4: Computational time (in seconds) of each block averaged over 100 frames with a single face.

Figure 3: Comparison of average classification accuracy ± SD (%) performance in each facial expression category.

Conclusion

In this paper, a classroom emotion classification method based on deep transfer CNN framework was proposed and tested on a broad image dataset involving facial images of students in real classroom learning environments. The framework consisted of a pre-trained

VGG-19 and a configured VGG-19 CNN, where the pre-trained CNN is trained using natural images and the configured CNN is fine-tuned using facial expression images. The performance of the framework is evaluated on a constructed dataset integrating three publicly available and coded datasets that link academic emotions to students' facial expressions (i.e., DAiSEE, Raf-DB, and EmotioNet), as well as classroom videos from the internet. From the experimental results, it can be concluded that the con- figured VGG-19 CNN achieved better classification accuracy and sensitivity compared to pre-trained VGG-19. Configured VGG-19 performance was also better for detecting each emotion and these model improvements were achieved with negligible changes in classification speed. These outcomes demonstrate the viability of using transfer learning to create powerful machine learning models for specific classification tasks that may lack the required training data. The specific model proposed in this research may also help teachers to monitor the emotional climate in the classroom and make necessary adjustments to the lesson delivery for improving the engagement and learning outcomes. Future work includes improve system performance by increasing the dataset size, add other emotion categories or even compound emotion categories and improve robustness of the proposed methodology by combining student's behavioral cues (e.g., head pose) with academic affective states.

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Transforming Science Education at Grade 9 With a Pedagogical Technological Integrated Medium: An Integrated Approach for Teaching, Learning, and Assessment

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Abstract
The study aimed to explore the potential of technology beyond its role as a teaching tool in science education by introducing the concept of a Pedagogical Technological Integrated Medium (PTIM). The PTIM approach functions as a platform for scaffolding, enabling students to construct meaningful knowledge structures. It brings together teachers (T), learners (L), and parents (P) in a TPL nexus to facilitate learning and promote the development of positive attitudes through interaction with peers, teachers, and parents. The PTIM philosophy was integrated with a set of science lessons for Grade 9 students (14 years old), covering biology, chemistry, and physics, on the educational platform "myptim" (https://myptim.org).This platform offers a range of valuable features, including testing of prior knowledge, parental interactions, cognitive engagement, and immediate feedback through diagnostic and formative assessments. The study used a qualitative approach for data collection and analysis. Data were collected from a science teacher, learners, and parents through questionnaires and interviews. Results showed that engagement of learners is sustained both at home and in schools through carefully crafted activities. In addition, the TPL nexus was found to be beneficial, allowing for two-way messaging between teachers and parents, identification of weaknesses in learners' prior knowledge, and monitoring of learners' progression and engagement. Overall, the study has far-reaching significance for improving teaching and learning of science at the Grade 9 level. It highlights the need for further exploration of the potential of technology in education, with a focus on its role in facilitating learners' construction of knowledge structures.

Keywords: Technology Integration, Teaching, Learning, Assessment, Teacher-Parent-Learner Nexus

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Introduction

Technology has deeply embedded itself into every corner of our contemporary society, with the education sector being no exception. Driven by educators' motivation to resonate with the contemporary generation of learners, often referred to as “digital natives” (Dingli & Seychell, 2015), modern pedagogical methods harness the expansive capabilities of advanced technological tools.

The landscape of educational technology spans a broad range of devices and software applications. These tools, celebrated as catalysts for a transformative societal structure (Rutkauskiene et al., 2012), offer real-time access to a world of information. Their flexibility provides unparalleled opportunities for global, synchronous communication, marking a transformative moment in educational evolution (Kraglund-Gauthier, 2015).

While the integration of such technology into education has unlocked new avenues for learning, it also brings forth questions surrounding student engagement and interactions within these digital spaces (Bharati, Fors, & Tedre, 2017; Cocieru, Katz, & McDonald, 2020). Classic, learner-centric classrooms emphasize active knowledge construction within collaborative ecosystems. However, the efficacy of a technology-driven educational space is contingent on the caliber of instructional strategies adopted. It is imperative to understand that the mere incorporation of technology does not assure improved learning outcomes; it must be synergized with effective instructional methodologies (Dynarski et al., 2007; Kulik, 2003).

In a conventional learner-centered classroom where technology is absent, the teacher adopts learner-centered strategies to drive classroom interactions which are needed for successful deep learning endeavours. Students are engaged in minds-on and hands-on tasks and are made to operate in groups to construct knowledge in a spirit of co-operation in this specific kind of setting, while the teacher adopts quintessentially and by default the role of a facilitator in challenging learners towards the fulfilment of desired learning goals. On the flip side, namely in a technology-mediated environment, Ross *et al.* (2010, p. 19) posit that effectiveness of technology “depends on how well it helps teachers and students achieve the desired instructional goals” and, regardless of the form of instruction adopted (e.g., lecture or computer-assisted), it “could be effective or ineffective based on the quality of the instructional strategies employed”.

In a technology-driven (virtual) learning environment, students do not automatically develop conceptual understanding of the content (Flanagan & Shoffner, 2013; Tamim, 2011) unless technology is meaningfully incorporated into an interactive teaching-learning environment. A profound "paradigm shift" (Kuhn, 1970) in assimilating technology into pedagogical practices is indispensable. Instructors must evolve into proficient guides in these tech-savvy environments, necessitating continuous professional development and the inclusion of real-world discourse patterns in their teaching (Scardamalia & Bereiter, 1994). It's also pivotal to acknowledge that online education structures often grapple with higher attrition rates compared to conventional learning environments, underlining the critical issue of student disengagement (Rovai, 2002; Carr, 2000).

In this backdrop, a comprehensive reassessment of our strategy for technology's integration into education is vital. By strategically amalgamating technology with traditional teaching approaches, we can pave the way for a more enriched learning journey, intertwining

cognitive, emotional, and social facets (Ramma, Bholoa, Watts, & Nadal, 2018). The onus is on educators to harness the full potential of modern technology within an education framework ripe for transformation (Bates, 1997).

The Case of Mauritius

Mauritius is eagerly moving towards adopting a full-scale technology-enhanced learning system, striving to align with the latest, state-of-the-art educational models and trends endorsed and embraced by countries globally. With a population of roughly 1.3 million, Mauritius boasted an internet and social media penetration rate of 68% in January 2020 (Kemp, 2020), and the number of digital connections was correspondingly significant, reaching 15% of the total population. Mauritian students frequently utilize advanced technologies in their daily activities, prompting sustained initiatives by local educational authorities to integrate these technologies into learning. In 2014, tablets were distributed to Grade 10 (age 14) students. Presently, students in Grades 1 to 3 utilize tablets during lessons, while the prospect of introducing tablets to pre-primary schools is being discussed.

Recent research conducted in the Mauritian context (Hurreeram & Bahadur, 2019; Jugee & Santally, 2016; Ramkalawon & Bholoa, 2016) suggests that Tablet PCs are viewed as promising tools for technology-mediated pedagogy. Notably, interactions between teachers and students and among students have markedly benefited from this integration. However, a substantial dependence on traditional teacher-learner interaction persists in the learning process. This dynamic impedes the full realization of technology's potential in classrooms, especially as many educators seem to lack confidence and expertise in integrating Tablet PCs (Bholoa, Ramkalawon, & Purdasseea, 2015), often leading to a technological divide between instructors and pupils. A significant number of teachers have voiced the need for comprehensive training and continuous professional development (CPD) regarding this. Current training workshops for educators have been deemed "basic and hence... not aligned with the demands of a genuine classroom setting" in a study by Hurreeram and Bahadur (2019, p. 28). The primary teacher training institution in Mauritius still needs to offer dedicated CPD on integrating technology in classrooms. The institution urgently needs to investigate the potential of delivering micro-credential CPD on technology utilization to educators.

Objectives of the Study

The broader aim of the research study is to design and develop the Pedagogical Technological Integrated Medium (PTIM) as a comprehensive platform that facilitates interactive technology-based lessons tailored for teachers, students, and parents. This paper elucidates the functionalities and features of the PTIM website (http://myptim.org) as a dynamic medium that champions interactions within the teacher-parent-learner (TPL) nexus. An integral aspect of this work is to report on the effectiveness of the PTIM platform in nurturing an interactive setting, thereby enhancing the enactment of the TPL nexus. The potential of myptim.org in providing a conducive environment for teaching support and amplifying the learning experiences for teachers, parents, and learners respectively is also assessed. By evaluating the transformative impact of the PTIM platform on teacher preparedness, parental involvement, and learner engagement, the study delves deeper into understanding its efficacy in an integrated teaching and learning milieu. Lastly, we report potential challenges and barriers encountered by users of the PTIM platform and we propose pragmatic solutions ensuring a seamless and efficacious TPL interaction.

The PTIM Model

In this part of the paper, we elaborate on the Pedagogical Technological Integrated Medium (PTIM) model that draws from the Technological Pedagogical Content Knowledge (TPACK) (Mishra & Koehler, 2006; Mishra & Koehler, 2007) and Community of Inquiry (COI) (Garrison & Vaughan, 2008) frameworks in particular. Like TPACK, our proposed model draws from Shulman's (1986) conception of teachers' content knowledge, pedagogical content knowledge and curricular knowledge. However, our model embraces broader considerations and Figure 1 throws light on our perspective regarding the relationships between content/contextual knowledge, technology, pedagogy, the affective domain and social dimensions.

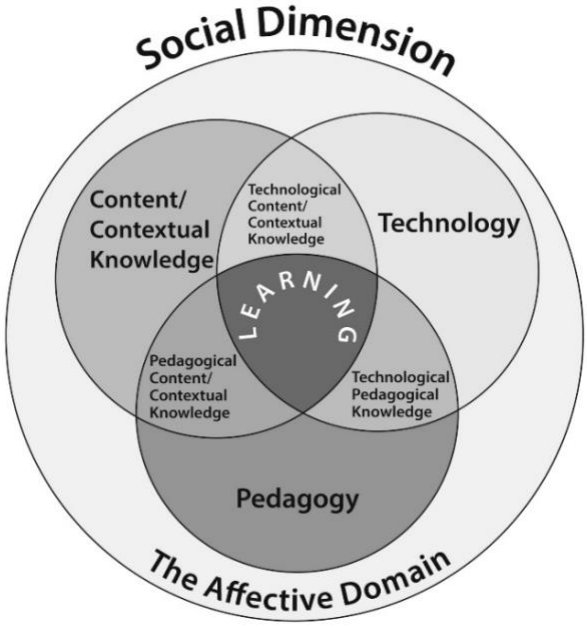

Figure 1: Pedagogical Technological Integrated Medium (PTIM) model

The PTIM model stipulates that the subject matter should always be contextualised, that is, set within a specific context (de Figueiredo, 2005). We opine that disembodied knowledge generates fragmented and effortlessly dissipated and unproductive learning. Context, on the other hand, acts as a reservoir of prior knowledge enabling the learner to relate with the newly acquired knowledge through a process of memory reactivation (van Kesteren, Krabbendam, & Meeter, 2018). The technology component of the model orients towards learners' increased use of devices such as laptops, tablets and smartphones to support learning. Technology should not be the means to deliver the content (de Figueiredo, 2005) rather construed and utilised as a medium that empowers learners in the construction of purposeful and meaningful knowledge structures. Pedagogy forms the third core element of the PTIM model.

Our interest here is in three essential constituents of pedagogy. Firstly, teachers are expected to be well-acquainted with technology-driven pedagogy in their professional realm. Teachers are tasked with elucidating and executing this technologically centric pedagogy to fully elucidate both the overarching and nuanced implications of the philosophy 'leading learners to learning' through the application of technology. They are also expected to act as facilitators, paving the way for a smooth integration of technology-driven learning in the classroom. It's pivotal for teachers to embark on professional development courses to amplify their technical

proficiencies and to inspire a transition to teaching methods anchored in technology. During these professional enhancement courses, educators will be equipped with the capabilities to foster collaborative technology-based learning environments and team-teaching methodologies (see Figure 2).

Furthermore, the significant role and contribution of parents in the educational journey of learners should be appropriately acknowledged and given its due importance, as a substantial amount of learning occurs within the family context. Our previous work (Ramma, Bholoa, Watts, & Nadal, 2018) delved into and illuminated the extent of these interactions within the teacher-student-parent nexus. Technology acts as a formidable conduit to enhance the interactions between teachers and students. With meticulously curated lessons, it holds the capability to facilitate the sharing and connection of experiences (based on prior knowledge), offer real-time feedback, and forge effective communication and relationships, thereby nurturing ultimate student progress and achievement. Additionally, students can utilize various technological devices and potent educational tools for independent learning and for interacting and collaborating with their peers.

The PTIM model strongly advocates and underscores the significance of the affective domain in the learning process within a multidisciplinary approach (Figure 2). In this specific study, we are interested in the ways in which these three elements – content/contextual knowledge, technology and pedagogy impact upon the lived experiences of teachers and learners. This includes their feelings, attitudes, and motivations towards evolving their methods in technology-enhanced learning.

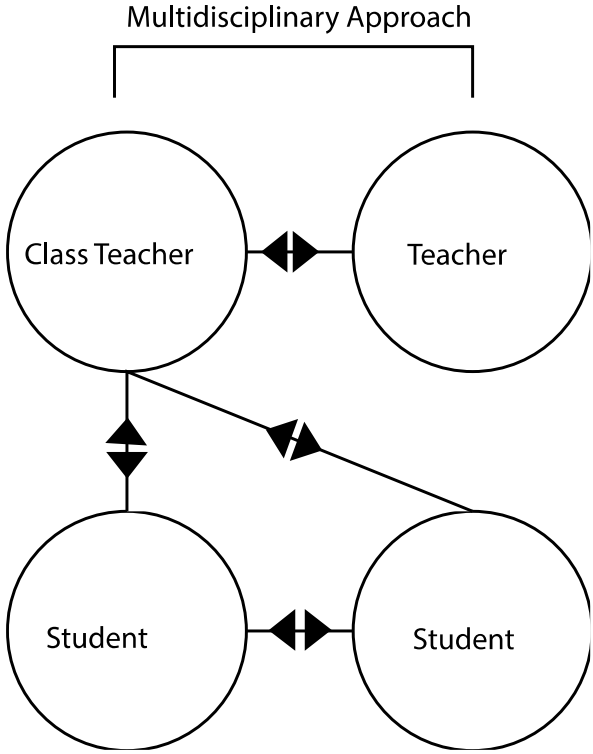

Figure 2: Teacher-student interactions

The engagement of students in the presence of the teacher makes a marked difference in the learning process. Bholoa et al. (2020, p. 116) opine that “increasing reliance on technology and digital tools can negatively affect our social skills, moral values and ethical principles”. In an online environment, students feel disengaged as they are not in the physical presence of

a teacher (Kennette & Redd, 2015) who is responsible for engaging learners in critical discourse situations. Brown and Duguid (2000) further affirm that, even with the advent of novel technologies, the interaction level among learners should remain at the cynosure owing to the fact that the social context dictates measurably the development of technology rather than the other way round.

Figure 3 and Figure 4 show two interactive web-based lessons (Ramma, Bholoa, Watts, & Nadal, 2018) which can be accessed through both Android and Apple mobile devices, thereby allowing flexibility of lesson delivery (https://myptim.org).

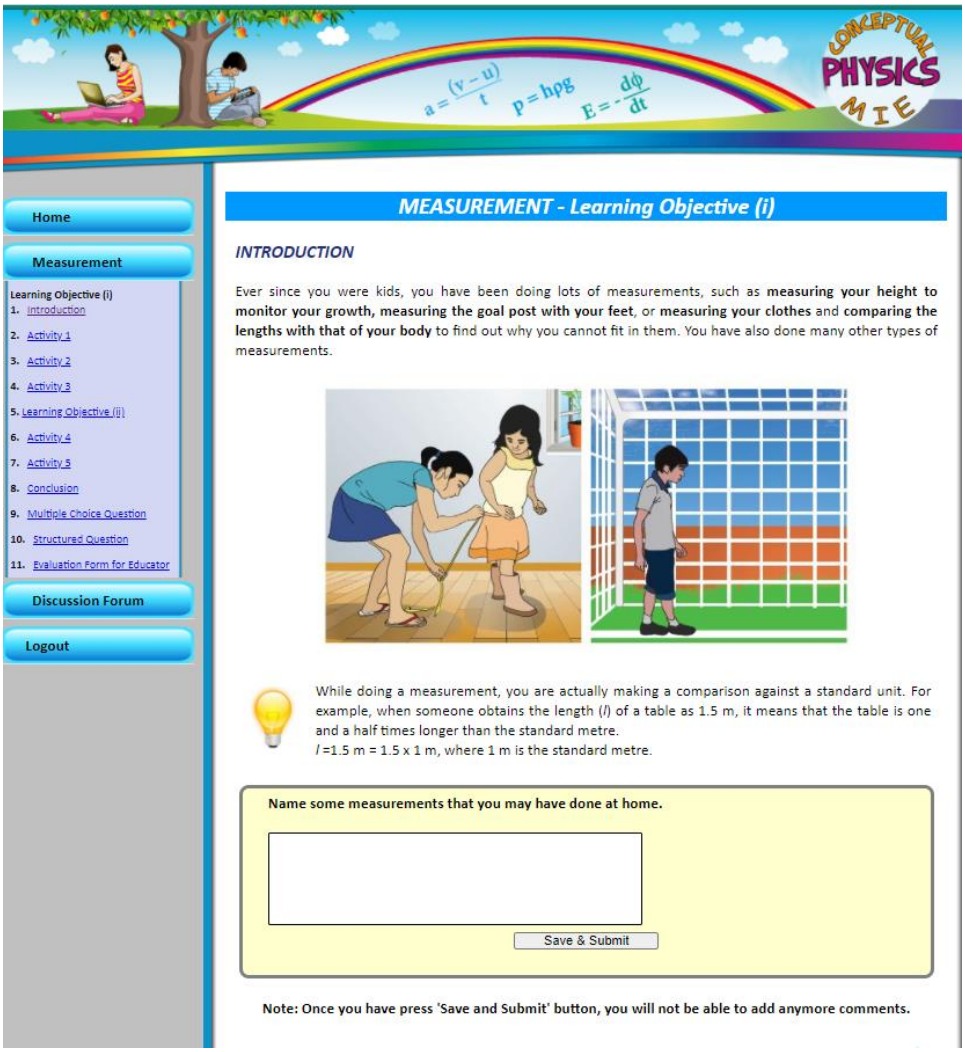

Figure 3: Interactive web-based lessons on ‘Measurements’

Both lessons contain a set of diagnostic, formative and summative assessment tasks which provide multiple perspectives to the learners, thereby allowing them to deepen their understanding of the concepts under study. In addition, some diagnostic tasks are meant to be conducted at home with the support of the parents, and these serve to review prior knowledge in a flipped classroom type approach. Upon the completion of tasks, the students upload their answers, the teacher examines the answers and then discusses them in the classroom setting.

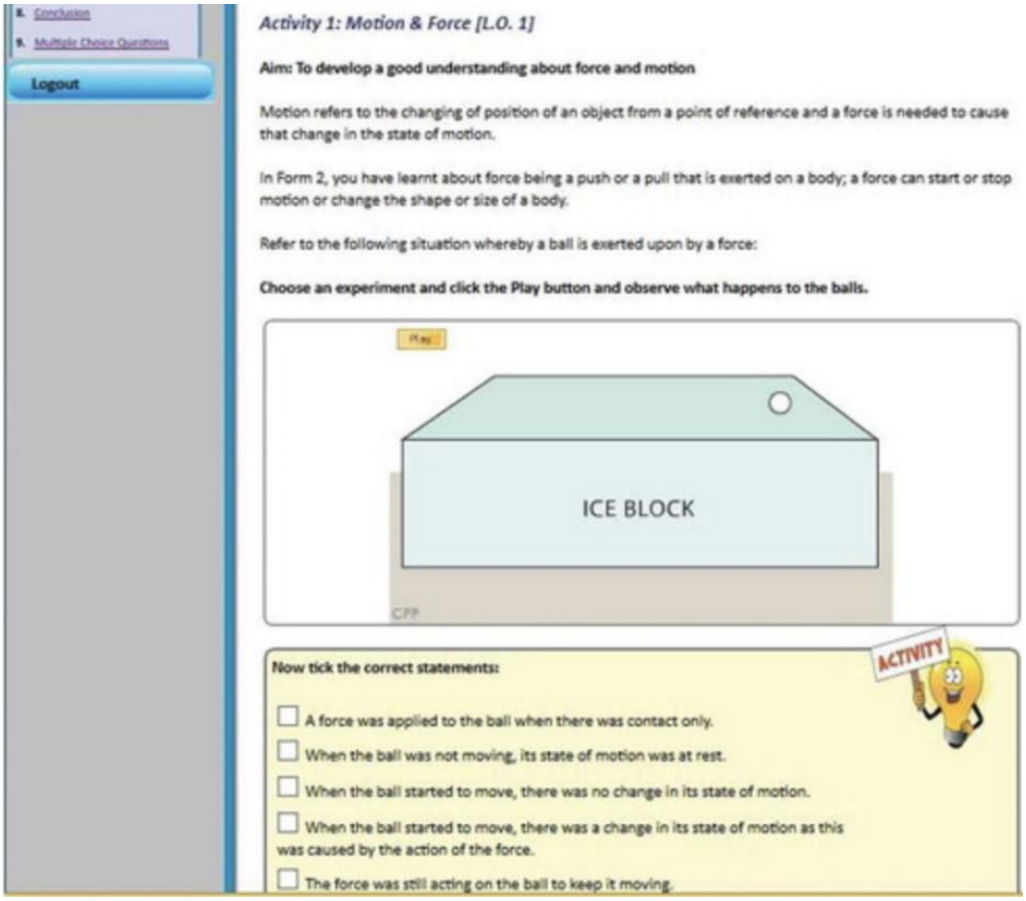

Figure 4: Interactive web-based lessons on 'Motion'

Methodology and Participants

In a bid to understand the intersection of technology and education in the context of Mauritius, a qualitative research methodology was deployed. This methodology, deeply rooted in semi-structured interviews, was designed to yield detailed insights into the lived experiences of educators, students, and parents as they navigate the landscape of technology-mediated education. By leveraging both deductive and inductive analytical approaches, the research sought to explore existing knowledge and identify emergent themes in the data. Each interview was thoughtfully designed, comprising five primary questions bolstered by subsequent probes to delve deeper into the participant's perspectives. While the phone-based interviews were concise, typically lasting between 10 to 15 minutes, they were rich in content. These conversations were meticulously audio-taped, transcribed, and subsequently analyzed.

The research unfolded in two distinct phases. The initial Design and Development Phase saw the active participation of 15 science teachers drawn from three secondary schools in Mauritius. The diverse group, consisting of educators specializing in biology, chemistry, and physics, collaborated on the design and development of Grade 9 science lessons. Their insights and feedback, primarily collected through questionnaires during workshops, proved invaluable. As the research transitioned to the Implementation Phase, it honed its focus on a micro-level, centering on one school. This phase was characterized by interactions with a single teacher and her Grade 9 class comprising 22 students. In-depth interviews were conducted with this teacher, along with a selection of 5 parents and 6 students to ensure a holistic understanding of the platform's impact.

Conclusions

Findings: A Triangular Perspective

Feedback from different stakeholders offered a comprehensive view of the platform's efficacy.

Students emerged as keen observers of the platform's functionality. Their collective feedback resoundingly affirmed the platform's user-friendliness, accessibility, and utility. The immediacy with which the platform addressed their questions was a standout feature for them. However, a constructive critique arose from their collective desire for the integration of structured questions, akin to those they encounter in their physics textbooks and examinations. This revealed an inherent need for familiar structures even in novel learning environments.

Parents, on the other hand, viewed the platform as a bridge to their children's educational journey, a sentiment reminiscent of their involvement during the primary education years. The platform's design, which allowed easy comprehension and round-the-clock access to teacher instructions, was lauded. In an interesting revelation, a parent voiced how the platform doubled as a learning tool for her, underscoring the potential of such technologies to transcend traditional learner demographics.

The teacher's feedback was a blend of appreciation and revelation. Accustomed to the conventional reliance on textbooks, the platform offered her a fresh vantage point. It became evident that while she hadn't been maintaining ongoing records of individual student progress, the platform flagged misconceptions and knowledge gaps in real-time. One such example was the students' misunderstanding related to the SI unit of volume. Empowered by these insights, she could proactively address misconceptions, optimizing her classroom teaching. This proactive approach contrasted with her erstwhile reactive stance, which typically revolved around post-test or examination interventions. Additionally, she acknowledged a foundational familiarity with crafting online content, hinting at the latent potential that can be harnessed with adequate training.

Implications, Recommendations, and the Road Ahead

The findings shed light on several implications and pathways for enhancing technology-mediated education. One of the immediate takeaways was the need to integrate structured questions into the platform. Students' unanimous feedback highlighted the comfort and value they associate with familiar structures, suggesting that blending novelty with familiarity could optimize engagement and learning outcomes.

The platform's potential as a diagnostic tool was evident. By spotlighting misconceptions or gaps in understanding in real-time, it offered educators a proactive tool to tailor their teaching strategies, thereby enhancing learning outcomes. Coupled with this was the realization of the platform as an avenue for parental engagement. The feedback from parents suggested that such platforms could rekindle their active involvement in their children's educational journey, much like the primary years.

However, for these potentials to be fully realized, the onus is on equipping educators with the necessary skills. The teacher's feedback highlighted a latent familiarity with online content

development. By investing in targeted training programs, this latent potential can be transformed into active prowess, ensuring that educators are not just consumers but creators in technology-rich educational environments.

As for the future, the research team is poised for further enhancements. The immediate plan involves augmenting the platform with open-ended questions, buttressed by real-time feedback mechanisms. The grand vision, contingent on funding, is to metamorphose the platform into a full-fledged Teaching-Learning Management System (TLMS). Parallelly, there's an ongoing effort to craft a standalone module, tailor-made to bolster the skill sets of teachers. This module is envisioned as an integral component of their Post Graduate certificate in Education (PGCE) course, ensuring that the next generation of educators is adept at navigating and optimizing the potentials of technology in education.

Limitations

We recognize some limitations in our methodology, particularly the absence of a separate pre- and post-test assessment and a control group. These elements could have bolstered the empirical robustness of our findings. However, the study's primary intent was to delve into firsthand experiences and perceptions of platform users rather than a comparative efficacy analysis. The approach, while more exploratory, enabled a rich, qualitative understanding of the platform's impact, laying groundwork for future, more structured studies. Additionally, while we leaned on parental oversight to ensure compliance outside school, we acknowledge the potential variability this might introduce. However, our aim was to simulate a realistic home environment, capturing authentic interactions with the platform. The participation of parents was predominantly passive. They were integral in facilitating and overseeing their child’s interaction with the platform, given the secondary school level of the participants. Their feedback about the platform was also actively solicited to gather a more holistic perspective.

Acknowledgements

We are immensely grateful for the support and funding received from the Higher Education Commission, under Award Number INT-2018-21, which has been pivotal to the realization of this research. This project represents an original contribution to the field, bringing forth fresh insights into the integration of technology in teaching and learning of science at the lower secondary level.

Special thanks are due to Mrs. S. Ramlugun from one of the participating schools, whose cooperation and input have been invaluable to our work. We would also like to extend our heartfelt appreciation to all the institutions, which, although not named here for brevity, have played crucial roles as collaborators or gatekeepers. Their unwavering support ensured the successful data collection essential to the completion of this research project.

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The Effects of Growth Mindset, Multicultural Efficacy, and Peer Relationship on Democratic Citizenship of Elementary Students in South Korea

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Abstract
The purpose of this study was to verify the effects of growth mindset, multicultural efficacy and peer relationship on democratic citizenship of elementary students. The subjects were 212 4th~6th grade elementary students in South Korea, surveys were conducted from November 2022. Descriptive statistics, correlation analysis, and multiple regression analysis was performed using SPSS 27.0 for data analysis. The results of this study are as follows. First, democratic citizenship showed a significant positive correlation with growth mindset, multicultural efficacy, and peer relationship. Second, the explanatory power of growth mindset, multicultural efficacy, and peer relationship on democratic citizenship was 43.7%. Particularly, multicultural efficacy was a greatest influential factor on democratic citizenship. The findings have implications that efforts to improve growth mindset, multicultural efficacy and positive peer relationship in order to strengthen democratic citizenship of elementary students.

Keywords: Democratic Citizenship, Growth Mindset, Multicultural Efficacy, Peer Relationship, Elementary Student

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Introduction

Democratic Citizenship Education (DCE) has increasingly become a hot issue in educational, social, and political discourse, not only across countries, but also within countries including different dimensions of the societies (Biesta & Lawy, 2006; Byeon, 2012; Crick, 2002; Holford & Edirisingha, 2000; Saha, 2001). According to these circumstances, citizenship education has been integrated in many national curricula (EURYDICE, 2017; Roberts, Nganga, & James, 2019; Shim, 2018). It comprises in sets of knowledge, skills, attitudes and values, also stimulating participation (Ruud, 1997; EU, 2006). Thus, citizenship education usually deals with students' values and attitudes of equality, liberty, rights, responsibilities, autonomy, diversity, and harmony in a democratic society.

The Korean government has officially tried to promote citizenship education in its formal education system since the late 2000s. The Ministry of Education (MoE) set out the national curriculum and through the 2007 curricular reform, citizenship and international understanding of education-related contents have become embedded in the regular school curriculum in elementary, middle, and high schools (Lee & Kim, 2010). In 2018, Korean Ministry of Education announced a plan to revitalize democratic citizenship education.

The plan for democratic citizenship education by Korean Ministry of Education shows the vision, purpose, and the top priority project that will be worked on for the next five years. The vision is that fostering democratic citizens who practice autonomy, respect, and solidarity. The purpose is that strengthening the capacity of democratic citizens by creating a democratic education ecosystem. The top five priority project are strengthening democratic citizenship education in school, enhancing teacher expertise and supporting educational activities, creating democratic school culture, revitalization of student autonomy, and establishment support system for democratic citizenship education.

Traditionally, Korea has regarded itself as a mono ethnic society. A mono ethnic society has been associated with positive images in South Korea. However, the growing number of immigrants to South Korea means that Korea is not a single ethnic and homogeneous country anymore. In South Korea society 2021, approximately 213 million foreign nationals lived in Korea, which was more than 4.1% of the total population. The number of foreign nationals increased more than 4 times from 2006 to 2021 (Ministry of Public Administration and Security, 2022). Also, the number of children from multicultural families has increased more than one million every year, currently 16 million multicultural students, and foreign students has increased approximately 13% from 2021 to 2022 (MoE, 2022). Thus, citizenship education has considered not only Korean students, but also foreigners in Korean public education system.

Democratic citizenship education is the most important goal of education in a democratic country. The ability as a democratic citizenship is an essential element of the constitutional right to education. In terms of legislation, however, the concept of democratic citizenship education has not been established or formally adopted in spite of the long argument. For many years, the subject 'morals' is a major vehicle through which democratic citizenship is taught in South Korean school system. The democratic citizenship education in South Korean schools has been criticized for failing to teach democratic behavior and practices, and concentrating on delivering knowledge of promoting understanding (Bae, 2000). Especially, a few researches related in effective factors to democratic citizenship for elementary students has been studied.

Elementary education is focused on basic experience, attitudes for becoming a good citizen and teachers have tried to diverse teaching and learning methods to improve their student's citizenship. But above all, teachers need to know which factors could be affect citizenship for children. One of the factors that could affect democratic citizenship is growth mindset.

Mindset is a set of attitudes and beliefs about abilities, such as intelligence. Psychologist and author Carol Dweck coined the terms fixed and growth mindsets to describe the attitudes and beliefs people have about learning and intelligence (2006). Students with a fixed mindset believe that they are born with their abilities and that they are unchangeable. In contrast, students with a growth mindset believe that their abilities can be developed and improved over time with practice. According to Dweck (2006), students' mindsets influence their learning behaviors. The learning behaviors related to psychological wellbeing of students. Building a classroom culture of growth mindset changes how students approach learning and helps them develop strong work habits that lead to democratic communication and classroom culture.

Multicultural education rests on democratic values, maintenance of cultural identity, social justice, and learner's development of critical thinking skills (Nieto & Bode, 2011). Accordingly, democratic values and beliefs are the premise of multicultural education in that democratic values depend on common and universal values which all citizens share across the world. Drawing from this aspect, democratic values and beliefs establish a foundation of students' multicultural efficacy as students' belief about their ability and skills. Thus, multicultural efficacy could affect democratic citizenship included respect for human rights, responsibility, cooperation, and democratic process in democratic society.

A number of important changes occur in children's peer-relevant social worlds during the primary school years. These shifts produce both new demands and new opportunities for social and emotional growth. Children's peer interactions, relationships and groups are not only relevant insofar as psychological and emotional adjustment are concerned but also clearly important entities as children attempt to make their way through their everyday lives in school (Rubin, Chen, Coplan, & Buskirk, 2005). Researchers have shown that friendship can promote or support positive adjustment, particularly during stressful times of transition (Berndt & Keefe, 1995). Positive peer relationship in childhood and quality of children's friendships also plays an important role in children's feelings of loneliness. Features such as the degree of companionship, help, and guidance, intimacy, conflict, and ease of conflict resolution can all be reliably measured among elementary school children. Research on children's peer relationships is conducted almost exclusively in schools, and children's experiences with peers in school have been linked to other aspects of their developing social competence as well as to academic success. But researches on relationship between children's peer relationships and democratic citizenship have not been studied.

Hence, the purpose of this study is to investigate the relationship and relative influence among growth mindset, multicultural efficacy, and peer relationship on democratic citizenship of elementary students. This study will provide the greatest influential factor among psychological, cognitive and social factors on democratic citizenship and suggest effective citizenship education for elementary school teachers.

The following questions guide my work:

1. What is the correlation between growth mindset, multicultural efficacy, and peer relationship on democratic citizenship of elementary students?

2. What is the relative influence of growth mindset, multicultural efficacy, and peer relationship on democratic citizenship of elementary students?

Method

Participants

The study group of the research consisted of 212 elementary students, 101 females (47.6%) and 111 males (52.4%), 70 4th grade (33.0%), 73 5th grade (34.4%), 6th grade (32.5%), who were selected by random sampling method from elementary school in city of Daegu, South Korea. The data of this study were obtained from class teachers after children filled out a questionnaire in the classroom, after researcher's explanation about the research purpose, 1-16, November 2022.

Data Collection Instruments

Growth Mindset: The scale is 5-point Likert type and consists of 8 items and 2 sub-dimensions (growth and fixed belief). The growth belief question example is 'If you work hard, you can change your ability as much as you want'. Fixed belief question example is 'Ability is already determined, so it is difficult to change even if you try'. The Cronbach's alpha internal consistency reliability coefficient of the whole scale was found .911. The corrected item-total correlation coefficients raged from .897 to .918.

Multicultural Efficacy: The scale is 5-point Likert type and consists of 15 items and 4 sub-dimensions (consideration for multicultural families, enhancement of human relations, generalized function, and learning ability function). The consideration for multicultural family question example is 'I can help friends from multicultural families be confident'. The human relations question example is 'I have a mutual respect for my friends from multicultural families'. The generalized function question example is 'I can find my prejudice against multiculturalism'. The learning ability function question example is 'I can find misconceptions about different races and ethnicities in the textbook'. The Cronbach's alpha internal consistency reliability coefficient of the whole scale was found .927. The corrected item-total correlation coefficients raged from .768 to .905.

Peer Relationship: The scale is 4-point Likert type and consists of 13 items and 2 sub-dimensions (positive and negative peer relationship). The positive relationship question example is 'I can tell my friends my secret' and negative relationship question example is 'When I fight with my friend, I don't make up well'. The Cronbach's alpha internal consistency reliability coefficient of the whole scale was found .812. The corrected item-total correlation coefficients raged from .543 to .828.

Democratic Citizenship: The scale is 5-point Likert type and consists of 20 items and 4 sub-dimensions (respect for human rights, responsibility, cooperation, and democratic process in democratic society). The respect for human rights question example is 'I think everyone is as precious as me'. The responsibility question example is 'I make an effort to do what I do in class'. The cooperation question example is 'I am living with my friends at school helping each other'. The democratic process question example is 'When I disagree with my friends, I solve it through conversation'. The Cronbach's alpha internal consistency reliability coefficient of the whole scale was found .892. The corrected item-total correlation coefficients raged from .627 to .725.

Analysis of Data

The data obtained from the participants were analyzed through the SPSS 27.0, statistical analysis software. Pearson product-moment correlation coefficient analysis was used to examine the relationships among the variable, and multiple regression analysis was used to determine the relative influence between the variables. Durbin-Watson was 2.039.

Results

First, table 1 shows that result of descriptive statistic analysis among the variables. Mean score of students' growth mindset was 4.073(*SD*=.823), fixed belief (*M*=3.951, *SD*=.977) was higher than growth belief (*M*=2.997, *SD*=.871) among sub-variables. Mean of multicultural efficacy is 3.934(*SD*=.633), consideration for multicultural families (*M*=4.415, *SD*=.699) was the highest score and learning ability function (*M*=3.577, *SD*=.811) was the lowest score among sub-variables. Mean score of peer relationship was 2.977(*SD*=.401), positive relationship (*M*=2.948, *SD*=.500) was higher than negative relationship (*M*=1.818, *SD*=.504) among sub-variables. Mean score of students' democratic citizenship was 3.871(*SD*=.479), respect for human rights (*M*=4.103, *SD*=.598) was highest score and democratic process (*M*=3.713, *SD*=.581) was the lowest score among sub-variables.

Variable	Sub-variable	*M*	*SD*	skewness	Kurtosis
Growth mindset	Growth belief	2.997	.871	-1.265	1.515
	Fixed belief	3.951	.977	-.988	.691
	total	4.073	.823	-1.049	1.143
Multicultural efficacy	consideration for multicultural families	3.691	.743	.073	.437
	enhancement of human relations	4.145	.699	.546	.027
	generalized function	3.860	.705	.193	.256
	learning ability function	3.577	.811	.044	.200
	total	3.834	.633	.009	.331
Peer relationship	Positive relationship	2.948	.500	.434	1.007
	Negative relationship	1.818	.504	.540	.818
	total	2.997	.401	.405	.955
Democratic citizenship	Respect for human rights	4.103	.598	-.527	-.039
	responsibility	3.777	.591	-.114	.115
	cooperation	3.891	.607	-.454	.245
	Democratic process	3.713	.581	-.185	.557
	total	3.871	.479	-.161	.171

Table 1: Means and standard deviations of subscale scores on variables

Second, table 2 shows that result of correlation analysis among the variables. Democratic citizenship showed a significant positive correlation with growth mindset, multicultural efficacy, and peer relationship. The correlation coefficient between growth mindset and multicultural efficacy is .353(p<.001), peer relationship is .402(p<.001), democratic citizenship is .472(p<.001). The correlation coefficient between multicultural efficacy and peer relationship is .453(p<.001), democratic citizenship is .592(p<.001). The correlation coefficient between peer relationship and democratic citizenship is .447(p<.001).

Variable	1	2	3	4
1.Growth mindset	-			
2.Multicultural efficacy	.353***	-		
3.Peer relationship	.402***	.453***	-	
4.Democratic citizenship	.472***	.592***	.447***	-

***p<.001

Table 2: Results of correlation analysis among variables

Third, table 3 shows that result multiple regression analysis of student's democratic citizenship. The first, growth mindset only put in model 1 and next, growth mindset and multicultural efficacy put in model 2. And then, growth mindset, multicultural efficacy and democratic citizenship put together in model 3. The explanatory power of growth mindset was 21.9%, the explanatory power increased 42.5% when add multicultural efficacy. Finally, the explanatory power of growth mindset, multicultural efficacy, and peer relationship on democratic citizenship was 43.7%. Particularly, multicultural efficacy (β= *0.434)* was a greatest influential factor on democratic citizenship than growth mindset (β=0.261), peer relationship (β=0.145).

Model	Variable	Unstandardized Coefficients		Standardized Coefficients	*t(p)*	adj. R^2	*F(p)*	*TOL*	*VIF*
		B	*SE*	*β*					
1	(constant)	2.753	.147		18.736	.219	60.261***	1.000	1.000
	Growth Mindset	.275	.035	.472	7.763***				
2	(constant)	1.750	.171		10.248	.425	78.820***		
	Growth Mindset	.175	.032	.301	5.390***			.876	1.142
	Multicultural Efficacy	.367	.042	.486	8.711***			.876	1.142
3	(constant)	1.476	.204		7.238	.437	55.670***		
	Growth Mindset	.152	.034	.261	4.520***			.802	1.247
	Multicultural Efficacy	.328	.045	.434	7.333***			.760	1.316
	Peer Relationship	.173	.072	.145	2.402*			.728	1.374

*p<.05, ***p<.001

Table 3: Multiple regression analysis of student's democratic citizenship

Conclusion

The findings showed that higher multicultural efficacy can play an important role in children's democratic citizenship. This showed relations between multicultural education and citizenship education in South Korea. Also, children's multicultural efficacy enhancement is important for citizenship education in multicultural Korean society. This study has implications that efforts to improve growth mindset, multicultural efficacy and positive peer relationship in order to strengthen democratic citizenship of elementary students.

This study was based on self-reported data and had limitations. These limitations should be considered when interpreting the data and finding. First limitation, typical in self-efficacy studies, was the reliance on self-reported data (Creswell & Creswell, 2018). While childrens were asked to rate their confidence level in multicultural efficacy, their answers may not reflect their true abilities to deliver these practices. Another limitation, the sample used in this research is limited to 212 students in the 4-6th grade, however, this number is still on a small scale. Therefore, there is a need to monitor other determinants outside the research variables.

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Protecting Children: Reflective Practice for Future Educators

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Abstract
In Italy, Bachelor's degree courses in Education Sciences prepare future educators who can work within public, private and third sector organizations in the planning, implementation and evaluation of educational interventions. A curricular traineeship of 250 hours is foreseen, preceded by a 50-hour training course on critical situations in educational contexts. During their traineeship, students participate in supervision meetings in small groups, moderated by a professor. To prepare for the meetings, each of them is asked to write a critical incident based on their field experience. The analysis of critical incidents is a training strategy that helps people to clarify their assumptions and to understand, through comparison with different perspectives, the value assumptions that guide their own and others' behaviors. During the meetings, the critical incidents are analyzed by the group starting from three key questions: what is the problem being narrated? Who should take charge of this problem? What could/should be done? In the trainees' narratives collected over the years there are some episodes of child maltreatment in school and educational services. It is essential for a future educator to be able to reflect on the distorted educational conceptions which, on the one hand, generate these phenomena and, on the other, prevent them from being eradicated. The paper, starting from the analysis of critical incidents reported by the trainees, focuses on the reflective practices necessary for future educators to build awareness of what maltreatment is and how to prevent, identify and manage it in educational contexts.

Keywords: Educator, Reflective Practice, Curricular Traineeship, Critical Incident, Child Maltreatment

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Introduction

In Italy, Bachelor's degree courses in Education Sciences prepare future educators who can work within public, private and third sector organizations in the planning, implementation and evaluation of educational interventions. A curricular traineeship of 250 hours is foreseen, preceded by a 50-hour training course on critical situations in educational contexts.

During their traineeship, students participate in supervision meetings in small groups, moderated by a professor. To prepare for the meetings, each of them is asked to write a critical incident based on their field experience. During the meetings, the critical incidents are analyzed by the group starting from three key questions: what is the problem being narrated? Who should take charge of this problem? What could/should be done?

The analysis of critical incidents is a training strategy that helps people to clarify their assumptions and to understand, through comparison with different perspectives, the value assumptions that guide their own and others' behaviors. The method was first developed by Flanagan (1954) in the 50s to observe and identify factors responsible for success and failure in the training of pilots. Since then, it has been further developed and applied to a range of contexts in management, services and social sciences.

At the roots of the critical incident strategy is the concept of reflective thinking. Many authors have underlined its importance in education.

Among them, Kolb (1984) described the experiential learning cycle in which knowledge is created through the transformation of experience in four stages: concrete experience, reflective observation, abstract conceptualization and active experimentation.

Mezirow (1991) described the interplay between critical thinking and transformative learning, based on a change in the frames of reference that build assumptions and expectations in the minds of adults. This kind of profound change requires critical reflection and thinking in such a way as to transform ideas, knowledge and practice, forming new frames of meaning.

Going on, Schön (1983, 1987) identified two types of reflection: reflection-in-action and reflection-on-action. The first is the process that allows professionals to reshape the situation while it is happening. This way, they may generate both new understanding of the experience and a change in the situation. Reflection on action takes place after the experience. The professionals reflect on what they did and whether they could have acted differently, examining alternative ways to improve their practice.

Mortari (2013) argues that education is an action intended to cultivate in others the desire to take care of themselves. She elaborates a concept of care meaning cultivating the life of the mind, educating people to think, to give sense to their experience.

Striano (2002) affirms that education professionals, faced with problematic situations, must be supported by two forms of rationality: heuristic-reflective and critical-emancipatory. The first guides the professional in investigating the experience in order to build the necessary knowledge

to interpret and manage it. The second makes the professional an agent of transformation and change. For this to happen, it is necessary to develop awareness and the ability to recognize the conditioning and distortive elements that prevent educational action from adequately responding to the actual needs of the people.

Narration is nourishment for reflective thinking. Authors such as Bruner (1987), Demetrio (1996) and Mortari (2003, 2013) underlined how reflective autobiography through narration can be an effective method for reworking and re-signifying experiences, making them an active part in the construction of one's daily actions. In a learning context, it is essential to promote a relational environment based on acceptance, mutual listening, real interest in the experiences of the others: the "cognitive scaffolding" must be implemented in close connection with the "affective scaffolding" (Mortari, 2013, p.50).

Theoretical Framework

This project falls within the framework of action research, first theorized by Lewin (1946), that provides for the investigation to be conducted on the field, on the basis of close collaboration between researchers and practitioners.

The action research strategy is based on the constructivist principle according to which knowledge is elaborated by subjects through practice and problem solving, in everyday circumstances that require attention (Sorzio, 2019). We can therefore speak of “experiential knowledge” (Mortari, 2007, p. 210) or of “situational” knowledge” (Sorzio, 2019, p. 151)[1].

Ultimately, action research is aimed to generate improvement and change in the context in which it is implemented.

The roots of the action research approach can be found in Dewey’s thought and in its criticism of the traditional separation of knowledge and action (1938). The philosopher hoped that the extension of experimental inquiry to social practice would lead to an integration of science and practice: in his view, knowledge implies not only the adaptation of the organism to the environmental conditions, under external pressures, but also the active modification of the environment itself to adapt it to one's needs and desires in the most effective way possible. In the interaction between organism and environment, they are both constantly changing: knowledge in itself implies the modification of the reality that is known.

Any reference to action research must also acknowledge Freire’s work (1970) in which learning is described as the process of developing critical awareness of one’s social reality through reflection and action. “Conscientization” concerns the relationship between the subject and the world. When the human being lives in the world being subject only to its constraints, his conscience is in a state defined as “intransitive”: the state of oppression - material, spiritual, psychological, cognitive - is such as to prevent any transformative interplay with reality. While being “in” the world is the condition of every living being, being “with” the world is a specific human condition that implies to be able to establish processes of exchange and reciprocal

[1] All the translations from Italian into English in this paper are by the autor.

influence with others and with the reality in which we live. In order to be with the world, it is necessary to develop “critical transitive consciousness”. While natural transitive consciousness tends to explain contradictions and problems uncritically, adopting routine and standardized ways of thinking, critical transitive consciousness, on the contrary, seeks explanations that are also scientifically valid, goes beyond the boundaries of conformism, reveals contradictions and sees problems as opportunities to build new knowledge. The passage from natural transitive consciousness to critical transitive consciousness can only occur through education. Critical awareness must be taught, but certainly not through the transmission of conceptions, ideas, attitudes in a way that would still be of a depositary nature. The Portuguese educator brings a "problematizing" and "dialogical" perspective in education, according to which knowledge is a problem for the person who has to build it, a question to be addressed critically, not alone, but through dialogue between those who teach and those who learn. In the dialogue, different types of knowledge are dialectically compared: the predominantly theoretical ones come into contact with the practical ones to produce new knowledge.

Reflective Practice

The term “critical incident” or “critical episode” refers to “non-ordinary events and issues that produce a moment of surprise, disorientation, criticality” (Fabbri & Romano, 2017, p. 153). The request to share an event that happened in one's own experience is within everyone's reach and this method is effective to avoid the risk of “getting lost” in non-substantive matters (Mortari, 2003). The discussion must take place in small groups, where it is easier to agree to submit one’s own thinking and action to the others’ critical scrutiny. The group chooses which topics to investigate in depth and the interaction stimulates deep reflection on the different interpretations provided by the participants.

As previously described, each trainee has to take part in at least two meetings during their traineeship. Before the meeting, participants must write and share their critical episodes in the google classroom. They are asked to describe the episode (what happened, when and where, who were the people involved, what each of them did, how they felt …) and then they must answer three questions: 1. What is the problem being narrated; 2. Who should take charge of the problem; 3. What could/should be done to address the issue? In small groups, under a professor’s supervision, the trainees analyze the episodes, exercising their critical thinking. Finally, a common conclusion is drawn up to answer the final question: what could/should be done?

Protecting Children: A Collective Responsibility

Over the years, some critical incidents were collected potentially referring to child maltreatment, defined by the World Health Organization (from now on, WHO) (2002, p.59) as “physical and/or emotional ill-treatment […] resulting in actual or potential harm to the child’s health, survival, development or dignity in the context of a relationship of responsibility, trust or power”.

Some studies assume the perspective of collective responsibility referring to “institutional abuse”, a form of “additional” maltreatment mostly of an emotional/psychological type, or omissive violence or abuse of power, by the same institutions that are responsible for the care, protection and safeguarding of children, such as schools (Dissegna, 2022). It is important to

reflect on the distorted educational assumptions which, on the one hand, generate these phenomena and, on the other, prevent them from being eradicated. The result of research and the dialogue among professionals in educational contexts have revealed that it might be difficult to identify and name violence and that there are unconscious mechanisms of denial that make violence invisible and cause the victims feel guilty (WHO, 1999, 2002, 2006).

In the foreword to the 2002 *World report on violence and health* by the WHO, Nelson Mandela reminds us that violence is not an intrinsic part of the human condition, on the contrary it can be prevented: security and serenity are the result of concrete actions and investments. Governments, communities and individuals can make a difference. Each of us can help making a difference.

In training programs for future educators, reflexivity is essential to build awareness that educating implies "being on the side of the human being" (Bastianoni, 2021, p.204). In other words, future educators must be aware of what is maltreatment, they must know how to identify risk and protective factors and be able to decide how to intervene. The perspective of institutional abuse emphasizes the importance of "taking care of care systems" (Dissegna, 2022, p.12). Promoting collegial reflection on action is a way to take care of systems and people.

Lisa, trainee in a nursey school in the Fall 2022, has brought two critical episodes to supervision[2]. The same educator is responsible for the ill-treatment in both episodes. This element of recurrence helps to define a situation of abuse.

CRITICAL INCIDENT 1

> The children play serenely, unlike Mirco, 2 years old, who is very nervous today and cries desperately, non-stop. The educator Roberta, with cell phone in hand, limits herself to supervising the children, does not play with them and appears very annoyed by Mirco's behavior. After half an hour of the child's desperate crying without any intervention on her part, Roberta approaches him shouting angrily "Stop crying! Put the pacifier! You have to learn how to stay with others!". He continues to cry and then Roberta takes him by the arm, yanking him, opens the door to a room where no one is present and puts him in there for punishment. Obviously Mirco screams even louder, desperate, so Roberta reopens the door, drags him into the playing area, sits him on the mat and, still yelling, says to him "Stay there if you don't feel like playing!" Mirco is exhausted, he cries non-stop and the educator starts using his cell phone again.
>
> (Lisa, trainee, Fall 2022)

CRITICAL INCIDENT 2

> Today's dance and movement activity has been really intense. At lunchtime, the kids are tired. In particular, I notice that Lucia, 2 years old, has sad expressions while eating. So I go over and help her eat, but I see that she's still sad. I think the reason is that she is particularly tired. In fact, once the meal is over, Lucia falls asleep on the table; therefore, I decide to pick her up and let her sleep in my arms. The educator Roberta, however,

[2] Names are invented. The critical incident has been rewritten to make people and contexts unrecognizable, leaving the meaning intact.

> immediately tells me that this is not good, that Lucia can't sleep now, she has to go to bed later with all the other children. Then he snatches her from my arms and sets her up still asleep. She rudely drags her to the bathroom and washes her face to wake her up.
>
> (Lisa, trainee, Fall 2022)

During the supervision meeting, both critical incidents were analyzed, read and re-read by adopting an authoritarian/institutional perspective vs. a perspective focused on educational responsibility. In the first, interventions are oriented according to standardized procedures which take the form of self-defense mechanisms, avoiding relational involvement. In the second perspective, the educational interventions pursue the pre-eminent interest of the recipient (Bastianoni & Zanazzi, 2023).

The following table summarizes the content of the group discussion.

Critical incidents at the nursery school	
[…] almost all the children play, unlike Mirco who is very nervous, cries desperately, does not want the other children to come near him. The educator Roberta … […] I notice that Lucia, aged 2, has sad expressions while eating. So I go over and help her eat, but I still see that she's always sad. I think it is because she is particularly tired. In fact, once the meal is over, Lucia falls asleep on the table. So, I decide to pick her up…	*"Reading" the critical incidents from an authoritarian or institutional perspective*
	WHAT IS THE PROBLEM? M. and L. have wrong behaviors that are not suitable for the nursery context. WHO SHOULD TAKE CHARGE OF THE PROBLEM? The children, who must learn to respect the rules of coexistence at the nursery school. WHAT COULD/SHOULD BE DONE? Isolate, scold, punish, force the children to understand which are the correct behaviors and which are the wrong ones.
	"Reading" the critical incidents from the perspective of educational responsibility
	WHAT IS THE PROBLEM? The educator, whose behavior is marked by reproach and punishment, does not respond to the needs of the children. WHO SHOULD TAKE CHARGE OF THE PROBLEM? The problem lies with the organization that should intervene to protect children from any form of abuse and with the educator who should radically change her approach to children. WHAT COULD/SHOULD BE DONE? Action must be taken to ensure that the relational rights of children are defended and their real needs are listened to.

Table 1 – Discussion on critical incidents at a nursery school

If we read the critical incidents with an authoritarian approach, the problem lies in the children's behavior that is not suitable for the nursery context. Punishment, scolding and isolation will work effectively to make them understand the difference between correct and wrong behaviors.

Differently, if we read the critical incident from the perspective of educational responsibility and educational relationship, the problem is that the educator, whose behavior is marked by reproach and punishment, does not respond to the needs of the children. Therefore, the problem lies with the organization that should intervene to protect children from any form of abuse, and with the educator who should radically change her approach to children. Action must be taken to ensure that the educational rights of children are defended and their real needs are listened to.

During the supervision meeting, Lisa was suggested to take a position to protect the children in the nursery school. Supported by the group of peers, she accepted to speak directly with Roberta, the educator, and to report to Sara, the Director of the nursery school.

Despite her courage, Lisa was not listened to. His interlocutors raised a wall: the institution provided a response based on denial, deciding to protect itself rather than protecting children. Before her second supervision meeting, the trainee wrote a follow up of the critical episode:

> I felt scared because, being a trainee, I have a hierarchically lower position than an educator and I didn't know how she could react. However, I asked Roberta to talk to her and she accepted. I told her my judgment on her behavior. Unfortunately, my emotions translated into crying while I explained everything to her. The answer seems conciliatory: Roberta said that she was glad that I had presented my doubts to her and added that she would take my perspective into account. After the interview I feel really bad, because I had not been able to hold back my tears, thinking about the two children victim of a form of violence. Moreover, I had felt in awe of a person in a higher position than me.
>
> As soon as I saw the Director Sara, we went to her office to talk. Again, I couldn't hold back the tears, I felt very agitated. Sara had expressions of astonishment, she almost seemed incredulous and immediately belittled what I was saying. She also immediately forced me to take a defensive position by asking me “Lisa, this is your first experience in a nursery, isn't it?” and then, again: “it's the first internship you're doing, I guess?” and, to my affirmative answers, she replied “ah ok …”. All this to underline that I wasn’t able to understand the dynamics I have witnessed, because I had no experience. Then she clearly stated that I was a beginner and, having only studied theory at university, I still had to understand that then, in the field, things change completely. She added that Roberta had behaved correctly, that she had also talked with the psychologist, who had assessed her educational action as positive and fair.

In her final traineeship report, Lisa reflected on the experience and reiterated that speaking up was *the right thing to do*. In the difficult circumstances described, she used both her heuristic-reflexive rationality and critical emancipatory rationality (Striano, 2002). The first, to understand, the second, to act and foster change.

> It was really difficult for me to be able to criticize the work of an educator. I felt oppressed by the Director, I felt devalued, embarrassed, immensely sad.
>
> Despite everything, I think that speaking up was the right thing to do for Mirco and Lucia.

> In the face of maltreatment, we must not stop. Maltreatment must be identified and highlighted so that it is no longer repeated.
>
> Writing this traineeship report helped me process many events of my experience at the nursery school and it's good because, this way, I'm overcoming, "metabolizing" the pain I've suffered.
>
> I'm sure I don't want to become an educator like Roberta, but I also treasure the belief that what I have seen, I will absolutely avoid in the future.

With reference to institutional abuse, the literature describes risk and protective factors. The following table summarizes some of them, particularly relevant for the critical incidents analyzed in this paper (Paradiso, 2018, pp.115-118).

In the context where Lisa carried out her traineeship, all the risk factors listed below were present and no protective factors have been identified.

Risk factors	**Protective factors**
✓ Absence of collegial meetings to discuss quality of relationships at school ✓ Absence of controls and sanctions by the school governance ✓ The school governance not taking charge of formal or informal reports ✓ Tolerance of behaviors that approve and/or instigate the dynamics of violence ✓ Denial or underestimation or silence by the educational and auxiliary staff who witnessed the episodes […]	✓ Spaces for discussion/training on the quality of relationships at school ✓ Governance system aimed at prevention, monitoring and control of educational and organizational quality ✓ The school governance listens to situations of discomfort and takes charge of formal and informal reports ✓ There are systems and methods for monitoring and evaluating educational quality and giving formative feedback […]

Table 2 – Institutional abuse: risk and protective factors

Institutional abuse against minors occurs in the presence of some situations that can be considered risk factors: firstly, the drive towards educational autonomy and independence released from any form of supervision of team work; secondly, the adoption of an institutional model of education, centered on the needs of the adults instead of the children's; thirdly, the absence of an institutional governance that monitors educational and relational quality, and of ethical guidelines. Ultimately, institutional violence on minors represents the outcome of an organizational process that fails to limit, control and sanction maltreatment and abuse. On the contrary, the protective factors are the actions for the co-construction of an organizational

context capable of monitoring educational quality and protecting the pre-eminent interest of the minor (Paradiso, 2018).

Conclusion

In the training of future educators, it is fundamental to help build a pedagogical culture of child protection in order to foster the definition of organizational models, tools and processes aimed at the prevention, control and management of the phenomena of child maltreatment and institutional abuse, in all its possible forms.

We believe that reflective practice can contribute to the achievement of this goal.

In the face of situations of abuse, the education professional must make a difference. Above all, it is essential to build and strengthen the awareness that violence can be prevented, that safety and serenity are the result of concrete actions and investments made in educational contexts (WHO, 2002).

For an educator, taking the side of justice and protecting the relational rights of every human being is an ethical imperative. In education neutrality is not an option: one must necessarily take a stand (Freire, 2021).

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Toward Teaching Kids in Arab Countries Programming Skills: A Case Study

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Abstract
Teaching children to code has gained popularity in recent years, with many schools and institutions now providing tools and programs to get young learners started with computer programming. High-level programming languages, such as Python, Java, and C Sharp (i.e., C#), are often used in these educational contexts due to their simplicity and versatility. This article discusses the benefits of teaching children to code with highlevel programming languages and offers tips and strategies for effectively introducing these concepts to young learners. Through hands-on activities and interactive lessons, children can gain valuable skills and knowledge to serve them well in their future academic and professional endeavours. A case study has been conducted to show that children in Arab countries can learn coding skills effectively when they are taught using interactive and hands-on methods.

Keywords: E-learning, Distance Learning, Children Learning, Teaching Children to Code, Software Engineering, HCI, C#, Coding Skills

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Introduction

Educators and researchers have recognized the importance of teaching children how to write code in recent years. Coding skills are increasingly in demand in the job market and are essential for success in various fields, including technology, engineering, and data science [Resnick et al., 2009]. Additionally, learning to code can help children develop essential problem-solving abilities, critical thinking, and creativity skills [Papert, 1980,Wing, 2006].

Evidence suggests that teaching kids to code can have broader benefits, such as promoting teamwork, collaboration [O'Shea and O'Keeffe, 2016], and increasing students' engagement, motivation and drive in their studies [Law et al., 2016].

The relevance of teaching kids to code lies in the numerous benefits it can provide for their cognitive development, future career prospects, and overall well-being. There are many reasons why teaching children how to code can be beneficial and motivating. Some of the potential motivations for teaching kids to code include the following:

1. Developing problem-solving skills: Coding requires children to break down complex problems into smaller, more manageable tasks and to think critically and creatively about how to solve those problems. This can help develop their problem-solving skills, which are helpful in various contexts.

2. Encouraging creativity and innovation: Coding allows children to create and build software and applications, which can be very rewarding and creative. It also encourages them to think outside the box and develop innovative solutions to problems.

3. Preparing for future careers: The demand for skilled software developers is high and is expected to grow in the coming years. Teaching kids to code can help prepare them for careers in technology and other fields that require coding skills.

4. Promoting teamwork and collaboration: Many coding projects involve working in a team, which can teach children the value of cooperation and teamwork.

5. Building confidence and self-esteem: Completing a coding project can give children a sense of accomplishment and boost their confidence and selfesteem.

1.1 Research Motivation

There is a growing recognition of the importance of teaching kids how to write code. This includes teaching them the technical skills needed to write and debug programs and helping them develop problem-solving, critical thinking, and creativity skills. This literature review will discuss some possible benefits of teaching kids how to write code. The benefits below motivate conducting this research and case study:

1. Academic Benefits One of the main benefits of teaching kids how to write code is that it can help them excel academically. For example, research has shown that students who learn to code perform better in math and science [Weintrop et al., 2016]. This is likely because coding involves using logical thinking and problem-solving skills, which are also important in these subjects.

In addition, coding can also help students develop their computational thinking skills, which involve breaking down complex problems into smaller, more manageable parts and using abstractions and algorithms to solve them [Wing, 2006]. These skills are increasingly important today and can be applied to various academic and professional fields.

2. Social Benefits Teaching kids how to write code can also have social benefits. For example, it can help them develop teamwork and collaboration skills, as they often work in groups to complete coding projects [Weintrop et al., 2016]. This can help kids learn to communicate effectively with others and work towards a common goal.

In addition, coding can also help kids develop leadership skills, as they may be responsible for leading coding projects or teaching others how to code [Weintrop et al., 2016]. This can help kids learn to take on leadership roles and be more confident in their abilities.

3. Professional Benefits Finally, teaching kids how to write code can also have professional benefits. For example, the demand for skilled coders is high, and knowing how to code can open up many career opportunities [Weintrop et al., 2016]. In addition, coding can also help kids develop skills that are highly valued in the workforce, such as problem-solving, critical thinking, and creativity [Weintrop et al., 2016].

Teaching kids to code can be a motivating and rewarding experience that helps them develop valuable skills and prepares them for success in the future.

1.2 Research Question and Hypothesis

In this research, we try to answer the following research question:

RQ1: Is it possible to teach kids in Arab schools how to code using a high-level programming language? Is selecting C# appropriate to prove the research assumption?

We hypothesize that “Arab kids have the ability and skills to learn and utilize high-level programming languages to address complex problems such as arithmetic operations”.

In this research, we conducted a case study to investigate the effectiveness of teaching children how to code using a high-level programming language. The study involved a group of young learners who participated in a series of coding lessons and activities over several weeks. Our findings suggest that children can learn coding skills effectively when they are taught using interactive and hands-on methods and that they can apply these skills to solve problems and create new projects.

2. Background

Teaching children to code has gained increasing attention in recent years, with many schools and organizations offering programs and resources to help young learners get started with computer programming. Coding education is a way to improve problem-solving and logical thinking skills, strengthen communication and collaboration skills, and increase creativity and innovation. In addition, high-level programming languages like Python and Java are often used in educational contexts due to their simplicity and versatility.

Research has shown that coding education can benefit children, including improving problem-solving and logical thinking skills, strengthening communication and collaboration skills, and increasing creativity and innovation [Bryant et al., 2016,Margolis et al., 2017].

Several studies have investigated the effectiveness of teaching children to code. A study by [Smith et al., 2019] found that children who participated in a coding program significantly improved problem-solving skills and computational thinking. Similarly, a study by [Johnson and Williams, 2018] revealed that children who learned to code demonstrated increased creativity and innovation in their problem-solving approaches.

In addition to the cognitive benefits, teaching children to code can have positive social and emotional impacts. A study by [Kim and Park, 2017] found that children who participated in a coding program reported increased self-confidence and motivation and improved social skills such as collaboration and communication.

One of the challenges in teaching children to code is choosing an appropriate programming language. High-level programming languages, such as C#, Python and Java, are often used in educational contexts due to their simplicity and versatility [Weintrop et al., 2016]. However, there is an ongoing debate about the most effective language for teaching children to code. Some studies suggest that more visually oriented languages may be more effective for young learners [Barker et al., 2018,Hockemeyer et al., 2019].

In addition to the choice of programming language, the teaching methods and strategies used can also impact the effectiveness of coding education for children. Research has shown that hands-on, interactive approaches are particularly effective for engaging and motivating young learners [Kelleher et al., 2015]. Project-based learning, in which children work on real-world problems or create their projects using their coding skills, has also been found to be an effective way to teach children to code [Wing, 2006].

The literature suggests teaching children to code can promote cognitive and social-emotional development. Educators need to utilize interactive and hands-on methods and provide support and guidance to help children succeed in their coding endeavours.

3. The Research Methodology

Design science research methodology (DSRM) is an approach to studying and solving problems involving iteratively designing, creating, and testing prototypes or solutions to address the issue. This approach is often used in fields such as computer science, engineering, and management, where the goal is to create new technologies, systems, or processes that can be applied in practice [Aljawawdeh, 2019]. DSRM focuses on the development and evaluation of innovative solutions to real-world problems. DSRM aims to create and evaluate new designs or artefacts that can be used to improve the functioning of organizations, systems, or societies [Hevner et al., 2004].

There are several steps involved in the design science research process, including:

1. Identifying the problem: The first step in DSRM is to identify a specific issue or challenge the research aims to address.

2. Developing a design: Once the problem has been identified, the next step is to develop a design or artefact that addresses the issue and meets the identified needs.

3. Evaluating the design: The design is then evaluated through empirical testing or other methods to determine its effectiveness and potential impact.

4. Refining the design: Based on the evaluation results, the design may be refined and improved to address the problem and meet the identified needs.

5. Disseminating the results: The results of the DSRM study, including the design and any insights or lessons learned, are then disseminated to the broader community through publication in academic journals or conference proceedings.

This process is then repeated as needed until a satisfactory solution is found. Fig. 1 shows the phases of the DSRM process model. The process model be modified to meet the requirements of this research attempt.

3.1 The Adoption of DSRM

To adopt this method to teach kids to write code, the following steps have been followed:

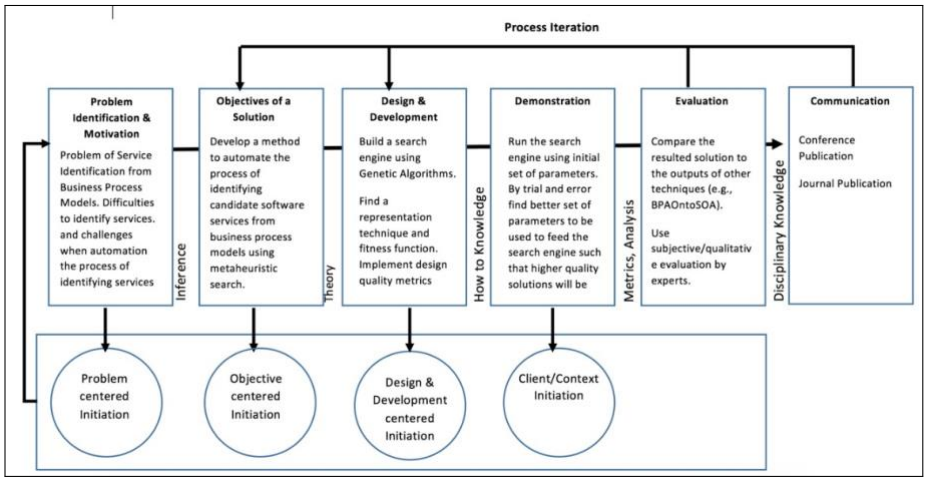

Figure 1: DSRM Framework Adopted to Teach Kids How to Code [Peffers et al., 2007,Aljawawdeh, 2019]

1. Identify the topics we want to address and select an approach. For example, choose the issues that help kids learn how to write code and solve some problems engagingly and effectively.

2. Develop clear and concise examples that support the research questions. For example, ”How can we design a teaching method that helps kids learn to write code effectively?”. That should be examined by monitoring the achievements of the participant kids.

3. Conduct a literature review to understand the current knowledge on the topic. This might include research on teaching coding to kids and studies on effective learning methods in general. This can help to enrich the teaching methods we adopt, and also it helps to learn from previous experiences.

4. Develop a design for a solution to the problem or opportunity. This might involve creating a lesson plan, building a tool or platform for teaching coding or developing a new teaching method.

5. Implement the design and test it with a group of kids. This might involve piloting the teaching method in a classroom or online setting.

6. Evaluate the results and conclusions. This might involve collecting data on the kids' learning progress and analyzing it to determine the effectiveness of the teaching method.

To fulfil the previous steps, a set of lessons have been prepared using C# language, and the lesson plan and materials have been reviewed by experts who work with kids to ensure that they fit the level of these young children. There are a few reasons why C# might be a good choice for teaching kids to code: • C# is a high-level programming language, meaning it is easier to read and write than low-level languages like C or assembly. This can make it more accessible for kids starting to learn to program:

- C# is a universal language that can be used to build various applications, including games, web applications, mobile apps, and more. Kids can use C# to create exciting and relevant projects.

- C# has a large and active community of developers, so many resources are available to help kids learn the language and get support when needed. • C# is a statically-typed language which checks for errors before the code is run. This can help kids learn good coding practices and avoid common mistakes.

In conclusion, C# is a good choice for teaching kids to code because it is easy to learn, versatile, and has a strong support community.

4. The Case Study: Teach Kids to Code with C#

This section describes the objective of this case study, the learning process of this case study, the experiment design, and the mechanism to transfer knowledge to young learners.

4.1 The Intended Learning Objective

In this case study, kids will learn topics from basic programming skills until they learn how to write a simple application, such as a calculator program, using a C# desktop application. They will also learn how to test their code and display the results.

4.2 The Learning Process

For the case study, the following steps have been conducted:

- *Step 1: Introduction to Programming*
  Before kids begin writing code, it's essential to introduce them to the basics of programming. This might include concepts such as variables, data types, loops, functions, and controls such as Buttons, TextBox, Labels and Panels. Many examples

and exercises have been used to help kids understand these concepts and how they can be applied to solve problems.

- *Step 2: Designing a simple calculator application*
  Next, kids must decide what they want their calculator to do. This might include basic arithmetic operations such as addition, subtraction, multiplication, and division and more advanced features such as square roots, logarithms, or trigonometric functions. In our experiment, the main focus was on basic arithmetic operations.

  Once kids have decided on the features they want to include, they should design a flowchart or pseudo code to outline the steps their program will follow. This will help them think through the logic of their program and make it easier to write the code.

- *Step 3: Writing the code*
  With a clear plan, kids can begin writing the code for their calculator program. They should start by writing the program's basic structure, including any necessary functions and loops. Then, they can add the code to perform the specific calculations they want.

- *Step 4: Testing and debugging*
  As kids write their code, they should test it frequently to ensure it works as expected. This might involve running the program, manually checking the results, or writing additional code to test specific features. Kids encountering errors or unexpected results should use debugging techniques such as print statements and error messages to identify and fix the problem.

- *Step 5: Displaying the results*
  Once the calculator program works correctly, kids can add code to display the results in a clear and easy-to-read format. This might involve using print statements to show the results in the terminal or creating a graphical user interface (GUI) to display the results more visually appealingly.

- *Step 6: Refining and improving the program*
  Kids can continue to refine and improve their calculator program by adding additional features, optimizing the code for speed and efficiency, or making the program more user-friendly. They can also use their program to solve real-world problems or create interactive simulations.

4.3 Experiment Design

To conduct the proposed case study, the following materials were needed:

- Computer with an integrated development environment (i.e., IDE) installed, i.e., Visual Studio 2022 IDE was used.

- Material and examples were prepared to support the learning process.

A group of twenty kids participated in this experiment, and intensive training for five weeks was conducted to teach the kids the prepared materials and prepare them to write real-life

applications. The age of kids ranges from eight to fourteen years old. The kids have sufficient skills to use the personal computer and are fluent in arithmetic operations.

The experiment has been conducted on multiple iterations; in each iteration, a chapter of the intended material has been provided, and it ended with a practical exercise.

4.4 Knowledge Transfer Strategy

Many different approaches and methods can be used to teach kids programming. Some general strategies that may be effective include:

1. Use hands-on, interactive activities: Kids often learn best through handson, interactive activities that allow them to explore and experiment with concepts [Kafai and Burke, 2017,Aljawawdeh and Nabot, 2021,Kafai et al., 2015]. Coding activities that involve creating and building software or applications can be particularly engaging for kids [Resnick et al., 2009].

2. Start with simple, visual programming languages: For younger children or those new to programming, starting with simple, visual programming languages can be helpful [Maloney et al., 2012]. These languages use blocks or other visual elements to represent code, which can be easier for kids to understand and work with [Kafai et al., 2015]. Examples of visual programming languages include Scratch [Resnick et al., 2009, Maloney et al., 2012,Kafai et al., 2015] [Kafai et al., 2015].

3. Use examples and projects that are relevant and interesting: Children are more likely to be motivated and engaged when working on relevant and exciting projects to them [Law et al., 2016]. Consider using examples and projects that align with their interests and hobbies [O'Shea and O'Keeffe, 2016,Aljawawdeh and Nabot, 2021].

4. Encourage experimentation and creativity: Encourage kids to explore and experiment with different coding techniques and approaches (Wing, 2006). This can help them develop their problem-solving skills and creativity [Papert, 1980].

5. Provide support and guidance: It's important to provide kids with the support and guidance they need as they learn to code [Law et al., 2016]. This might include providing resources and materials, answering questions, and offering feedback and encouragement [O'Shea and O'Keeffe, 2016].

6. The key to teaching kids programming is to provide a supportive and engaging learning environment that encourages exploration, experimentation, and creativity [Wing, 2006]. Fulfilment of the previous steps will help to collect data and do the analysis.

5. Results and Analysis

There are a few different criteria that you could use to evaluate whether kids have learned a C# course:

1. Understanding of the fundamental concepts of programming: Can the student explain the basic concepts of programming, such as variables, loops, functions, and control structures?

2. Ability to write, compile, and run C# code: Can the student write simple programs in C#, using the correct syntax and following best practices for code organization and style? Can they debug their code and identify and fix errors?

3. Knowledge of shared C# libraries and frameworks: Does the student understand how to use standard libraries and frameworks, such as the .NET framework and the System namespace, to perform tasks such as input/output and data manipulation?
4. Ability to solve problems: Can the student analyze a situation and design and implement a solution using C#? Can they use appropriate data structures and algorithms to solve problems efficiently?

5. Ability to work with a team: Can the student collaborate with others on a programming project, using version control and other tools as needed? Can they communicate effectively with their team members about their code and project design?

6. Ability to learn new concepts: Does the student have the ability to learn new programming concepts and technologies on their own, using online resources and other materials?

Each participating student was examined against each point; the evaluation process included tests, tasks and direct personal questions to measure the student's understanding of the material. Each point has been evaluated from 0 to 10. Fig. 2 shows the table of results, in which the result of each student ranges from 0 to 10 against each Intended learning objective. Note that the average achievement of the intended learning objectives (ILOs) was 74%, and many kids achieved higher values in some outstanding goals. There were some weaknesses in achieving some objectives. Still, the reasons behind that refer to the complexity of some topics, lack of teamwork skills, short time of the course, and sufficient background of all kids, which makes it difficult to solve some of the milestone tests. Fig. 3 shows a graphical visualisation of the results.

Results show that teaching kids to program with high-level programming language is challenging but worthwhile. Gains from this experiment are promising and encourage teaching kids more technical topics in the future while monitoring their progress and performance.

Student No	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Understanding of the fundamental concepts of programming	4	9	4	3	7	3	7	9	10	8	9	8	10	5	5	9	6	7	7	10
Ability to write, compile, and run C# code	9	5	9	10	5	5	10	5	10	8	3	9	7	10	9	9	10	3	7	10
Knowledge of common C# libraries and frameworks	3	6	4	7	10	8	10	3	6	9	7	6	3	4	6	3	10	9	6	10
Ability to solve problems	4	5	6	5	10	9	9	7	8	6	5	4	10	7	7	8	10	9	10	9
Ability to work with a team	5	3	7	3	6	9	4	8	3	4	7	7	9	5	5	3	5	10	7	3
Ability to learn new concepts	6	5	9	10	9	10	9	7	8	7	6	8	3	7	7	9	7	5	6	10
Average	4.57	5	6	6	7.43	7.14	8	6.71	7.71	7.43	6.86	7.71	7.86	7.43	7.71	8.14	9.29	8.71	8.86	10.29
Total Average	7.4425																			

Figure2: Tableofresults

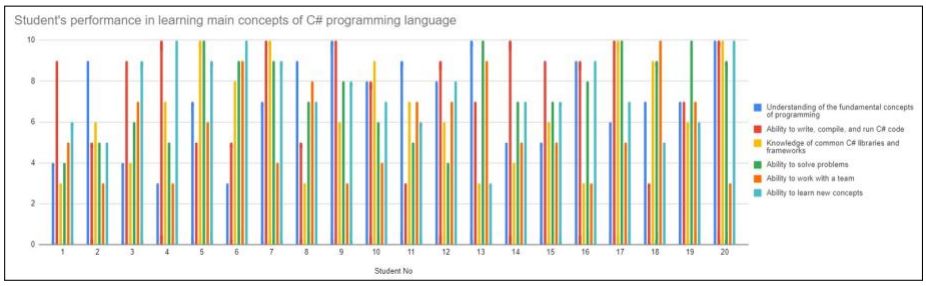

Figure3: ChartofResults

6. Conclusion

This article presents a case study on the methods and techniques for teaching kids how to code using the programming language C#. This article answers the research question and supports the hypothesis by presenting a case study on the effectiveness of using C# to teach kids how to code.

The results of this case study suggest that using C# to teach kids how to code can successfully introduce them to the fundamental concepts of programming. The case study demonstrated that kids could learn C# and create simple programs, indicating that they could grasp and apply the material practically. These findings are promising because they suggest that C# can be an effective tool for teaching kids how to code and that kids can learn programming skills at a young age. These results pave the way for further research and development in coding education for kids. 74% of the learning objectives have been fulfilled.

In conclusion, learning how to code with C# can be a fun and rewarding experience for kids. Following the steps outlined in this case study, kids can learn fundamental programming concepts and start creating simple programs. As they continue to practice and build on their skills, they will be able to tackle more complex projects and continue to grow as coders. With patience, persistence, and a little creativity, kids can learn to code with C# and open up a world of possibilities for their future.

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Educational Management and Quality of Life: Diagnosis of an Educational Unit of Ambato

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Abstract
The paper addresses a critical and collaborative vision of educational management (EM) and quality of life (QoL). The measurement of the levels of the study variables was for EM (the questionnaire proposed by the Ministry of Education of Ecuador composed of 3 dimensions, 4 sub-dimensions and 55 questions) and for QoL (the QOL - GOHISALO test composed of 7 dimensions and 74 questions). Twenty-five teachers from an educational institution in the city of Ambato, Ecuador were evaluated. Obtaining "Outstanding" results (76%) due to the fulfillment of quality standards to develop their work in favorable scenarios. On the other hand, the level of Quality of Work Life (QWL) is between High (44%) and Medium (20%) and Low (34%), indicating that it not only covers work environments but also personal aspects that cover in detail the study dimensions of the two data collection instruments.

Keywords: Educational Management, Quality of Life, Education

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Introduction

This paper addresses a critical and collaborative vision, in which reference is made to educational managers exercising their functions in a local educational unit, who provided information about their professional reality, as well as the challenges they present in terms of the level of quality of life (QOL) they perceive, to subsequently analyze the data collected, in order to broaden the understanding attributed to management within the educational system.

The studies offer an alarming panorama with respect to School Management, since, in spite of being highly relevant, it presents deficits in both substance and form. This is because it lacks the necessary resources; teachers are overloaded with work and have little training (Abril-Martínez, 2020).

For this reason, in recent years, GE has been conceived as a complex and underdeveloped concept, so in search of a radical change in this reality (Abril Martínez, 2019) they propose the renewal of the pedagogical process, the restructuring of educational models, the implementation of new paradigms of competition and cooperation, the use of information and communication technologies (ICT), the attention to new teaching-learning demands and the increase of academic offerings.

In addition, it should be mentioned that GE encompasses a series of systemic and interconnected processes that guide decision making in favor of the efficient management of the resources available in an institution for the achievement of goals. Additionally, the Coordination of Educational Development and Curricular Innovation (2020) explains that it comprises the collectivity and individuality of the educational community, as well as a set of general and specific knowledge. According to the above, GE is a proposal as an indispensable and permanent exercise (Briceño Toledo et al., 2020). Therefore, educational managers execute actions in favor of the requirements demanded by the educational environment and try to solve the aforementioned deficiencies.

However, the implications that these challenges represent are mostly assumed by teachers, who neglect their QOL in different ways to achieve their work objectives (Campó, 2021). Even when aiming to achieve high levels of teaching-learning, the GE executes plans that develop feelings of discomfort in teachers, which contributes to the aforementioned scenario (Bruneau-Chávez et al., 2021).

On the other hand, QOL is a construct of a complex and multidimensional nature that requires dynamism and directly involves a subjective character as it depends on the individual's own perception of his or her reality On the other hand, QOL is a construct of a complex and multidimensional nature that requires dynamism and directly involves a subjective character as it depends on the individual's own perception of his or her reality (Arteaga González et al., 2018).

Additionally, he proposes that QOL is the result of two components, the objective and the subjective, the first referring to aspects that are static and do not depend on the individual's opinion since they are verifiable and irrefutable, and the second refers to those subjective aspects that are interpretations resulting from what the subject values in his or her way of living and thinking, influenced by a sociocultural root (Aranda, 2018).

QoL is a complex, multifaceted and understudied construct. It is an ideal sought by all governments to improve their level (*Methods of Measurement of Quality of Life Based on Statistics-Web of Science Core Collection*, n.d.). It is constituted by the existing connection between the subjective and objective dimension perceived by the individual (*HOLISTIC AND SUSTAINABLE QUALITY OF LIFE Conceptualization and Application-Web of Science Core Collection*, n.d.).

Work QOL is related to a person's feeling of satisfaction with the factors involved in his or her professional practice. Likewise, the work environment is influenced by the interaction of managerial, social, and physical elements that affect workers' QOL (Parra-Giordano et al., 2020).

QOL is generally defined as a state of well-being; however, this concept has a connotation that encompasses a contextual assessment that emphasizes the perception of satisfaction in the social, physical, emotional, spiritual, intellectual, and occupational areas that the individual has in relation to his or her reality. It should be noted that the needs presented by the subject can be individual and/or collective (*World Health Statistics 2016: Monitoring Health for the SDGs - World | ReliefWeb*, n.d.).

The present study is organized firstly, by the search and exploration of theoretical postulates that allow the scientific construction of the study. Secondly, by the measurement of the levels of EM and QOL of the teachers of a local educational institution. Third, by a discussion of the information collected; and as a last point, it concludes with a general analysis of the variables studied.

Therefore, management will be defined as the actions that allow the achievement of objectives in accordance with the mission and vision of the organization, thus, in the educational field it is positioned as one of the most relevant activities by directing the plans in favor of the institution, promoting the empowerment of the students in their formative process, execution of joint and harmonic actions by its collaborators, considering the political decrees in accordance with its worldview, teacher training and other activities (Luz & Vega Gutiérrez, 2020). It also requires innovative practices by all members of the community (managers, teachers, students and parents) (Rosa et al., 2020). Finally, it seeks to strengthen pedagogical processes and enriches the projects implemented in the institution to respond to the challenges of the environment (Fernando et al., 2021).

Methodology

The methodology used in this research consists of 5 phases to diagnose the level of EM and VC in an institution in the city of Ambato. The procedure used is as follows:

1. Design and Population

For the study, the total population of an educational unit located in Ecuador in the province of Tungurahua in the canton of Ambato, El Progreso neighborhood, was taken into account as a case study. Population and sample" is defined as a population is an agglomeration formed by the total number of elements of interest in a study that does not require sampling (García-García et al., 2013).

Being an "object of study" population, according to Mucha et. al (2020) (Mucha-Hospinal et al., 2021), it is necessary to consider previously established selection criteria, so the inclusion criteria were: (i) voluntary participation of respondents; (ii) teachers working within the educational institution throughout the 2022 - 2023 school year; (iii) teachers who have received induction on EM and QOL. The exclusion criteria were (i) teachers who did not attend the socialization meeting; (ii) those who did not wish to participate in the research; (iii) people without a contract certifying that they are collaborators in the institution. It should be noted that, considering the aforementioned criteria, the instruments were applied to 100% of the population initially considered for this research (Posso Pacheco et al., 2021).

In addition, sociodemographic information was considered, such as male and female sex, the participant's work history in the institution, age, work schedule and place of residence. Finally, the population consisted of 25 teachers.

2. Validity Verification of the Instruments

After the search and selection of the instruments, their validity in the national territory was verified in order to guarantee the reliability of the information collected by the instruments.

For the EM, the questionnaire proposed by the Ministry of Education of Ecuador (MINEDUC) in the Manual on School Management, Professional Management Performance and Professional Teaching Performance was used as a reference. It consists of 55 questions divided into three dimensions and 4 sub-dimensions each. The response scale is Likert-type with four response options: Not met, In process, Satisfactory and Outstanding. Additionally, the instrument provides the norms that support each item, the means of verification and the meaning of what each response option implies (García-García et al., 2013).

The QOL - GOHISALO test created by Raquel González-Baltazar in 2010 Mozo & Osorio (2019). was used to measure the level of QOL. It has an overall reliability of 0.95, it has both content, criterion and construct validation. Its application can be both individual and collective, it maintains a Likert-type response scale ranging from 0 to 4 corresponding to the options "Never" to "Always". It has 7 dimensions and 74 questions (Gonzalez-Baltazar et al., 2017).

Table 1: *Dimensions of the QOL test - GOHISALO*

Dimension	Indicator	Items
Soporte Institutional support for work (SIT)	Supervision, evaluation, and promotion opportunities	6, 19, 26, 27, 28, 44, 45, 46, 47, 48, 49, 50, 51, 52.
Job security (ST)	Contractual rights, established procedures, professional development	5, 7, 8, 9, 10, 11, 12, 13, 29, 30, 31, 33, 61, 63, 72.
Job integration (IPT)	Sense of belonging, motivation, and work environment	18, 32, 36, 37, 39, 40, 41, 42, 43, 65.
Job satisfaction (SAT)	Pride, participation, autonomy, recognition and self-worth at work	1, 2, 3, 4, 14, 15, 16, 17, 20, 21, 22.
Well-being achieved through work (BLT)	Identification with the organization, benefits, satisfaction, housing, health and nutrition	23, 34, 34, 35, 38, 59, 60, 62, 66, 71, 73.
Personal development of the worker (PD)	Achievements, expectations for improvement and personal security	53, 54, 64, 67, 68, 69, 70, 74.

Leisure time management (ATL)	Free space	25, 55, 56, 57, 58.

3. Evaluation of the Level of Evaluación Del Nivel De EM Y QOL

Initially, a socialization was carried out where the terms and implications of the problem studied and the generalities of the instruments in the educational institution were presented, in order to reduce the risk of confusion and strengthen the reliability of the information collected, since each project has a specific nature (Silvius & Schipper, 2018). The data were collected manually at the institution and then tabulated in an Excel spreadsheet, to be later exported to the Rstudio software for validation. It is necessary to verify the information collected through data mining since the latter will allow us to predict the behavior of the data (Castrillón-Gómez et al., 2020).

4. Consolidating and Validating Information

Once we had all the data, it was necessary to validate the reliability of these data to check that they matched the reality of the respondents. Therefore, after consolidating the information in an Excel spreadsheet and selecting the Rstudio software, the library was exported to that application to perform a data mining analysis, where it was confirmed that the data were "clean" and conformed to the requirements of the instruments. The Rstudio software was used because it is easy to access and use, which integrates a development environment that allows statistical analyses such as those required in this research (Gopal et al., 2018).

5. Analysis of the Results

Finally, based on the information obtained from the questionnaires and previous knowledge, we proceed to analyze the implications of the level of EM and QOL.

Results

Once the methodology has been applied, the following results are presented below:

1. Design and Population

Based on the inclusion and exclusion criteria, the population consisted of 25 teachers distributed in all levels of education of the Educational Unit that make up 100% of the population studied, 60% of them are men, ranging from 21 to more than 50 years of age and have been working in the institution an average of 1 to more than 5 years; on the other hand, 40% are women between 21 to 50 years of age, who work in the educational institution from 1 to more than 5 years; all participants reside in the city of Ambato (Table 2).

Table 2: *Sociodemographic characteristics of the participants*

Variable	Response scale	N	%
Sex	Female	11	40
	Male	14	60
Age	21 – 30	13	52
	31 – 40	6	24
	41 – 50	5	20
	Over 51 years old	1	4
Time working at school	0 – 1	10	40
	1 – 2	2	8
	2 – 5	8	32
	More than 5 years	5	20
Place of Residence Ambato	Ambato	25	100
	Other	0	0

2. Evaluation, Consolidation and Validation of EM and QOL Level Information

The results obtained by each participant and the general data that allow a detailed analysis of the results obtained are presented below.

2.1. Results for Each Employee Assessed

Table 3 shows the EM matrix with the corresponding responses of the participants in each of the dimensions of the instrument.

Table 3: *Results of the dimension EM, Managerial and Teaching Professional Performance of each participant*

NP	D1	D2	D3
1	44	56	46
2	70	82	64
3	71	84	64
4	69	82	64
5	56	76	60
6	65	82	64
7	61	80	58
8	71	83	61
9	54	63	48
10	69	84	64
11	53	58	35
12	69	80	59
13	66	72	55
14	49	60	52
15	62	75	61
16	70	84	64
17	70	84	64
18	57	66	54
19	71	82	62
20	66	81	60
21	54	63	56

22	55	67	48
23	53	63	55
24	57	69	43
25	59	81	63

Table 4 presents the information corresponding to the seven QOL dimensions for each participant.

Table 4: *Results per participant for the dimensions SIT, ST, IPT, SAT, BLT, DP, ATL*

SIT	ST	IPT	SAT	BLT	DP	ATL
26	28	28	22	30	20	12
43	44	37	37	39	28	12
49	54	37	42	43	30	17
41	35	38	40	40	25	15
42	30	27	33	39	18	13
46	51	35	44	40	25	10
52	41	37	29	38	28	18
23	36	24	24	34	22	8
25	36	35	25	37	25	9
56	51	35	44	41	32	20
32	28	22	17	26	21	12
44	43	38	38	40	24	11
31	33	31	20	36	17	11
26	20	28	20	33	15	12
27	40	30	32	33	16	7
43	48	34	31	40	20	14
52	46	38	27	38	27	11
32	37	31	25	37	22	10
41	42	37	40	40	26	13
49	44	40	36	44	27	17
29	23	27	39	33	23	5
39	42	35	35	40	24	12
27	21	27	29	38	12	14
39	36	29	21	32	25	14
30	36	26	20	30	20	7

2.2. Consolidated Results of the Educational Unit (UE)

Table 5 presents information on the MS level of the campus, highlighting that in all dimensions there are responses that fit a "Satisfactory" and "Outstanding" level.

Table 5: *EM Questionnaire*

Variable	Scale of response	N	%
School management	Does not comply	0	0
	In Process	0	0
	Satisfactory	6	24
	Outstanding	19	76
Desempeño Profesional Directivo	Does not comply	0	0
	In Process	0	0
	Satisfactory	6	24
	Outstanding	19	76
Desempeño Profesional Docente	Does not comply	0	0
	In Process	0	0
	Satisfactory	5	20
	Outstanding	20	80

Table 6 shows the level of QOL, which highlights that within the dimensions Job Integration, Job Satisfaction, Well-being Achieved through Work, Personal Development of the Worker, and Management of Free Time, there is a percentage of responses that do not reach the minimum average proposed by the instrument.

Table 6: *QOL Characteristics*

Dimension	Scale	N	%
Institutional Support for Labor (SIT)	High	14	56
	Medium	5	20
	Low	6	24
	Very Low	0	0
Safety at Work (ST)	High	13	52
	Medium	9	36
	Low	3	12
	Very Low	0	0
Job Integration (IPT)	High	12	48
	Medium	4	16
	Low	8	32
	Very Low	1	4
Job Satisfaction (SAT)	High	6	24
	Medium	4	16
	Low	5	20
	Very Low	10	40
Well-being Achieved Through Work (BLT)	High	9	36
	Medium	7	28
	Low	2	8
	Very Low	7	28
Worker Personal Development (PD)	High	6	24
	Medium	10	40
	Low	7	28
	Very Low	2	8
Leisure Time Management (ATL)	High	2	8
	Medium	3	12
	Low	10	40
	Very Low	10	40

3. EM and QOL Analysis of the UE

It should be noted that even though in Table 5 the results indicate that there is a "Satisfactory" and "Outstanding" level of EM in the educational institution. It is worth mentioning that a "Satisfactory" rank implies that the educational offer provided by the school follows the MINEDUC ordinances in accordance with the institution's operating standards; likewise, considering these guidelines, the Institutional Educational Project (PEI) and the Institutional Curricular Planning (PCI) were consolidated in a participatory manner. The educational unit has procedures for the development of academic and administrative activities. Training is carried out after a diagnosis of the institution's needs. Support activities and pedagogical accompaniment are offered according to institutional needs. Teaching merits and achievements are recognized under institutional guidelines. Academic and administrative information records are stored securely and are always updated and complete. The lines of communication have previously established guidelines, are characterized by being timely and of knowledge for all educational actors. As for the infrastructure of the establishment, it must be equipped with resources that contribute to the teaching-learning process. The Educational Unit offers complementary services following the regulations proposed by MINEDUC. It provides student counseling service with attention to pedagogical and socioemotional needs.

Likewise, presenting an "Outstanding" level means that the PEI and PCI were constructed in a participatory manner and under the guidelines of MINEDUC, in which innovative strategies were included. In addition, the academic and administrative regulatory procedures are innovative and efficient. After learning about the school's needs, training and exchange spaces are held to express knowledge and experiences that lead to actions to solve these deficiencies. Pedagogical support and accompaniment activities are characterized by being innovative. Administrative and academic records are securely stored through innovative procedures that demonstrate the capacity to manage information. In addition, the means of communication used by the educational actors are innovative and are limited exclusively to academic and administrative issues. The complementary services offered go beyond compliance with the guidelines proposed by MINEDUC and demonstrate management capacity. The institutional advisory service, in addition to its functions in favor of the institution, collaborates with other institutions.

On the other hand, in the QOL questionnaire there are certain dimensions such as those related to IPT, SAT, BLT, DP and ATL that do not reach the minimum scores required by the questionnaire, which establishes a level below what is expected as a minimum. The following table presents some of the characteristics implied by these dimensions (Rojas-Torres et al., 2021).

Table 7: *Implications of the QOL-GOHISALO test dimensions with low scores*

Dimension	Characteristics
IPT	Conflict resolution among peers, motivation for the development of their daily work
SAT	Dedication to work, pride, sense of belonging, self-esteem, active participation, autonomy, development of skills and creativity
BLT	Satisfaction with housing, health, nutrition; enjoyment of goods and wealth obtained from their work
DP	Achievements, Individual Improvement, Personal Security
ATL	Organization of free time and balance between work and personal life

Conclusions

The main objective of this research is to diagnose the level of MS and QOL of the teachers of an educational unit in the city of Ambato.

The results of the present study establish that the MS from the perspective of 76% of the population is "Outstanding", which implies that the educational unit complies with the standards proposed by MINEDUC and that its members are capable of adapting the diverse methodologies and strategies to the needs that the context requires, with the purpose of guaranteeing that the members that integrate the Educational Unit can develop in favorable conditions.

On the other hand, the data from the QOL Questionnaire - GOHISALO establish that the participants' perspective on their QOL level is between High and Medium. Forty-four percent state that it is "High", 20% "Medium" and 34% "Low".

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The Value of Leisure Reading Among the Youth in A Higher Education Institution in South Africa

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Abstract
Some young adults like reading, but others struggle. They may not have learned the value of reading or how to read throughout their early schooling. Many children may grow up without local or worldwide information if they don't read. Due to their bad social group, not reading may keep them busy and out of trouble. This article examined young adult-leisure readers at a South African university. The study purposely selected 12 young individuals. The study employed individual and focus group interviews. According to studies, early exposure to books and other leisure readers at home and school can encourage kids to read. Listening to captivating stories as a child improves concentration and listening skills. Reading is a life-changing, intellectually helpful hobby. Due to a lack of adequate leisure literature, some people read topic material (science textbooks) over the holidays. Others read subject content because they were interested in it (history and political science textbooks). They wanted to study, but not for a test. Leisure reading may revolutionize early schooling, according to the findings.

Keywords: Leisure reading, Leisure-Readers, Transformative Learning

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Introduction

While some youth like reading, others struggle. They may not have learnt the benefits of reading in early education. Without reading, children may develop a lack of local or global knowledge. Due to their limited social circle, their inability to read may keep them distracted and out of touch with current events. This study evaluated the leisure reading habits of South African university students. Researchers selected 12 adolescents on purpose. Individual and focus group interviews were conducted as part of the research. Research indicates that early home and school exposure to books and other leisure readers promotes reading. Listening to intriguing tales helps children concentrate and pay attention. Reading is both educative and transformative. Some tourists read technical textbooks due to a dearth of suitable recreational reading material. Some readers are drawn to specific topics (history and political science textbooks). They desired to learn without an examination. According to research, recreational reading may influence early education.

Youth dislike or cannot read, despite its necessity. Some adolescents find reading difficult or tedious. Non-readers are required to read for school or job. Lack of early education or reading instruction at home may cause children to despise recreational reading. Reading is simplified by technology. Reading on a screen differs from reading on paper or in print (Mkhabela, 2022). Many children may never learn to read. Rumours may be the only source of erroneous information for isolating children. Reading keeps youths occupied. This case study analysed young adult leisure readers in higher education in South Africa, where many young adults avoid reading.

The study was guided by the following research questions:

- What factors influence young adult-readers' interest in leisure reading?
- What perceptions do young adult-readers hold about the importance of leisure reading?
- How do young adults experience leisure reading?
- What benefits do young adults think can be gained from leisure reading?

The Context of the Study

In the context of this study, the researchers believed that little is known about the leisure reading and higher institution experiences of young adults. The researchers were interested in examining the value and experiences of young adult readers at a higher education institution to uncover any issues or impediments that young adults have that hinder their love for leisure reading. They would be able to offer measures to encourage young adults to read for pleasure if the data support this conclusion. Efforts must be made to assist initiatives to promote leisure reading.

In addition, they desired to discover and characterize the value of leisure reading to influence policy. This is because reading for pleasure is not only enjoyable for young adult readers, but also contributes to lifelong learning. In addition to being self-satisfying, leisure reading adds to the acquisition of new information (Ross, 2000 as cited in Moyer, 2007:66). In following their reading passion, keen readers may experience a range of additional educational benefits (Wilkinson et al 2020:157).

Leisure reading may be a method for enhancing text consistency. Thus, it is necessary to emphasize the importance of reading books in South Africa (SABDC, 2016). Through the

Programme to Support Pro-poor Policy Development (PSPPD), Van der Berg, Spaull, Wills, Gustafsson, and Kotze (2016:59) provided several efforts to improve the reading culture in South African schools. The objective was to prepare early childhood educators to teach young children to read. Torppa, Vasalampi, Eklund, and Niemi (2022:16-22) demonstrate that reading with children throughout their early stages of development has a direct effect on their reading motivation and understanding as they get older. For this culture of reading to grow, Faircliff (2017) says that the joy of reading must be instilled to children at a young age and fostered until adulthood. Even though the focus is on leisure reading among young adults, this study intends to contribute to the body of information concerning the advantages of reading. At this stage of development, it may be assumed that young adults' brains and attitudes should be open to reading extensively. However, the reality on the ground in South Africa is that only a small number of young adults pursue reading for leisure.

Problem Statement

The study determined that the higher education system in South Africa does not spend enough time encouraging and educating young adults about the benefits of leisure reading. McClure (2011) discovered insufficient leisure reading among school-aged, racial minority adolescents in Johannesburg. Most black South African homes and schools avoided leisure reading for different reasons, resulting in the absence of a reading culture. Another study demonstrated that leisure reading has been neglected in many South African educational studies (Rimensberger, 2014:01). Tsekpo (2008) cautions that the country's educational, economic, social, and other progress may be hindered by residents who are ignorant, misinformed, and lack the bravery to compete with outsiders.

Researchers predict young people would fail to achieve tertiary reading requirements later in their academic careers if no treatments are offered (Lukhele, 2013). Thus, the research regarding students' experiences and the benefits of leisure reading (le Roux, 2017; Phasha et al., 2012; Tlou & Snyman, 2020) indicates that policies and strategies must be established to address the intergenerational problem of a shortage of leisure reading.

Since 2006, the leisure reading of South African people has decreased by 75–70 percent. SA Book Promotion Council (2016). 43 percent of young adults in South Africa read for pleasure, making it the eighth most popular leisure, according to Faircliff (2017). The author demonstrates that 59% of post-matriculated students, 47% of matriculated high school students, 38% of selected high school students, 19% of elementary school students, and 3% of non-students are avid readers. Mpumalanga, South Africa, has not performed any investigation to determine if a problem exists despite these tiny numbers. The researcher believes that Faircliff's findings are exaggerated or anecdotal. The researcher's reading has diminished.

The internet of things and technology have caused young people to spend hours on their smartphones. Digital culture has affected the culture of reading. Some digital technologies make it possible to read books online, although many young people do not. They surf the Internet, converse with family and friends, watch films, play video games, and listen to music. Reading fell to second place.

The researcher and a recent study identify the consequences of bad reading. Reading benefits college students and beyond (Chireac, Olivares & Arbona, 2022:231). Therefore, non-readers will fail in several aspects of life. The authors related reading abilities to effective

communication and personal contentment. Therefore, the well-being and social functioning of young people can be enhanced by promoting and supporting reading. This research aimed to address the following questions.

Research Questions

The central question of the research was:

How do young adult-leisure readers at the Institution of Higher Learning describe the value of leisure reading?

The sub-questions explored were as follows:

- What factors influence young adult-readers' interest in leisure reading?
- What perceptions do young adult-readers hold about the importance of leisure reading?
- How do young adults experience leisure reading?
- What benefits do young adults think can be gained from leisure reading?

Objective of the Study

To reach the aim of the study, the following objectives were applied:

- To explore the factors that influence interest in leisure reading amongst young adults.
- To identify the perceptions that young adult-readers hold about the importance of leisure reading.
- To determine any obstacles that young adult-readers encounter that make leisure reading difficult to maintain.
- To establish any benefits in leisure reading for young adults

Theoretical Framework

This article used Jack Mezirow's Transformative Learning Theory, which filled a gap in adult learning theories and helped educators grasp adult education philosophy and enhance adult education training and practice (Cranton, 2017). A theoretical framework helps explain the phenomenon under inquiry (Sheafor & Horejsi, 2003:51).

Mezirow (1997:5) believes that learning is transformational and may change one's perspective, hence the Transformative Learning Theory was best suited to explaining young people' lack of interest in leisure reading and fostering positive change. This transformation may assist adult educators promote constructive leisure reading, according to Cranton (2017).

The Transformative Learning Theory states that learning is a process that transforms one's frame of reference and shows how young adults experience modifications to assimilate new learnings into their worldview (Mezirow, 1997; King, 2011). Learning challenges assumptions, perceptions, ideas, and values, according to Cranton (2006). Taylor (2017) adds that transformational learning alters one's perspective and cognitive structure. In this study, young adults might benefit from transformational learning.

This research study is on adult education and learning therefore Transformative Learning was crucial since adults and young adults learn differently than children (Cranton, 2016). Young adults, according to Mezirow (2000), require fresh views to grasp old things as they change. Mezirow (1997) says that young adults may use their previous experiences to teach and learn to improve their present. Hence Mezirow (1997) believes critical contemplation and evaluation can help young adults grasp fresh ideas.

Thus, this study will allow young adults to critically evaluate their leisure reading habits and attitudes. This research should help young adults see leisure reading in a fresh light and learn how to maximize its advantages.

Franz (2007) and Mezirow (1997) encourage transformative learning in adult and higher education. The Transformative Learning Theory prompted young men and women at the Institution of Higher Learning in South Africa to reconsider leisure reading and change their unproductive habits. The researchers feel that participating in the research would provide participants a chance to learn and create a new meaning that challenges their past experiences (Mezirow, 2000) so they can appreciate leisure reading, one of the study's aims.

Implications of the Theory for Leisure Reading

Through discourse and self-reflection, the researchers anticipate that young adults may discover several meanings in their leisure reading, which may alter their perspective. This new viewpoint may increase their enjoyment of reading.

Taylor (2017) assumed that a frame of reference is comprised of cognitive and emotional components, namely mental habits, and a point of view. Mental habits are shaped by assumptions. Attitudes, views, value judgements, and interpretations are indicators of mental habits. Therefore, young adults must alter their behaviour to read for pleasure.

Young adults may be unwilling to examine alternative viewpoints. King (2011) believes that having an opinion might cause young adults to doubt their values. After evaluating their frame of reference, adolescents and young adults may adopt an inclusive, self-reflective, and integrative frame (Mezirow, 1997), so altering their perspectives. This action can help individuals accept alternative viewpoints without abandoning their own.

According to the study, young adults will discover alternative interpretations of leisure reading through debate and self-reflection. This new perspective may increase their desire to read for pleasure.

Taylor (2017) asserted that a frame of reference consists of cognitive and emotional components, such as mental habits and a point of view. Assumptions are general, non-specific, and guiding. Attitudes, viewpoints, value judgements, and interpretations reveal mental habits. To encourage young adults to engage in recreational reading, their attitudes and behaviors must alter.

Young adults may get so committed to their own ideas that they disregard those of others. Having an opinion may cause young adults to reassess their values and beliefs, according to King (2011). After reviewing their terms of reference, adolescents and young adults can shift their perspectives by adopting an inclusive, self-reflective, and integrative frame of reference

(Mezirow, 1997). This can help individuals accept the perspectives of others without abandoning their own.

Research Design and Methodology

This study was motivated by constructivism. The actual experiences of young adult leisure readers require constructivism. Regarding constraints and possibilities, constructivism stresses experiential, social, and subjective reality. As required by Creswell (2014) and constructivist philosophy, the constructivist researcher focuses on the subjective leisure reading experiences of the participants.

This research is qualitative in character. According to Khan, qualitative research prioritizes feelings and impressions above facts (2014). It seeks to characterize the investigated issue through understanding the life experiences of individuals. In a qualitative study, researchers observed occurrences in the natural settings of individuals to better comprehend their life meanings (Shokane, Makhubele and Blitz, 2018). This study employed qualitative technique once more since it is fluid and unstructured and may be utilized to explore and define participants' understandings of leisure reading, as opposed to quantifying them (Johnson and Christensen, 2017).

It was applied research (Fouché and De Vos, 2011) that aimed to address the apathy of young adult readers in recreational reading. According to Kumar (2011: page?), applied research aids in issue resolution by enhancing comprehension and problem-solving skills.

In a South African institution, exploratory and descriptive study was undertaken on young adult readers through a case study. Case studies are empirical examinations of contemporary occurrences in their specific contexts (Yin, 2014). The case study method enabled a comprehensive investigation of unusual or intriguing events, such as the leisure reading habits of a group of young people (Phelan, 2011). Because the researchers wanted a group of young people who engaged in leisure reading to investigate its advantages and disadvantages, limitations and potential, a collective case study approach appeared most appropriate (Mouton, 2011).

The study comprised reading-inclined college students from South Africa. "Population" refers to all individuals or study groups with the to-be-researched characteristics (Hanlon and Larget, 2011). Because investigating the whole population was impractical, Shokane et al. (2018) utilized snowball and purposive sampling. 12 young adults (18–35) who loved reading and attended or worked at a university in South Africa were surveyed.

Data Collection

On the main campus of the university, two focus groups of six people each were engaged in discussion. Using a semi-structured interview schedule, twelve participants from a separate campus of the same institutions participated in in-depth individual interviews and two focus group interviews. To confirm the information gathered from focus group discussions, in-depth interviews were conducted with each of the 12 candidates.

Data Analysis and Discussion

The field-collected data were manually analysed and reported in text format. Thematic analysis is a methodology for systematically discovering, organizing, and comprehending data meaning patterns (Braun and Clarke, 2012). The data analysis followed Braun and Clarke's six-step data analysis procedure (2006). Additionally, the researchers employed a variety of extensively explained measures to assure trustworthiness.

Results and Discussion

The purpose of the study was to explore the value of leisure reading among the youth in a higher education institution in South Africa. Young adult-readers in a higher education institution expressed their perceptions why their peers dislike reading, and what are the reasons for that, expressed their views why they though leisure reading is valuable. Lastly, they also suggested ways to attract more leisure readers. To make the analysis manageable the data were pruned, arranged, and discussed under the following themes:

Theme 1: Why Many Young People Lack Reading Skills

This theme contains claims that other young adults do not read along with speculation on why that may be. These include a lack of interest and distracting technology. Participants had this to say, and it was reproduced verbatim.

> *... my mother she never read any book for me while I was growing up.*
>
> *It was just something that we just never did.*
>
> *The majority are not interested.*
>
> *Like they are not used to the whole idea of reading books just for the fun of it.*

According to Akanferi, Aziale, and Asampana, young people are too tech-focused to read conventional novels (2014: 19-20). Baker and Johnson (1993) proposed family literacy as a means of breaking the cycle of illiteracy. Their moniker was "the aspirational family literacy program." For centuries. Reading-challenged parents may put their children at a disadvantage. This combats illiteracy. Family literacy is a paradigm for reading, according to the writers. It is used by librarians, parents, and carers. Totmeyer (2009) discovered that many perceived reading to be instructive. Some college and university students dislike reading or are too preoccupied to do so. Teachers, lecturers, facilitators, and librarians should promote leisure reading (Jansen, 2019)

According to the World Youth Report (2003:213, cited in Lloyd, 2005:326), adolescents and young adults who do not read are more likely to engage in dangerous behaviours such as substance abuse, unprotected sexual activity, and other forms of delinquency. Youth may unwind. Free time can lead to drinking, smoking, sexual activity without protection, and criminal behaviour. Utilizing discretionary time effectively is beneficial for the individual and others. According to Phasha et al. (2012), most young adults exclusively read for school. Mahala (2010) proposes extracurricular reading and evaluation.

Theme 2: What Makes Many Young People Dislike Reading

This theme contains claims that other young adults dislike reading along with speculation on why that may be. The participants' perceptions include digital distraction, academic pressure, perceived boredom about reading and competing activities.

> *people hate opening a book…*
>
> *Because once you tell them about like books, they find it weird.*
>
> *…we are more consumed into social media; we are more consumed into listening to music.*
>
> *... most of us are outgoing, so they would rather spend time doing something else...*
>
> *Yes, they do not do leisure reading, except when they are obliged by studies, and they have to.*

Digital distractions have proliferated because of digital entertainment, social networking, video games, and streaming platforms (Liu, 2022; Sridhar, 2021; Spjeldns & Karlsen, 2022). Young people prefer these activities to reading. Academics, extracurriculars, and social responsibilities leave young adults with little time for leisure reading. Young people emphasize other activities above reading for pleasure (Packialakshmi et al 2021; Yusof, 2021, & Ahmad et al, 2021). Some young individuals may also view reading as uninteresting or obsolete (Kil et al, 2021). In a world brimming with entertainment and amusement, reading for pleasure may sometimes struggle (Ross, 2021; Loh & Sun 2022).

Theme 3: The Value of Reading for Socio-Economic Life

This theme explores the importance of reading in social and economic life. Incentives, book groups, interest-based books, and making leisure reading trendy are often suggested. The participants suggested the following:

> *…but one that I can think of is you know giving prizes to people who are reading.*
>
> *…and also developing a culture of reading clubs.*
>
> *So, a reading class would be better and also maybe to investigate what is there in our libraries that can attract young people.*
>
> *I would say writing more stories about the youngster experience, more books about that and also ja, if there were more books about that, then I believe that people would read more.*

Incentives or rewards to read, join book clubs, and make leisure reading popular by giving books based on interests were typical ideas. Book clubs read a book together monthly (Álvarez-Álvarez, 2016). The rules of any book club are up to them. A well-run book club may help young adults enhance their literacy, explore new concepts, get new life experiences, develop analytical skills, and respect others' viewpoints (Álvarez-Álvarez, 2016).

Leisure reading by young adults is important for their development and society's long-term benefits. Mbali-Ann promoted social advances like leisure reading (on the talk show). On Radio 702 (10.07.2020), Mbali warned Manyhathela that our cultures are stereotyped and ethnically uncomfortable. Leisure reading helps young people transcend tribalist, racist, and patriarchal attitudes.

Theme 4: Ways To Encourage Leisure Reading Among the Youth

This theme explores strategies to encourage leisure reading. How participants encouraged leisure reading. Participants recommend using virtual book clubs, audio books, and blogs to attract leisure readers.

> *we can create book clubs through social media platforms.*
>
> *and then I have this hash tag, "#reading is fun to mental", which means it is an entertainment for your brain…*
>
> *created audio books, because like most young people they hate to go to a library and like open like a hardcopy book....*
>
> *I would say more blogs on books that encourage reading uhm (pause) ... and I would say platforms where books are shared.*

To encourage reading, join book clubs, and make leisure reading current, incentives or prizes were offered. Book clubs meet monthly to read a book. Any book club can establish rules. A good reading club may assist young adults learn new things, gain life experience, develop analytical skills, and respect others' viewpoints (Álvarez-Álvarez, 2016).

Leisure reading is important for young people' growth and society's long-term benefits. Mbali-Ann encouraged leisure reading (on the talk show). Mbali informed Manyhathela on Radio 702 (10.07.2020) that our cultures are stereotyped. Leisure reading helps young adult readers overcome tribalist, racist, and patriarchal biases.

Conclusion

The conclusion of the study was that young adult leisure readers encounter reading difficulties, such as access to reading material while they are not attending institution of higher learning. The study also revealed that young adult leisure readers must be nourished and cared for to have a positive leisure reading experience. Reading is seen as less vital by other higher education students. Some young adults might not find reading entertaining. In addition, leisure reading increases language and knowledge. Reading for pleasure increases self-esteem and helps individuals resist peer pressure. Reading allows individuals to escape harsh situations and gain fresh perspectives. According to the presented statistics, exposing children to reading at a young age has the potential to benefit them later in life since it keeps them interested in reading. Additionally, if recreational readers are rewarded for their reading, enhanced library access may attract new reader populations.

Recommendations

- Reading communities for teens to share their reading suggestions. Organize family reading sessions or book clubs.
- Inclusive reading places for diverse learners. Audiobooks, graphic novels, and multimedia may fit varied preferences.
- Reading challenges and rewards to encourage youth reading. Encourage reading through awards, book vouchers, or recognition.
- Provide flexible reading options for busy teens.
- To connect leisure activities and reading by using popular culture, such as movie or video game books.
- Use social media to recommend books, reading challenges, and reading-related information to young people.
- Provide inspiring and engaging literature for young adult readers in libraries.
- Foundation-phase reading course for teacher preparation.
- Government should create additional libraries in marginalized neighbourhoods.

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Reimagining the Role of Art for Student Learning at Wenzhou-Kean University

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Abstract
This research aimed at exploring the opinions of undergraduate students at Wenzhou-Kean University (WKU) towards the issue of reimagining the role of art for student learning. Previous research had shown that the art method was crucial for students' learning process. This study had investigated 70 students varying in different majors from College of Business & Public Management, College of Liberal Arts, and College of Science and Technology in WKU to further explain the relationship between art and students' learning process. Incorporated with quantitative and qualitative methods, this research would try to clarify the working principles behind art towards improving students' memory skills, as well as examine the efficiency of art in motivating students' further studies. Through the study, it was found that students in WKU widely applied art methods during their learning process. As revealed, there were also some constructive results that were brought up by the study which need further explanations.

Keywords: Art Method, Undergraduate Students Learning Method, Memory Skill

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Introduction

People always said that "art is the universal language of the world". Not only does art have a variety of forms, but also it exists more in ideology, which is not restricted by a set of boundaries including languages and living areas. In today's educational environment, it's not hard to find that schools usually integrate different forms of art into students' studies. Forms of art include but are not limited to stage performance, singing, drawing, and other audio support. Tafti et al. (2020)[1] did research that focused on primary education of four typical countries in different parts of the world, trying to find out the similarities and differences in the goals of art curriculums. The research implies that there is a consensus of the significant role of art playing in students' studies, which makes art more than a subject but for individual and social development. Another example is the effectiveness of introducing audio teaching methods in class. Rossiter et al. (2009)[2] show some innovative audio teaching methods in the research studying student-generated audio to enhance learning. By incorporating recording methods for second language learners, students effectively learn from their mistakes in an enjoyable learning procedure. Therefore, with the fast spread of cultural communication and technological development, art plays an increasingly important role in education as a universal language, helping students to understand the content of courses better.

Learning is a lifelong career. Thus, the application of art in the educational field also ranges from the time that a baby is born to the time after his or her college graduation. During this long period, knowledge is gained step by step, and the form of art is also changing through time. Art contributes a lot with connecting new information to the old one, restructuring a new learning map. As research done by Gibson and Larson (2007)3 in Visual Arts and Academic Achievement implies that integrating art into learning promotes self-fulfillment, as well as the development of human beings. Society also benefits from the influence of art, which reflects in every aspect of daily life.

Statement of the Problem

This study aims to figure out the connection between art and student success, especially for classroom teaching in the east of China. To be specific, it's going to answer the following questions:

1. Is that a significant relationship between art and student learning?
2. How does art work to improve students' memory skills?
3. How does art motivate students' further studies?

Objectives of the Study

This study aims:

1. To determine the significance between using the art method and student learning.

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2. To define the working principle behind art towards improving students' memory skills.
3. To examine the efficiency of art motivating students' further studies.

Research Methods

Research Design

Based on the research problem, this study is a mixed-method study that focuses on the attitude of Wenzhou Kean University students about art learning and art teaching. By using the qualitative and quantitative method, the research design can be more flexible, while the researcher could also get more details and depth in respondents' answers. The attitude on art learning and art teaching would be more abstract and personalized, which would be hard for numerical statistics. Thus, this research applied Constructivist Worldview combined with Interpretivism as a philosophical foundation for a qualitative approach to better explain some subjective answers (Creswell, 2019)[4]. The multiple intelligences theory introduced by Gardner (1993)[5] was also integrated in this research to consider the relations between art and students' learning. The applicable research design can be helpful to respond to the research questions. According to Gaille (2020)[6], a survey method has many benefits in gathering data from multi-dimension, as well as providing opportunities for final data comparison. For better explaining the research questions, the researcher chose to apply a survey method into this study, which could reflect some opinions about art learning among modern bilingual university students.

Research Instrument

For the survey method, a self-made questionnaire for students in Wenzhou Kean University has been used to gather data. The questionnaire has been divided into four parts: Part I- Socio-demographic characteristics of the respondents; Part II- WKU students' understanding of art learning and art teaching; Part III- WKU students' art method in learning and memory; Part IV- WKU students' view towards applying art method in leaning. This study will also be supplemented with unstructured interviews and observation to better understand the research problems.

Respondents and Sampling

The research will utilize the primary data to prevent delay and later modification. The respondents from Wenzhou Kean University will intentionally cover three colleges: College of Business & Public Management, College of Liberal Arts, and College of Science and Technology, including 30 respondents from College of Business & Public Management and College of Science, 10 respondents from College of Liberal Arts through simple random sampling, which totally means 70 respondents as a sample for the analysis. Likewise, a purposive sample of 30 users and pushers is included for a better comparison of results.

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Data Analysis

Descriptive statistics like ranges, frequency counts, listing your favorite art method, and describing how the art hobbies affect your school learning help provide qualified answers to measure the relationship between art and students' learning (objective 1), clarify the relevant students' memory principles about art (objective 2), examine the influence of art brings to students' future study (objective 3).

Limitation of the Study

In the whole process of the research, some limitations still exist in different aspects. The research sample may be too small to represent the whole attitude of WKU students or even the modern undergraduates in China. Besides, some students may forget some hobbies in their childhood period which could bring a significant impact on their adulthood learning. In addition, it also happens when some students are not realizing they get help from their understanding of art when they trying to figure out a problem.

Ethical considerations

In any research, ethical issues take top precedence, and this is well kept in mind throughout the course of this study. In this study, every participant will be explained clearly the purpose of the study. All responses from the surveys and interviews reported will be bound by ethical consideration. The confidentiality and anonymity of the participants will be maintained, and their views will also be respected. Furthermore, approval from all the participants will be sought before answering the survey questionnaire.

Results and Discussion

Totally, there are seventy (70) undergraduate students from Wenzhou-Kean University participating in this research study. Table 1 shows the distribution of the students. Through simple random sampling, ten (10) students from different majors were chosen. Three majors were chosen respectively from College of Business & Public Management and College of Science and Technology, while one major was chosen from College of Liberal Arts as it had less major included. The research did not include participants from the College of Architecture & Design, as all the majors in the college were related to art which would lead to weaker pertinence to the research topic.

WKU Respondents

Categorical Variables	Type		Frequency	Percent	Total
Gender	Male		32	45.71%	100%
	Female		38	54.29%	
Major	College of Business & Public Management	Finance	10	14.29%	42.89%
		Accounting	10	14.29%	
		Marketing	10	14.29%	
	College of Liberal Arts	English	10	14.29%	14.29%
		Computer Science	10	14.29%	42.89%
	College of Science and Technology	Mathematical Sciences	10	14.29%	
		Biology	10	14.29%	
Age	Freshman Year		18	25.71%	100%
	Sophomore Year		33	47.14%	
	Junior Year		14	20%	
	Senior Year		5	7.14%	

Table 1. Frequency Distribution of the Respondents of the Study

Respondents' Gender, Major and Age

Referring to Table 1, all the seventy (70) respondents agreed on the consent before taking the questionnaire. In respect of gender, 32 males and 38 females were included in the study, as the number of respondents in gender was almost equal, with the number of females slightly exceeding the number of males. The respondents were from three colleges in different majors, including Finance, Accounting, Marketing, English, Computer Science, Mathematical Sciences, and Biology. Ten (10) students were equally chosen from each major mentioned above, which had an equal distribution of 14.29%. Among the three colleges, College of Business & Public Management and College of Science and Technology as big colleges had a higher percentage of respondents that is 42.89%, while College of Liberal Arts represented by English major with 14.29%. The age of the respondents was also divided into four levels. The great majority (47.14%) of the participants were in their sophomore year indicated by 33 respondents. 18 freshman students participated in the questionnaire with a percentage of 25.71%. Following by freshman, junior students owned 20% with 14

participants. The age group with the least students included was senior year, with only 5 respondents accounting for 7.14%.

Degree of Applying Art Methods in Class

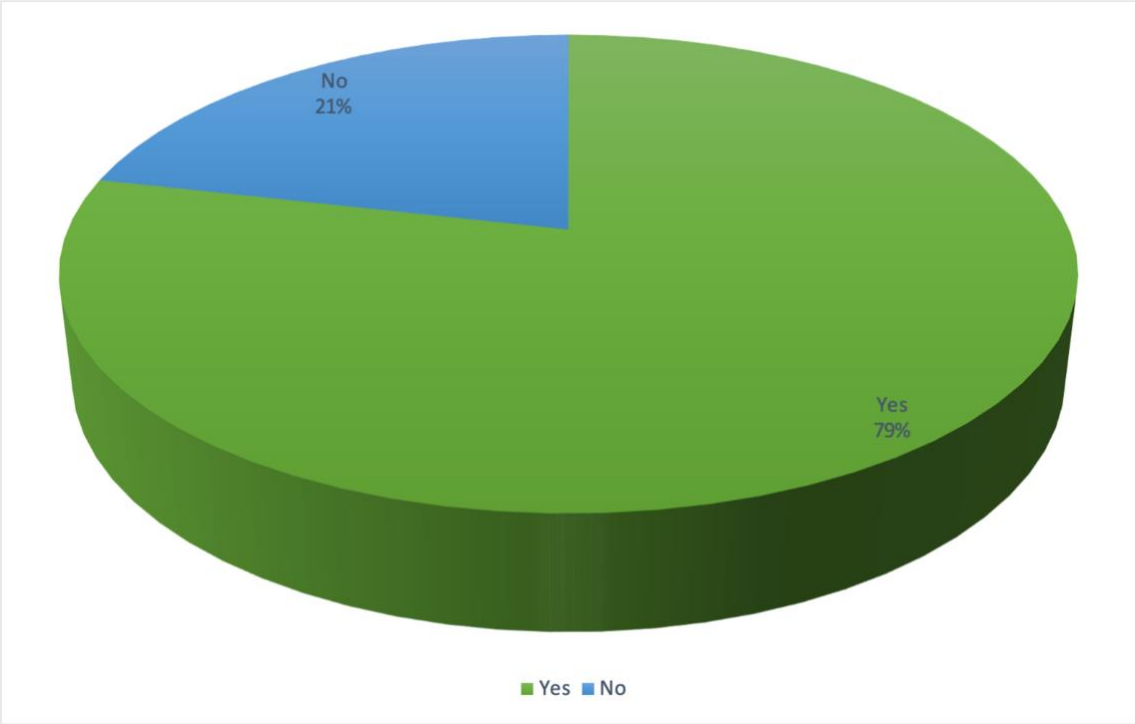

Figure 1. Incorporating Art Teaching Method in Class

In the in-class learning environment, teaching methods with art are varied a lot. According to Tirath (2017)[7] in the research of *Innovative Teaching Method for State-of-Art Education in India*, some new emerging art teaching methods are mentioned. E-textbooks with hyperlinks can provide students with multiple resources from the Internet, creating a multimedia learning experience. Computerized grading is usually used for exams including multiple choices, which benefits from the rapid development of AI technology. Shabiralyani et al. (2015)[8] also noted some traditional art methods in learning, for example, models, charts, maps, flashcards, and blackboards, which play important roles in encouraging students' learning. These visual aids powerfully support teachers to transfer the text to students in a vivid and active way. Interactive learning method can also be categorized as one of the art methods. According to Giorgdze and Dgebuadze (2017)[9], the interaction is between teachers and students, while teachers are usually at the center of the lecture and the students act as the audience. The flipped classroom is another interactive method. It means teachers will provide the lecture in advance through recording lessons. The formal class time will focus more on the homework tutor rather than the content of the lecture. As Webb and Doman noted

[7] Tirath, R. (2017). A study of innovative teaching methods for state-of-the art education in India. *Research India Publications.*
[8] Shabiralyani1, G., Hasan, K. S., Hamad, N., & Iqbal, N. (2015, November 19). *Impact of visual aids in enhancing the learning ... - ed*. Journal of Education and Practice.
[9] Giorgdze, M., & Dgebuadze, M. (2017). *Interactive teaching methods: Challenges and perspectives*. International E-Journal of Advances in Education.

(2020)[10], flipped classrooms aimed to offer students more personalized instruction, and this mode needs teachers to prepare a lot of plans and activities in advance.

In my research among all the 70 respondents, the majority (79%) of them had applied art teaching methods like visual aids, group work, performing, or other kinds of art methods during their class time. Nevertheless, there was still a small amount (21%) of students with no art method incorporated in the class. Besides, according to the results of the questionnaire, most of the participants regarded the art teaching method as helpful to their learning progress, whereas only a small fraction of the students thought the art method did no good in their studies. On the other hand, about sixty-six (94.29%) respondents were willing to incorporate more art methods into their future studies, while the other four (5.71%) students still provided the negative answer. The results clearly showed the significant relationship between art methods and students' learning, as most students regarded themselves with making identified progress during art learning and were eager to acquire more art learning methods in their further studies. The results also proved that art methods were a strong motivation for students learning.

Respondents' Degree of Fondness in In-class Art Methods Applying

Question No. 6	Mean	Interpretation
Do you like incorporating the art teaching method in class? Measure your Likert scale.	**3.77**	**Agree**

Table 2. The Fondness Degree of Incorporating Art Teaching Method in Class

Through the Likert-type questions, it could be found that the average of the participants was fond of incorporating art teaching methods in the class. More than half (64.29%) of the respondents expressed their interest in learning art, while eighteen of them chose to stay neutral (25.71%). Only a small proportion (10%) of the students gave negative feedback, which indicated that the art method was welcomed during the students' learning process.

[10] Webb, M., & Doman, E. (2020). Impacts of flipped classrooms on learner attitudes towards technology-enhanced language learning. *Computer Assisted Language Learning*, *33*(3), 240–274. doi:10.1080/09588221.2018.1557692

Art Methods for Memorizing

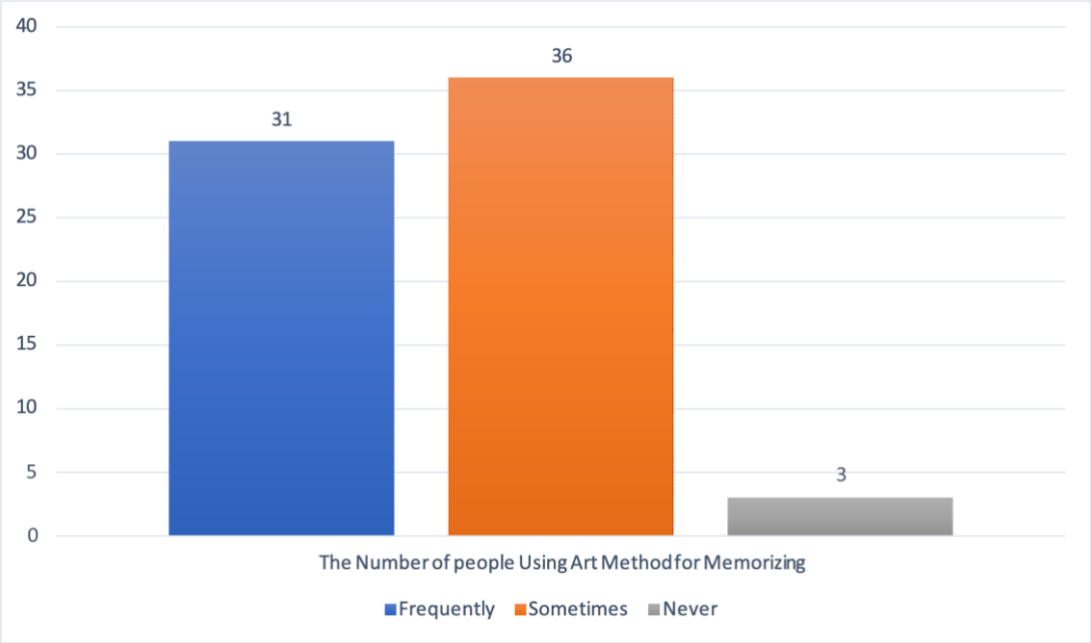

Figure 2. Frequency of Using Art Method to Memorize

As the results are shown in Figure 2, sixty-seven (95.71%) students have applied art methods for memorizing, while only three (4.29%) students showed they never memorized content in art methods. For students who expressed they had utilized art methods, more than half (51.43%) of the respondents had a middle frequency in incorporating art method, while the other thirty-one students highly applied art methods during memorizing process. According to the survey, some popular art methods were given, including performing drama, mind map, vivid graphs, and music. Drama performing was noted significantly mainly be English major students. Drama playing needs students to take command of multiple skills including writing, speaking, and performing. Only students fully understand the text the drama will successfully be performed. As Gullatt (2008)[11] mentioned in the research of *Enhancing Student Learning through Arts Integration*, drama gives students an opportunity to get into the deeper content of the learning materials. The drama activity is also a platform for students to learn multidisciplinary, as well as triggering critical thinking (Gullatt, 2008). The great number of respondents applying the art method indicated that the vivid visualized and audio techniques could prompt students' memorizing ability.

[11] Gullatt, D. E. (2008). Enhancing Student Learning through Arts Integration: Implications for the Profession. *The High School Journal*, *91*(4), 12–25.

Effectiveness of Using Art Methods in Memorizing

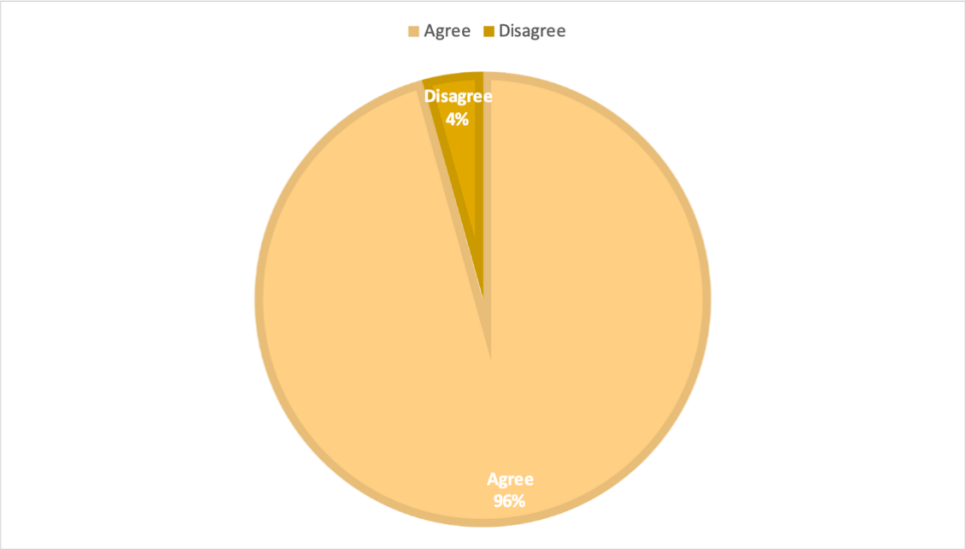

Figure 3. Agreement on Using Art Method to Improve the Memory Level

According to the results shown in Figure 3, most (96%) students gave positive feedback on the issue of using art methods to improve their memory level, which could be inferred as the majority of the respondents regard the various art methods as helpful and efficient for their learning process. Only 4% of the students still offered a negative feeling for applying the art method into their memorizing process.

Importance Between Using Art Methods and Students' Motivation

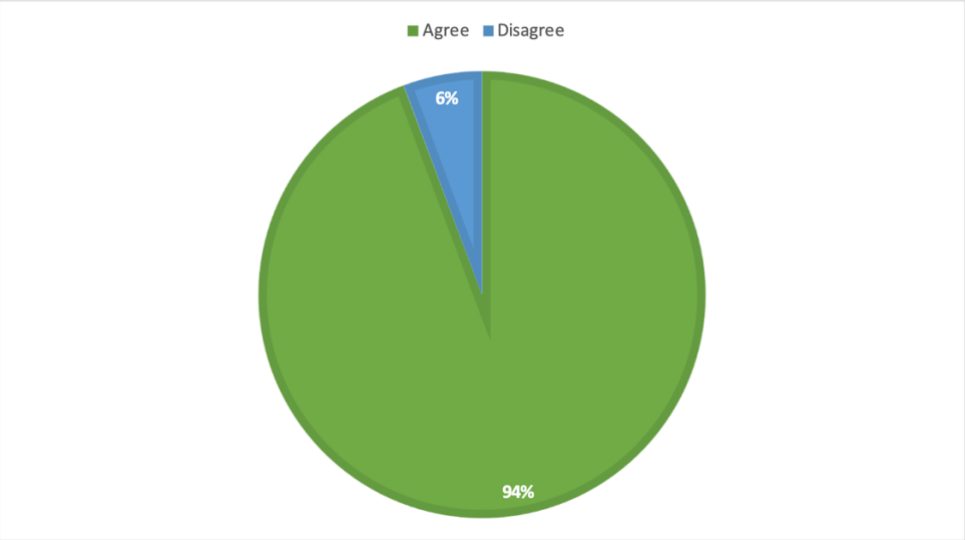

Figure 4. Agreement on Using Art Method in Studies Can Make Studies More Interesting or Easier

Among the 70 participants, most (94%) of them thought that using the art method in the study could make their learning process more interesting and easier. Only a small fraction (6%) of the participants regarded incorporating art methods as not enough for them to pick up their motivation. The result indicated that there was a significant relationship between art and

student learning. While using various art methods, students were more willing to continue their studies, as well as put more effort into it.

Art Related Hobbies

Through the discovery, most students had some art-related hobbies that to some extent could help their learning. Listening to music, drawing, and watching movies were the three most popular hobbies among all the participants. Nevertheless, students got help from the three art-related hobbies from different perspectives. Some used music to gain motivation for learning, while some fully utilized the lyrics in the music to recite the article. Others even took advantage of English songs to learn native expressions and pronunciation. Watching movies mainly had benefits in students memorizing, helping students learn native expressions, as well as broadening students' horizons and enabling them to notice the art expressions in the movies. Other hobbies like watching talk shows, playing various instruments, or dancing were also boosted students learning spirit. As a result, some of the art-related hobbies may help us to learn stuff outside school learning while building connections with school learning content subconsciously. According to the research, Tyson (2019)[12] found that students get better scores in exams and graduation rates when they have art teaching methods applied in their courses. Students gain more happiness during the participation and interaction in class. The main reason is that art provides students with a more positive way to express themselves, as well as create new things. What's more, Tyson strongly believes that the use of art during learning could have a further positive influence on students' later careers. Hence, art-related hobbies provided students with more passion and motivation for their school learning, and students were also apt at encouraging themselves by incorporating hard learning content with their art- related hobbies. Tyson's study also matches with the results of this study in WKU.

Conclusion

The study was conducted primarily to: (1) describe the socio-demographic characteristics of the respondents; (2) determine the respondents' attitudes of the role of art in students' learning; (3) identify the significant relationship between art and students learning; (4) examine the efficiency of art motivating students' further studies; and (5) speculate students' art related hobbies also contribute to their school learning.

Results revealed that the mean age of the respondents was 20 years old with 19 years old as the youngest and 23 years old as the oldest. The majority of them were female and in sophomore year. Most of the respondents were willing to incorporate art learning methods in their studies and regarded art methods as an interesting and easier way for the learning process.

The respondents' commented that they heard about art methods in-class learning, and they also applied the art methods in their daily studies. It was also found out that the respondents felt optimistic about art methods for their future learning.

The foremost problem encountered in the implementation of the using of art method was the lack of incorporating art method in class while most students considered art learning was helpful and could boost their memorized ability. In the light of the findings of the study, the following conclusions can be drawn. The respondents regardless of age, gender, major, are

[12] Tyson, J. (2019, April 1). *The impact of Arts Education on student success*. Maryland Shared Open Access Repository Home.

aware of the significance of incorporating art into their learning process but still need to improve in the in-class learning. However, as the respondents noted, their art-related hobbies like watching movies, listening to music, or drawing, helped them a lot during their self-studies, which provided significant views on the further implementation of art method learning.

Based on the conclusion, the following are recommended:

1. Teachers in the school should consider more about incorporating the related art methods in the class. Some surveys and adjustments could also be done to fit in different students' characteristics
2. After understanding students' hobbies that they applied in their daily life for learning, using music for memorizing and learning was impressed, as visualized learning method was usually considered by most people. Thus, the further researcher can be done in the direction of audio learning. It may be better if students combined audio learning methods more into their studies.
3. After the observation of my little sister's learning progress, I suspected that music learning may have a significant effect on child language learning. As my other sister who was one year younger than me often played piano and singing along at home, my little sister imitated and started to do the same by herself at the age of two. She is three years old now and has a better fluency and vocabulary in language than her peers. Further studies could be done in the aspect of instrument and music playing effect towards infant learning.
4. More various art classes should be promoted at school learning system.
5. There should be some flexible courses at school for students to do some creative art learning sharing.

Acknowledgment

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Introducing Artificial Intelligence in High School Curriculum

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Official Conference Proceedings

Abstract
In May 2019, the United Nations Educational, Scientific and Cultural Organization (UNESCO), convened the first conference on Artificial Intelligence (AI) and Education to reflect on the impact of this emerging technology on teaching and learning. In the history of education, disruptive technologies including electronic calculators, computers, the Internet, and the World-Wide Web have set new milestones and entirely redefined the landscape of education. The design and implementation of AI conversational models, including ChatGPT by the American company Open AI, strongly suggest that accessing and using knowledge will be a lot easier in the near future. It also means that having knowledge at one's fingertips is becoming a reality. That is to say, there is a need to prepare learners and teachers for the coming technological and social changes induced by AI. Following this trend, we suggest in this paper that younger generations should be trained in the design and implementation of the building blocks of this new technology. Therefore, our paper lays down the foundations of AI curriculum design and development for high schools. It also helps prepare young students for the coming technological and social changes, and the Fourth Industrial Revolution (4IR). To achieve this goal, we propose an initiative that focuses on three directions: 1) Creating accessible course contents adapted to young audiences; 2) Training teachers to master the new technology in order to deliver appropriate content; and 3) Harnessing the necessary resources to create an environment that supports learners and teachers and help them thrive.

Keywords: Curriculum Design and Development, Artificial Intelligence, Secondary Education, Learning, Teaching

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Introduction

In the last few decades, artificial intelligence (AI) has been attracting a lot of attention from the public, industries and society. Through collaborations, information and communications, AI applications spread quickly from the confines of academic and industrial research laboratories to the public. Today, virtually all segments of modern society including the entertainment industry, the financial system, the media, the medical and health sciences are using AI tools and techniques to solve complex problems or improve their processes. It is only recently that a number of governments and international organizations including the United Nations through the UNESCO initiated policies and strategies for leveraging AI in order to achieve their sustainable development goals (SDG) (UNESCO, 2022; Human-centered AI, 2021).

In this perspective, UNESCO organized the first international conference on AI and education ("Planning education in the AI era: Lead the leap") in Beijing, China in May 2019. This event served as a platform for governments, international organizations, society and related industry to reflect on the impact of this emerging technology on teaching and learning. The main outcome of this conference is the Beijing Consensus on AI and Education which suggests participants should take actions towards the systematic integration of AI to innovate teaching and learning through the delivery of flexible education systems (UNESCO Digital Library, May 2019, p. 16-18).

Traditionally, the research and teaching of AI are done in science and engineering departments of universities worldwide (Winston, P. H., 1992). The contents, tools and techniques of AI education at the academic level are out of reach of the public. In addition, younger students in secondary schools have no clue of the inner workings of this new technology beyond its mundane applications they enjoy. AI-based apps are embedded in virtually every social media platform or tools they use daily. For example, current search engines integrate voice input in addition to text (Text-to-Speech technology from NLP in AI), to make online search accessible to everyone. Yet, formal AI learning remains elusive in secondary-level education. Therefore, there is a need to downsize and adapt existing higher-level AI curricula to young learners. In the meantime, it is possible to bring into interested schools open-source curricula as volunteer-based programs the way computer science and programming were introduced through the CodeEd program to girls in New York (CodeEd, 2023).

The new AI curricula will help them become familiar early on with the fundamental concepts and methods of the field. High-school students exhibit enough level of maturity and critical thinking for understanding the technological and cognitive foundations and methods of AI. This paper starts a fruitful discussion on the wide-scale implementation of AI in high-school science education (Nisheva-Pavlova M. M., 2021). After this introduction, Section 2 lists a number of notable corporate and governmental projects that are pushing AI into the standard secondary-level education. Then, in Section 3, I propose the structure and content of a curriculum that would progressively implement AI into any current high-school science curriculum. Last Section 4 concludes this contribution.

Related Initiatives

Recently, several inspiring initiatives on AI education targeting young audiences, has emerged around the world. These projects focused mainly on AI education at the K-12 level

(Nisheva-Pavlova M. M., 2021; UNESCO, 2022). They devoted much attention to crafting balanced contents of theory, practice and also philosophical, legal and ethical issues. The expected challenge here is to find the right level of adaptation of university content to high-school audiences. For example, key topics in a traditional academic AI curriculum like problem-solving by search or planning, knowledge representation, automated reasoning, and natural language processing are either left out for convenience or ridiculously simplified. These issues are not actually new and quite common when a known and successful field is "transferred" from academia to high-school. The history of Biology in secondary-level education provides an excellent illustration. In spite of these challenges, the following successful initiatives from around the world are paving the way to a smooth integration and acceptance of AI education.

AI4ALL Open Learning in USA

AI4ALL Open Learning is an American non-profit organization founded in 2019 originally at Stanford University. Its mission is to created a diverse and inclusive environment in AI education, research and development. The main goal of the Open Learning platform is to provide free, accessible AI curriculum and resources for high school teachers of all disciplines to use in classrooms of all subject areas. Within the AI4ALL, there is the specific AI for K-12 initiative (AI4K12) which develops guidelines for integration of AI in K-12 (UNESCO, 2022). According to its founders, it is a "curated resource directory to facilitate AI instruction" and "a community of practitioners, researchers, resource and tool developers focused on the AI for K-12 audience" (Touretzky, D. et al., 2019).

China's New Generation AI Development Plan for 2030

In 2018, AI was first introduced to Chinese high-school curriculum to attract young people towards this field. The same year, a related nine-chapter textbook named "Fundamentals of Artificial Intelligence" was published (see Figure 1), (China Daily staff writer, 2018).

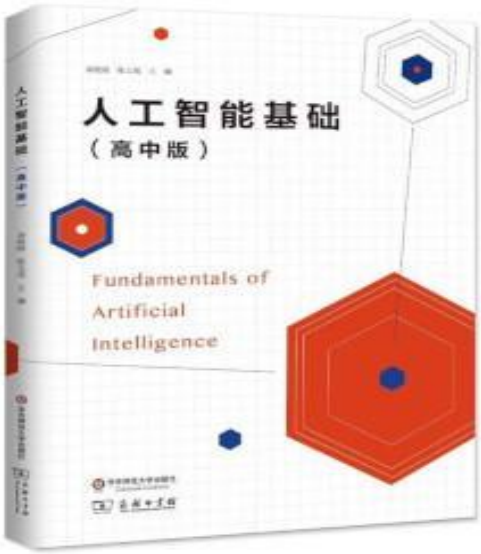

Figure 1: First high-school AI textbook in China: "Fundamentals of Artificial Intelligence". (Source: SHINE - https://www.shine.cn/news/metro/1804293918/)

It includes the history of AI and its applications in daily life such as facial recognition, auto driving and public security. The Chinese government selected 40 pilot high-schools to

implement its AI agenda made of basic recognition techniques of image, sound and text and also deep learning. Then, in 2019, China, the State Council for the People's Republic of China launched the national AI strategy including R&D, capacity building, education, and ethical norms for national security. As China is mandating AI education in high school, it is also urging corporations involved in AI development to partner with schools and universities in training students.

AI Education Initiatives in India

Under the leadership of an organization called AI School of India, a team of experts created a special AI curriculum specifically for K-12 students in the innovative AI LAB environment (Staff writer, 2021). These experts include ISTE, Intel and IBM-certified educators and engineers supported by academics from Oxford University in U.K. and Graz University of Technology in Austria who designed contents. The AI LAB is equipped with hands-on, interactive and virtual AI courses with young learners having control over timing and resource allocation. The main objective of the AI LAB is to make young students AI -literate, discover the world of AI and immerse them into a unique learning experience. However, there are still questions about the readiness of this audience to tackle real-world problems using AI tools and techniques. In addition, the Indian Central Board of Secondary Education (CBSE) partnered with IBM to launch the "AI for high school program".

AI in Secondary-Level Education in Korea

Around the end of 2019, the ministry of education of the Republic of Korea (South Korea) announced a bold new "National AI Strategy" that will put the country on the world AI map. Then in 2021, it embarked on an ambitious program to introduce AI in Korean high-schools (Yonhap, November 2020). The ministry also intends to expand this program in terms of technological infrastructure and material to kindergartens, elementary and middle schools by 2025. These secondary-level curricula elective AI subjects include "Introductory AI" and "Mathematics of AI". In addition, the elementary and middle school curricula will cover basic programming skills, foundations of AI, practical use of AI and its ethics. In this plan, Korean graduate schools and universities will train and supply teachers who will teach students (Kim, S. et al., 2021).

Saudi Authority for Data and Artificial Intelligence

In July 2020, the Saudi Data & AI Authority (SDAIA) was created to spearhead the national agenda for Data & AI and position the kingdom in the data-driven economies. One of the three core elements of the SDAIA is the National Center for Artificial Intelligence (NCAI). The objective of this center is to support AI research and development, serve as an AI advisory board to government, and promote AI education and awareness. In September 2019, Riyadh's Misk Schools of the Misk Foundation became the first Saudi school to introduce AI into the classroom. Misk Schools uses Century, an AI-based teaching and learning platform that adapts learning to individual student's strengths (Al-Kinani, M., April 2019).

Proposal of an AI Curriculum for High-School

The Learner's Perspective

There are certainly many successful methods for teaching AI to young audiences. The selected projects mentioned in the "Related initiatives" section above, provide an interesting array of strategies and examples. Here, we put an emphasis on the practical side of AI. Getting hands on experience with AI methods and techniques is the best way to initiate and attract young people to a new technology. The following tables suggest a layout of the most important elements of a course syllabus in the typical high-school education. Here, I assume that the standard number of years for completing high-school is three years. The contents of the following tables provide information on each year's content via modules. A course syllabus is an informal contract between the teacher and the learner (Parkes, J., & Harris, M. B., 2002). Each table introduces a module, its intended learning outcome, a related planned experience when possible, and the module synopsis.

AI Syllabus for Year One

In the first year, students have a smooth and gentle introduction to AI, knowledge representation and the world of computer programming. The main purpose of this content in year one is to attract students and make sure that their overall perception and feeling about AI is very positive from the beginning. It would serve as an incentive to continue further their exploration and discovery of AI.

First Year High-School - Artificial Intelligence			
Module	**Intended Learning Outcome**	**Planned Learning Experience**	**Module Synopsis**
A Gentle Introduction to Artificial Intelligence	- Understand the nature, history and foundations of Artificial Intelligence. - Discover applications of AI in real life.	Watch videos of successful AI applications in society and industry (ex. apps, software, robots) Corrode videos series (https://code.org/educate/resources/videos#how-ai-works)	Artificial intelligence is a field that explores intelligent human behavior. It then tries to duplicate and implement this intelligence in a computer system.
Knowledge Representation (KR) in Artificial Intelligence	- Get familiar with the form of Knowledge Representations in AI. - Learn logic and reasoning. Use logical reasoning to make simple inferences	Use tools and platform to draw and implement visually KR in a lab. environment	This module introduces the concept of knowledge and its many representations. It also presents elementary logic, propositional logic and first order logic.
A gentle introduction to algorithms and languages for Artificial Intelligence	Develop abilities in the most used programming languages for AI: Python, Java, R	Learn by example the basics of computer programming. Coding short programs in IDE (ex. AI Lab from Code.org)	This module introduces computer programming in Python, Java, and R. It also shows how these languages are important for AI systems.

Table 1: AI curriculum for high-school, first year

The first step is to learn how to program in high-level languages. Nowadays, it is quite common to use an AI-powered environment in secondary education to teach how to write computer programs in high-level languages. For example, PyCharm and Visual Studio are

integrated development environment (IDE) that are used together with useful code completion extension like GitHub Copilot and IntelliCode from Microsoft. The next logical step in this exploration is Knowledge Representation and Reasoning (KRR) in AI for high school as explained in (Guerreiro-Santalla, S., 2021) which deals with how humans represent knowledge and reason logically when solving a problem. This representation is done in a format that computing systems equipped with inference engines or theorem provers can use to solve complex problems. To this end, students learn about some of the most popular formalism including semantic nets, frames, rules and ontologies. To help students feel grounded with these concepts, the Planned Learning Experience (see Table 1) could introduce the Knowledge Machine (KM), a free knowledge representation and reasoning tool made of a language and a reasoning engine. A student can use KM in a laboratory setting, to easily create a knowledge base (KB) as a collection of facts, objects, rules, and relationships. In addition, he/she would also design rules that connect facts and allow us to reason about those facts. Then, during the experimenters can run simulations and ask questions (queries) to the KB, and make inferences based on facts and rules in the KB.

AI Syllabus for Year Two

In year two, the objective is to introduce students to core AI techniques and methods and teach them how to solve real-world problems using these techniques as proposed in Table 2. That is to say, students discover Machine Learning, its algorithms, search and planning techniques. Machine learning is a branch of AI and data science that creates and train algorithms (ex. Neural networks, Linear regression, Clustering) for the purpose of classifications, predictions, and mining of insights from large datasets (IBM, 2023) With this technology, students learn how to build simple models from collected data in order to solve complex real-world problems. That is to say, the learner identifies, defines and analyzes a problem. Then, given the model he/she built previously, an optimal solution (least costly path) is chosen and implemented.

Second Year High-School - Artificial Intelligence			
Module	**Intended Learning Outcome**	**Planned Learning Experience**	**Module Synopsis**
Machine Learning (ML) part I: Basics	- Understand simple learning algorithms - Building models from collected data	* AI lab projects that showcase ML applications in virtual sandboxes. * Introduction to Machine Learning: Image Classification uising the *MIT App Inventor* tool.	The content of ML, Part 1 includes the study of learning algorithms and how to use them in building models. It explains predictive and descriptive methods.
Problem-solving using AI techniques	- Learn about **AI search** methods. - Learn about **AI planning** - Acquire problem-solving skills	Hands-on lab experiments with AI planners	The objective of this module is problem-solving using critical thinking, logical reasoning, and creativity.
Capstone project	- Identify and solve an AI-friendly real problem - Master AI techniques for solving an actual problem	AI lab projects that showcase simple real-world problems. example: Microsoft AI Lab - Innovation Sandbox	The student conducts a research project on a special topic

Table 2: AI curriculum for high-school, second year

To make sure the expected learning outcomes are fulfilled, students must engage in a group Capstone project that gives them a unique opportunity to carry out independent work of interest and craft innovative solutions to real-world problems. The ultimate purpose of the Capstone project is to encourage young students to think critically and learn how to tackle and solve challenging problems. It is a good way of checking students' knowledge acquisition and skills. Additionally, its creative nature also helps improve their oral communications and independent research skills.

AI Syllabus for Year Three

The third year of AI covers Deep Learning, a special topic in Machine Learning; Natural Language Processing, a central theme in AI; Robotics and Vision; and the social and ethical impact of AI as displayed in Table 3. The Robotics module introduces students to actual robots and how to program them to perform simple actions. For young people, these robots are perceived as toys and interacting with them takes the form of playing games. Learning about Robotics in schools may assist students in turning their knowledge into creativity and innovation. For example, in he U.S., some K–12 students are exploring science with an online tool called BrainPOP that offers movies, quizzes and play games on math, science, social studies, English, technology, and art. At the same time, the platform tracks students' learning progress and provide teachers with lesson plans, tutorials, scheduling tools, and guidelines. A study conducted by the Games for Learning Institute (G4LI) at the NYU's Steinhardt School of Culture showed that the game-based learning approach can get students interested in and motivated to learn difficult subjects (Biles, M., 2018).

In spite of the glitters and promises of a better environment, AI should not be trusted to be fair and neutral and may present a potential peril for mankind. With little government

oversight, AI technology is being used by private corporations to make important decisions on patients' health, human resources, credit applications in fintech, and decisions in a court of justice. AI systems trained by human experts are able to capture their expertise over time, perform tasks better, more efficiently and with fewer errors. It is essential that young learners be aware at an early age of some of the unintended consequences of the use of AI and ethical concern for society including privacy and surveillance, bias and discrimination, and human judgment (Pazzanese, C., October 2020).

Third Year High-School - Artificial Intelligence			
Module	**Intended Learning Outcome**	**Planned Learning Experience**	**Module Synopsis**
Machine Learning part II: Deep Learning	- Understand Learning models and learning algorithms. - Learn about neural networks and their applications.	* AI lab projects that showcase ML applications in virtual sandboxes. * Building ML and deep-learning models to solve real-world problems.	The content of Part II includes the study of predictive and descrip-tive methods, learning algorithms and Neural networks.
Natural Language Processing (NLP)	- Understand the syntax, semantics and morphology of natural languages. - Build computational models of discourse.	Experiments with Text to Speech (TTS), automatic summa-rization, AI machine translation software	This module introduces comp-utational modeling of natural (human) languages. Topics: language morphology, modeling, and discourse analysis.
Robotics and Computer Vision	- Learn the basic building blocks of a robot - Develop robot cons-truction skills - Learn to program robots	* Lab. experiments with robots using Spark-funRedBot, EngageK12. Visit robot-enabled factory.	This module is a hands-on series of sessions to introduce the basic concepts of robotics and computer vision.
Social and ethical impacts of AI	* Be aware of the ethical implications and moral questions that arise from the implementation of AI technologies. * Appreciate issues of bias, fairness, transparency, and privacy in AI.	* Study of examples of AI ethical chal-lenges and recom-mendations (see UNESCO docs) * Fake Voices: The Ethics of Deepfakes with the *MIT App Inventor*.	The use of AI entails risks and challenges, or inequalities and divides. This module focuses on the ethics of AI, a human-centred AI that can benefit the entire humanity

Table 3: AI curriculum for high-school, third year

Sandel, a political philosopher and Professor of Government at Harvard University Law School said: “Debates about privacy safeguards and about how to overcome bias in algorithmic decision-making in sentencing, parole, and employment practices are by now familiar.” (Pazzanese, C., October 2020, A veneer of objectivity section) Therefore, it is a good idea that at this early age in high-school, students learn about responsible implementation of AI systems and where the consequences of the misuse of AI could lead us (Russell S., June 1996).

The Teacher's Perspective

Teaching AI in higher education is now a well-established activity in terms of structure, content and methods. Given the sensitive context of high-school, simply downsizing university AI programs cannot work. The success of AI education in high-schools rests on competent teachers that have been trained or reeducated in teaching AI-related content. That

is to say, except for teachers who already specialize in AI-related fields, there is a need to design a course tailored to prospective AI educators. Such initiative should be done by AI researchers at the university level in cooperation with local governments through an on-the-job training program for high-school teachers in service.

Teaching Resources and Environment

In order to teach this new discipline, it is important that teachers create an open network to support one another in terms of resources, best-practices, tips and advice. For example, the network would propose the idea of a moderated AI Education platform that collects contributions from experienced teachers and curriculum designers, and AI experts (Manaris, B.; Russell I., 1996). Then, the platform will make freely available AI course materials, tools, best practices, related policies, and frameworks. The following presents several useful AI-powered tools and platforms that effectively assist teachers in designing and delivering contents.

* Lesson planning tools assist teachers in assembling pedagogical documents, teaching strategies and supporting material and organizing field trip when necessary. For example, Content Technologies, Inc. (CTI), a US-based company, uses Deep Learning to create textbooks tailored to specific course contents and students' needs. A syllabus is uploaded into the CTI engine that creates personalized textbooks and contents. Another AI-powered tool is Netex Learning which helps anyone design responsive curricula.

* Teachers and education administrators use data and learning analytics to understand their students' progress and behaviour. Then, students can improve their performance through guided experience. OnTask is a popular tool that follows user-defined data points teachers identify as important, to help them track students' progress, and give more frequent, better, personalized feedback.

* AI can help identify students with learning issues, diagnose the areas of difficulties and suggest a plan to assist these students.

* There are several self-paced tools based on AI technology that provide professional development to educators.

Conclusion

The main purpose of this paper is to start a conversation about the idea of including AI in high school. It also suggests a standard AI curriculum for high schools that relies on the general guidelines introduced by the UNESCO and draws from traditional courses taught in universities around the world for decades. However, this paper attracts the attention and focuses on the experimental aspects of introducing this field that is entirely new to secondary-level education. This contribution is also suggesting that it is possible for African high-schools to step into the arena and build their own AI curricula and prepare the new generations for the challenges of the coming 21st century industrial revolution.

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Appplying and Adapting Resistance to Change Theory to the Changed Adult Education Landscape in South Africa

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Abstract
This article demonstrates how the 'Resistance to change' theory of Kurt Lewin can be interpreted as be helpful in facilitating consultative and participative change management. I demonstrate this through the investigation on transition of former Adult Basic Education and Training sector to Community Education and Training sector. This transition was elicited by the need to upgrade adult education sector to a level in which it can contribute towards the attainment of National Development Plan, which is, to eliminate poverty and reduce inequality. I created data through document analysis, in-depth interviews and focus group discussion with 11 and 5 participants respectively, whom I selected through purposive maximum variation sampling strategy. Some of the themes that concern the application (and adaptation) of resistance to change theory are consultation and communication, and collaboration of all stakeholders. It is suggested that as change is outcomes-oriented, it is important that all stakeholders involved in change processes are informed, for them to be willing to actively participate.

Keywords: Adult Basic Education and Training, Community Education and Training College, Resistance to Change Theory, National Development Plan

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Introduction

This article demonstrate the interpretation of Resistance to Change (RTC) theory as a consultative and participative change management (Burnes 2015). It gives an alternative interpretation to different interpretations of RTC theory – such as those who understand RTC as a confirmation that people spontaneously oppose any change initiative (Singh, Goel, Ghosh, and Sinha 2021). I demonstrate this interpretation through the investigation on transformation of Adult Education from Adult Basic Education and Training (ABET) sector to Community Education and Training (CET) sector.

Most African countries remained in poverty even after freedom from colonialism (Alemazung 2010). South Africa remained a poverty stricken and unequal society even after freedom from apartheid (Brankovic, Mphahlele, Nunu, Ngxukuma, Njana, and Sishuba 2020). National Development Plan was launched with an intention of eliminating poverty and reducing inequality (Fofana, Chitiga-Mabugu, and Mabugu 2018). All sectors of society, including former ABET centres, were expected to play a role in the elimination of poverty and reduction of inequality (Baijnath 2018). Unfortunately, ABET did not have capacity to contribute due to qualifications of low quality that are offered in ABET centres, low enrolment rates, low throughput rates, limited contact hours and unsuitable venues of operation (DHET 2015; Mokgatle 2014 and Maphumulo 2014). Hence, transformation of adult education was inevitable.

The progress of the transformation, thus far, is that nine Community Education and Training Colleges (CETCs) have been gazetted; former ABET centres have been declared as Community Learning Centres (CLCs) – as operational venues or satellites of their respective provincial CETCs; members of college' council, principals, deputy principals and support staff members have been appointed; operational budget is annually allocated to CETCs and there is gradual improvement of lecturers salaries. But the shortcomings of former ABET centres are still prevailing in most CLCs (DHET 2015) , which elicit doubt of whether the CETC will have contributed to NDP by 2030.

Lessons Learnt From the Implementation of Development Plans in Other Countries

Existing literature captures the findings of international studies on the causes of success and failure of implementation of development plans – like the South African NDP. In Kenya, for example, poverty rates remained high, despite the formulation of various poverty eradication policies such as development plans and publications on poverty reduction strategies, due to the formulation of these policies often being dominated by donors' prioritisations. In this case the voices of the poor were excluded, treating them as passive participants during policy formulation and implementation (Nyamboga, Nyamweya, Sisia, and George 2014).

In Ghana, despite a long term NDP being collectively adopted by different stakeholders such as the Council of Indigenous Business Association, Federation of Association of Ghanaian Exporters, Private Enterprise Foundation, National Union of Ghana Students, National House of Chiefs, Ghana Employers Association and many more, the NDP also failed in that country. In this case, the primary reason for failure could be ascribed to the governing party allegedly prioritising its manifesto over the NDP (Abubakari, Asamoah, and Agyemang 2018).

In Nigeria, different national development plans and strategies have been undertaken since independence, with these not achieving the expected results. As a result, the country is still

characterised by widespread poverty, dilapidated infrastructure facilities, high levels of unemployment, low-capacity utilisation, technological backwardness, short-life expectancy, urban congestion, excessive debt burdens, environmental degradation, and high incidences of diseases, despite the efforts to support development (Iheanacho 2014). These plans are said to have failed as a result of corruption, poor planning, limited discipline, lack of commitment, unavailability of relevant data, over-ambitious development plans, lack of continuity for governmental programmes, public service insufficiency and poor collaboration between the public and private sectors (Iheanacho 2014, 57-58).

On the contrary, Malaysia, Indonesia and Turkey have better succeeded in implementing their economic policies and development plans. Naiya (2013) attributes these accomplishments and successful implementation of national development plans to political stability, human development, and levels of functioning as well as sound economic management. While playing a supervisory role in the economy and minimal intervention on investments in infrastructure, energy and transport, the government in Turkey laid 'more emphasis on private sector development, labour-intensive production, and export-oriented projects' (Naiya 2013, 33). Naiya (2013) highlights an outstanding achievement that the Malaysian government displayed as the facilitation of national unity by providing economic and viable employment opportunities to all Malaysians in their diversity. He also highlights an outstanding achievement that was displayed by Indonesia as peaceful, democratic, and affluent society that reduced poverty through economic development, employment opportunities and environmental sustainability.

Conceptual Framework

Change is a continuous and developmental process which can be understood through a multi-philosophy approach (Graetz and Smith 2010; Wee and Taylor 2018). Hence, I integrated concepts of different related theories (Ngulube, Mathipa, and Gumbo 2015): resource dependency theory (Cone, Krone, Phillips, and Yacoub 1993), strategic theory (Huber and Glick 1993), post-modern philosophy (Dijksterhuis, Van den Bosch, and Volberda 2003), and psychological philosophy (Weick 1979). RTC theory was introduced in 1947 by Kurt Lewin (Burnes and Bargal 2017) as a 'systems concept' that arises from the context in which change takes place, with an intention of motivating change managers to encourage participative decision making instead of imposing change on people (Burnes 2015). Singh, Goel, Ghosh, and Sinha (2021) critiqued the interpretation of RTC theory as a 'systems concept' and regarded RTC as a framework that considers people as spontaneous opponents of any change initiatives, resisting it no matter how it is proposed. It follows that although there is no one interpretation of RTC theory, RTC can be used in research when investigating people's reaction to change, for example in terms of resistance due to failure of a change initiative (Amarantou, Kazakopoulou, Chatzoudes, and Chatzoglou 2018). In my view, such a use of RTC theory from a negative perspective can result in an investigation that focuses on the identification of those who resisted change, with a punitive intention.

According to Dent and Goldberg (1999), RTC theory does not imply that all people will be spontaneously prompted to resist change, but rather posit that people would want to actively participate in the planning and implementation of a change process (Lortie 2020). This view is supported by Sarayreh, Khudair, and Barakat (2013) who state that employees would want to be consulted when a change process is planned and initiated. Taylor (2020) regards anxiety as a spontaneous reaction to change; yet in this regard, Frahm and Brown (2007) and

Velmurugan (2017) indicate that the thorough explanation of a change process may reduce the levels of anxiety experienced by those involved in the foreseen change process.

These arguments emphasise the importance of not ignoring the already existing systems and individuals in an institution where change will be implemented (Argyris 2017). It is further important that change involves all sectors of an institution and, for example, not only concentrate on relocating workers from one site/position to the next without considering their personal circumstances (Belschak, Jacobs, Giessner, Horton, and Bayerl 2020). As such, keeping people informed and considering their needs and personal circumstances are seemingly two guidelines to consider when wanting to implement change.

Research Methodology

I followed a qualitative approach in undertaking my study. This enabled me to explore the lived experiences of the participants and gain in-depth insight into their personal views (Frechette, Vasiliki, Monique, Kelley, and Mélanie 2020). I adopted an active approach whereby I, as the researcher, actively participated and encouraged the participant to think deeply and even discover new interpretation of their experiences of events (Romm 2018). This approach enabled me to stimulate critical discussions between the participants and me, which I captured during and after the interviews in the form of audio-recordings and field notes (Merriam and Grenier 2019). I relied on Phenomenology (Frechette et al. 2020) as research design, allowing me to elicit the participants' personal interpretations of their experiences in relation to CET college's role in e.g., eliminating poverty and reducing inequality.

I used the purposive maximum variation (PMV) sampling strategy to select three colleges and their respective regional offices. Based on the (PMV) strategy I selected participants across the spectrum that related to the topic of my study (Doyle, McCabe, Keogh, Brady, and McCann 2020). More specifically, I selected one principal, one CLC manager and one lecturer from each college together with one regional manager and one curriculum implementer from the regional office that support the college. In addition, I selected one official from the DHET head office. In the end, nine people from colleges, six from regional offices and one from DHET head office participated.

For data generation and documentation, I conducted a document analysis of relevant documents such as the Report of Task Team for Community Education and Training Centres (TTCETC), Government gazettes, policy documents, as well as circulars and minutes of DHET portfolio committee. Next, I conducted individual semi-structured interviews with the participants of the first two colleges, being guided by open-ended questions that I prepared in advance but following a flexible approach in terms of the sequence of questioning and follow-up questions that were regarded as relevant (Harding 2018). I also conducted a focus group discussion with the five participants of the third college (Hennink and Kaiser 2021). All regional officials, principals and CLC managers were requested and agreed to participate in follow-up interviews if these were to be required. Finally, I conducted semi-structured interviews to facilitate evaluative discussions with one official from the DHET. During the evaluative discussion with DHET head office official, inputs and concerns of some regional and college participants were discussed to gain more perspective in terms of these views. Throughout, I made field notes and recorded the interviews, which were transcribed verbatim, for data analysis purposes.

In conducting data analysis, I relied on the principles of Atlas TI which encourage simultaneous coding of data from literature and from fieldwork (Ronzani, da Costa, da Silva, Pigola, and de Paiva 2020). I used splitting method of coding, categorisation and thematisation as explicated by Miles, Huberman and Saldaña (2018). Participants' and literature's inputs that had the same connotation were categorised. As I clustered categories that had the same connotation, themes that related to aspects of this research's conceptual framework emerged.

Research Ethics

I secured permission to conduct the study from the Research Ethics Committee of the College of education at the University of South Africa before commencing with my study as well as from the DHET head office and the managers, principals and CLC managers of the selected regions, CET colleges and CLCs. Participants provided written informed consent to declare their voluntary participation. For the purpose of anonymity, especially of the principals and regional managers, I did not use the names of the selected colleges in any written report. Throughout, I also attended to the principles of confidentiality, trust, and protection from harm (Surmiak, 2020).

Findings

My discussion of the findings is guided by RTC theory and my integrated conceptual framework, as this allows me to elicit the basic principles of change (Frahm and Brown, 2007; Velmurugan, 2017; Roth and DiBella, 2015). Themes that emerged relate to consultation and communication and the collaboration of all stakeholders; the slow and fragmented change process; and unavailability or non-provisioning of resources.

Theme 1: Consultation, Communication and Collaboration of All Stakeholders

It is one of the aspects of post-modern philosophy.

Differences in the time and mode through which the CLC managers and lecturers were informed about the change that their institutions would undergo suggest that consultation by DHET officials involved a roadshow during which the institutions were notified about the impending change. According to the participants, the roadshow entailed one-way communication and a mere notification format. For example, the principal of College 1 said that '*The DHET official from labour office was just notifying us and wanted to find out if there were those who would like to remain in the DBE. He did not want our inputs'* (Patrick); the lecturer at College 1 concurred '*It was a top-down announcement of a management plan for the implementation of a finalised product. It was not a consultative road show*' (Sarah), and the principal of College 3 reiterated '*the roadshow did not demand our in*puts' (Harry).

When I enquired about the time and dates on which the participants learned about the transition, they indicated that they were informed about it during the planning and reporting back session of the TTCETC in 2010 or in some cases, only later. The Regional manager at College 3 for example said that '*I heard about the function shift in 2012 at the national AET meeting that was arranged by the DHET'* (Daniel). The lecturer at College 2 indicated that he heard rumours about the pending change in 2013, with other participants learning about the change in 2012 and 2013 during road shows (Simon).

To explore whether or not the participants understood what exactly the transition would entail, I prompted them to indicate their feelings towards or against the change. The principal of College 1 responded, respectively:

> I was anxious since there was no one who seemed to understand what exactly is going to happen. People who were supposed to explain to us were also not having enough convincing information. Most people that I talked to were having the same problem of not understanding what this transition was all about. Maybe those who were given proper information felt differently. Only if you are properly informed then you could feel differently. (Patrick)

Speculations and rumours that seemingly influenced the beneficiaries' perceptions about the expected change suggest that the lecturers and CLC managers did not receive sufficient information, with some not getting any information. For example, the CLC manager at College 3 explained that he and his colleagues were initially excited when hearing rumours of a salary increment yet were later devastated when they received almost half of their usual salary (David). The term 'rumours' implies that the CLC managers and lecturers seemingly assumed that they would receive a salary increment, without confirmation or guarantee from the change agents.

'If you were fully involved, what would be your input?' I asked.

The curriculum implementer of College 1 suggested that 'The College has to knock at the doors of the business houses for sponsorship. There must be funds made available by the department for youth development' (Maria). The curriculum implementer of college 3 repeated Maria's assertion:

> The current funding model for colleges does not make provision for skills training. College councils are expected to establish partnerships with business and other sectors to fund skills training…most of our former students found employment in our neighbouring hotels because our area is a tourist attractive area. There are many Hotels, restaurants, and resorts. I suppose that the management of these Hotels are potential employers and sponsors that must participate in the collaboration of all stakeholders. (Rachel)

The principal at College 2 suggested that 'all unused school buildings should be handed over to the DHET' (Suzan).

Theme 2: Slow and Fragmented Restructuring (Change Process)
(Strategic theory – change is outcomes oriented; and psychological philosophy – change is elicited by experience, especially long-suffering experience)

To CLC managers and lecturers, progress that has been made thus far is not satisfactory because their conditions of employment, times and venues of operation remained unchanged. When I told the DHET head office official about their concern, he said:

> We told them [CLC managers and lecturers] that at the end, the post of a college lecturer would be equivalent to an assistant director; of a principal would be equivalent to the director and the deputy principal to the deputy director…. I think that we should have emphasised that we were just beginning, it might take some time,

> but we need to start somewhere. We should have also indicated that it would be a trial and error learning curve, but their future was not at risk. (Derrick)

The regional manager of College 3 avowed that the planning at national government level, which only proposed the structure or organogram of the envisaged CET colleges, was satisfactory. He however expressed unhappiness about the (limited) way in which details about the change process were discussed with the people who would be experiencing the change. He said:

> I was thrilled by the objectives of the White Paper that could be achieved through the CETC. [Now] I am disappointed. Structures are being put in place for implementation, but planning, time, resources and consultation was not sufficient. Many people are left out. (Daniel)

Promises of introducing the second and third categories of the CET college programmes and qualifications was seemingly a source of excitement to the participants. However, they were of the view that quietness and inactivity about the skills programmes represented a failure. In this regard, the curriculum implementer of College 3 referred to:

> The continuation of CETC to fund NQF levels 1 to 3 qualifications only, while it committed to expand to NQF levels 4 and 5 is a drawback to the achievement of the change' (Clifford). In support, the CLC manager at College 2 said that 'our clientele is not interested in ABET learning areas but want to learn skills that will enable them to get employment. (Frank)

Participants expressed different views about their expectations of the link between the expansion of CET college curriculums, capacity building and the permanent employment of lecturers and CLC managers. For example, while the CLC manager at College 1 shared an optimistic view by saying:

> Skills development programme was very scares in the former AET system. I hope the DHET will give it a priority, especially upgrading former AET educators into CET College lecturers. (Ben)

The regional manager of College 2 shares the same sentiments:

> People are no longer interested in ABET levels 1-4 but instead they need skills programmes that will assist them to be employed… Most of the current lecturers we have cannot handle such and therefore the results are affected…the college must be assisted in appointing the relevant qualified lecturers who will be able to handle the learning areas and programmes. (Hazel)

Theme 3: Unavailability or Non-provisioning of Resources
(Resource dependency philosophy – instead of resisting, people may be disabled to change by unavailability or non-provision of facilities)

The participants were seemingly of the view that the achievement of CET colleges' founding principles could enhance the attainment of the developmental strategies of the NDP, yet they noted that the lack of sufficient facilities such as school buildings, workshops and laboratories posed a high risk and could result in failure. They concurred that the introduction

of second and third categories of programmes and qualifications could enable them to achieve their aspirations of producing a strong workforce but noted that the unavailability of facilities could impede their aspirations. For example, Ben said, respectively:

> I aspire to produce independent thinkers, self-sufficient entrepreneurs and lifelong learner. However, our college is not providing an enabling environment like classrooms. The promised skills programs and full-time employment of educators is also threatened by lack of own school/college buildings. I think that all unused school buildings should be handed over to the DHE. (Ben)

Discussion

The findings of the study indicate that DHET officials' consultation and communication with CLC managers and lecturers during the initial planning and implementation stages of the change process involved a monologue that did not encourage input from those at ground level. Hence, most CLC managers and lecturers were unacquainted, confused and anxious about the change they were subjected to. Even though minutes of later meetings (2018 to 2020) of the DHET portfolio committee indicate that the DHET officials, college councils, CET college management and student representative councils (SRC) engaged with their constituencies and different stakeholders, the prominent role-players should have participated in the initial discussions, during the planning and implementation stages of the foreseen change. While the government was developing policies that would enable adult education sector to reduce inequality and eliminate poverty on CLC managers, lecturers and most importantly, students, the very same CLC managers and lecturers felt alienated because they did not know what is happening in offices (Lian, Ngok, Wong, Tsang and Li 2022). Govender (2022) advises that people must be involved in policy developments so that they can enable policy developers to draw policies that are relevant and practicable.

In terms of the pace at which the restructuring process occurred, the study I undertook indicates that the pace at which the establishment of CET colleges' management teams took place, i.e., of appointing principals and deputy principals, gave hope to CLC managers and lecturers that their long-suffering experience of unsatisfactory conditions of employment might be nearing the end. However, the required qualifications and curriculum for CLC managers and lecturers to qualify as CET college lecturers was not yet formulated when the process of change commenced. As a result, many lecturers with ABET diploma qualifications continued to redirect or improve their qualifications and then migrated to mainstream schools.

By the time I concluded this research, no evidence of the eminent introduction of second and third categories of CET college qualifications and programmes could be found. Furthermore, CLCs which were still using DBE's schools as venues of operations could not extend their time of operation. Hence, the necessary changes in terms of many important aspects that could enhance the attainment of the NDP by 2030 seem to be very slow.

With regard to resource availability and provision, the planning of any change project should include thorough budgeting (Maravilla and Grayman 2020), however no evidence could be found that the DHET had estimated the money that would be needed for recurriculating CET college qualifications, the training of CET college lecturing staff, the provision of suitable venues for operations, or allowance for staff appointments (from head office to a CLC level). It seems as if the only budget that was planned for was for head office officials and CET

colleges' management teams. Even though a trial and error approach implies that not everything will necessarily be readily available when a project starts (Sosna, Trevinyo-Rodríguez, and Velamuri 2010), planning implies budgeting for all potential activities (Atakan, Cocco, Orlecka-Sikora, Pijnenburg, Michalek, Ronnevik, ... Drury (2022), which was seemingly not done as part of the change process.

Finally, when considering the importance of collaboration with stakeholders, the South African Department of Basic Education's involvement in the transition process primarily involved the supply of information about PALCs' staff structures, some of which was insufficient. The DHET also signed memoranda of understanding (MOU) with the Department of Basic Education that would permit the newly established CLCs to continue using public schools as venues for operation and for the Department of Basic Education to be able to administer ABET level 4 examinations. As a result, some CLCs ended up utilising unused public schools for full-time contact sessions, which demonstrated a positive contribution by the local government towards the livelihood of CLCs. The involvement of other sister departments and the private sector is however not evident.

Conclusion

It can reasonably be said that everybody is yearning for an adult education system that contributes towards elimination of poverty and reduction of inequality. Therefore, the delay or supposed reluctance of realising the ideal CET sector cannot be attributed to resistance, but to inaccurate implementation of resistance to change theory, that is, a change process that does not take on board the requirement to involve stakeholders. For the envisaged CET colleges to be realised in South Africa, equal involvement of the various stakeholders in the planning and execution of the restructuring project was required yet has not been sufficiently executed. Project leaders are therefore urged to continue with participatory and conversational consultation on a broader level, involving e.g., as governmental departments, private businesses, and labour formations. While not everything can be done at once, an incentive to sustain formerly qualified ABET educators is encouraged for a smooth transition and as more affordable option than retraining or upgrading staff members' qualifications. Finally, cooperation between CET colleges, SETAs and the industry may positively affect the attainment of the NDP through e.g., short-term courses that can render CET college students with employment opportunities, while the various components of the envisaged fully fledged CET colleges may be generated.

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Investigating the Challenges of Teamwork for 1st Year Undergraduate Engineering Students

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Abstract
Literature has shown that the ability to work in teams is one of the most highly coveted skills by engineering employers (Levy & Rodkin, 2016). On the Biochemical Engineering programme at UCL, teamwork is present across the programme curriculum and has seen consistently high levels of positive feedback in annual evaluation surveys. However as the pandemic forced educators to move to the online environment, this resulted in significant implications for how students interacted with each other and engaged with teaching material, which in turn highlighted gaps in staff support. As we move to a blended approach, this project sought to understand the challenges 1st year undergraduate students face with teamwork in remote settings vs. in-person vs. a blend of both, discern any difficulties in teamwork related to inclusivity and gather information on how teaching staff could better support students working in teams for the first time at university. We addressed this with a mixed-method approach consisting of questionnaire design and case study-based workshops with our post-pandemic cohort of students who have experienced in-person, online and blended learning. Results showed that communication and engagement were the most common challenges students faced in remote teamwork settings, specifically related to language barriers and accessibility. The results also highlighted issues with inclusivity related to students who do not have English as a first language. It was also highlighted that there was a need to better address the implementation of adjustments for disabled/neurodivergent students in teamwork settings.

Keywords: Teamwork Challenges, 1st Year Engineering Students, Remote vs. In-Person

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Introduction

Teamwork skills are of paramount importance in the field of engineering, as they play a vital role in achieving successful and efficient project outcomes. Engineering projects are rarely solitary endeavours; they require collaboration and coordination among diverse specialists to address multifaceted challenges. *Diverse expertise* is one of a number of important outcomes of teamwork as engineering projects involve multiple disciplines, such as mechanical, electrical, software, and civil engineering. Team members bring unique skills, knowledge, and perspectives to the table, contributing to innovative solutions that a single individual might not envision. A study conducted by Pazos et al., 2020 looked to explore what aspects of teamwork skills were enhanced through interdisciplinary collaborations in engineering. It was found that the diversity in disciplinary knowledge encouraged *holistic* and *innovative* solution strategising and creation. Other competencies developed during teamwork include:

1. *Complex Problem Solving***:** Engineering challenges often involve intricate problems that demand creative solutions. Collaborating with team members allows for brainstorming, idea sharing, and refining concepts to devise optimal solutions.
2. *Effective Communication*: Clear and concise communication is integral to any engineering project. Teams facilitate effective information exchange, preventing misunderstandings and ensuring that everyone is aligned towards the project goals.
3. *Adaptability:* Engineering projects can encounter unexpected challenges. A well-coordinated team can swiftly adjust plans, redistribute tasks, and find solutions in a dynamic environment.

The table below summarises further reasons why teamwork skills are crucial:

Outcomes of teamwork upskilling	Rationale	Sources
Efficiency and Speed	A well-coordinated team can divide tasks, enabling parallel work on different aspects of a project. This accelerates the project timeline, saving time and resources compared to individual efforts.	(Chowdhury & Murzi, 2019; Kozlowski, 2018; Pazos et al., 2020)
Risk Mitigation	Collaborative teamwork ensures that multiple experts review and validate designs, reducing the likelihood of errors or oversights that might lead to costly mistakes down the line.	(Baker, Day, & Salas, 2006; Salas, Bisbey, Traylor, & Rosen, 2020; Shaikh, Osei-kyei, Hardie, & Stevens, 2023)
Professional Growth	Working in a team environment fosters personal and professional growth. Engineers learn from their colleagues, develop leadership skills, and gain insights into different engineering disciplines.	(Gelbard & Carmeli, 2009; Murzi, Chowdhury, Karlovšek, & Ruiz Ulloa, 2020)

Table 1- Outcomes of upskilling students in teamwork

With this in mind, a number of stakeholders involved in engineering curriculum development, implementation and assessment, such as accreditation bodies, industry collaborators, government and professional institutions have sought to ensure that teamwork be made an integral part of engineering education. At UCL Biochemical Engineering, students are upskilled through both theoretical and practical application of teamwork (Mitchell et al., 2019). The ENGF0001 module – known as The Challenges and managed by the Integrated Engineering Programme (IEP) at faculty level, is the first exposure to teamwork that 1st year Biochemical Engineering undergraduate (UG) students get in term 1. They work in interdisciplinary teams with Chemical Engineering and Biomedical Engineering students to solve a global issue (practical application) whilst learning about engineering teamwork on the Design and Professional Skills 1 module (DPS1) (theory).

Approaches and Challenges With Teaching Teamwork

Teaching teamwork skills to engineering students requires a multifaceted approach that combines theoretical knowledge with practical experiences. A number of different approaches are used on the IEP as described below (a more extensive explanation of these approaches can be found in Mitchell et al., 2019).

Project-Based Learning: In the first term of the first year of UG studies, students are enrolled onto the Challenges module which is the largest interdisciplinary project-based module on the UG curriculum (excluding final year projects) where they are broken into sub-teams and self-assign tasks to solve a global issue. Studies have shown that incorporating team projects into the curriculum, especially *interdisciplinary collaboration* exposes students to real-world scenarios and assigning diverse tasks encourages collaboration, problem-solving, and communication (Huang, 2010; Vogler et al., 2018).

Role Rotations: On ENGF0001 students use the Clifton StrengthsFinder to understand how their attributes contribute best in teamwork settings which allows assigning different roles within a team, such as leader, communicator, researcher, and timekeeper, allows students to experience various aspects of teamwork. Studies have shown that this approach enhances their adaptability and understanding of team dynamics (Read-Daily, De Goede, & Zimmerman, 2018).

Peer Assessment: On both the Challenges and DPS1, a number of peer-assessment approaches are implemented such as the use of Individual Peer Assessed Contribution to group work or IPAC (Garcia-Souto, 2017), GoReact for presentations (Nweke, 2021b) or in-built functions in the Moodle Virtual Learning Environment (VLE). Incorporating self-assessment and peer evaluation within teams has been found to encourage students to reflect on their contributions and receive feedback from colleagues. Studies have shown that this practice promotes accountability and highlights the importance of recognizing and valuing each member's input (Planas-Lladó et al., 2021; Willey & Gardner, 2009).

Simulations and Role Plays: On DPS1, mechanical engineering students participate in engineering ethics roleplaying which helps them place themselves in real-life workplace ethical scenarios. Studies have shown that engineering challenges through role plays or scenarios fosters critical thinking and decision-making in a controlled environment. This approach encourages students to collaborate under pressure and consider different viewpoints (Hayes, Power, Davidson, Daly, & Jackson, 2019).

Industry Collaboration: Industry collaboration is present in various parts of the IEP programme, particularly in the DPS1 scenarios (Mitchell et al., 2019). Literature shows that partnering with industry professionals on projects or internships exposes students to real-world teamwork dynamics. Industry mentors can provide insights into effective collaboration, emphasizing practical skills that extend beyond the classroom (Faizi & Sarosh Umar, 2021).

Communication Workshops/Classes: The DPS1 module is where communication theory is learned. This includes written communication (reports) as well as verbal communication (presentations, pitches etc.). Conducting workshops on effective communication, active listening, and conflict resolution has been shown to equip students with essential soft skills for successful teamwork. Studies have shown that these workshops encourage open dialogue and mitigate potential misunderstandings (Sharp, 2001).

Reflective Practice: Both the Challenges module and DPS1 use reflections in various pieces of assessment. This was implemented in order to encourage students to analyse their teamwork experiences and their own impact and contribution to their team's efforts. A number of publications have reported that reflective exercises help students identify strengths and areas for improvement, enhancing their ability to work harmoniously in teams (Hirsch & McKenna, 2008).

Gamification: Minecraft has been used on the Challenges module as a virtual reality laboratory simulator (Yerworth, 2021). Literature reports that using educational games or simulations to teach teamwork concepts makes learning engaging and interactive. Gamified activities have been proved to help students grasp teamwork principles while having fun (Nurtanto, Kholifah, Ahdhianto, Samsudin, & Isnantyo, 2021; Zhang et al., 2018).

Combining these approaches has created a comprehensive strategy for teaching teamwork to engineering students. The IEP has been celebrated as having helped to create a well-rounded curriculum that integrates theoretical knowledge, experiential learning, and skill-building activities and better prepares future engineers for the collaborative challenges they'll face in their careers; and as such, was awarded the prestigious Collaborative Award for Teaching Excellence (CATE, 2017). However there are still a number of challenges that many institutions face (UCL included) in upskilling students in teamwork abilities.

As reported in a study by Fomunyam, 2021 *individualistic education culture* is often a tension when trying to upskill students in teamwork. The study found that engineering education often emphasizes individual achievement and problem-solving. Shifting from this solitary approach to collaborative teamwork can be challenging for engineering students as they are accustomed to working on their own. The impact of rising international student numbers in engineering (Harrison, 2011), as well as the effect of the pandemic on student wellbeing (Burns, Dagnall, & Holt, 2020) has contributed to the increase in *diverse backgrounds*, abilities and needs of the engineering student body. Aligning these differences and fostering effective communication among team members can be difficult. Other challenges that impact the upskilling of students in teamwork competencies can be found in the table below:

Challenge affecting teaching teamwork	Rationale	Source/s
Assessment	Evaluating individual contributions within a team setting poses a dilemma. Determining fair assessment methods that recognise both individual efforts and team collaboration requires careful consideration.	(Tucker & Abbasi, 2016; Willcoxson, 2006)
Uneven participation	Unequal participation within teams can hinder the development of teamwork skills. Some students may dominate discussions, while others remain passive. Balancing engagement and encouraging all members to contribute can be a persistent challenge.	(Burdett, 2003; McQuade, Ventura-Medina, Wiggins, Hendry, & Anderson, 2020)
Time constraints	Academic years and term/module times are restricted. More often than not, teamwork skills are developed during medium-long term projects, which poses problems for academic timelines.	(Alghamdi, Alsubait, Alhakami, & Baz, 2020; Kadam & Yadav, 2016; Kalu, Ozuomba, & Isreal, 2018)
Conflict resolution	Teamwork can lead to clashes in opinions, work styles, and approaches. Teaching students how to manage conflicts constructively and reach consensus is essential for productive teamwork.	(Forrester, 2013; Shapiro & Dempsey, 2008; Winter, Neal, & Waner, 2005)
Instructor training	Engineering educators may not always possess the necessary training in teaching teamwork skills. Developing their own understanding of effective team dynamics and communication can be an ongoing process.	(Kurtdede-Fidan & Aydoğdu, 2018; Malm, 2009)

Table 2- Challenges that impact the upskilling of students in teamwork

Addressing these challenges requires a multifaceted approach, involving consistent curriculum redesign, updating active learning strategies, experiential projects, mentoring and workshops. It also necessitates a cultural shift within engineering education to value teamwork as an integral part of engineering practice, rather than just a supplementary skill.

Impact of COVID-19 on Teamwork Teaching

The COVID-19 pandemic has significantly impacted the way teamwork is taught to engineering students, introducing both challenges and opportunities to the educational landscape. Some of the challenges are associated with the *lack of physical collaboration* and linked to that, *time zone differences*. Studies have shown the social nuances involved in in-person interaction related to communication and collaboration do suffer when moved to a

virtual environment and hinder the understanding needed for practical team dynamics (Goñi, Cortázar, Alvares, Donoso, & Miranda, 2020). Literature has also reported on *digital fatigue* becoming a factor when learning online. A study by Al Mulhim, 2023 showed that prolonged virtual engagement can lead to digital fatigue, diminishing students' enthusiasm for participating in online team activities and discussions.

However, as previously mentioned, the pandemic has provided novel ways to promote the teaching and learning of teamwork, particularly through the use of online platforms and virtual collaborative tools and simulations. Studies have shown that the use of technology has opened the door for global collaborations, irrespective of time zones, adaptive problem-solving due to the need to adapt to changing circumstances, which has been shown to encourage agile thinking and innovative problem-solving. Lastly, the gradual return to in-person teaching has allowed for flexibility in teaching and learning and therefore the introduction in hybrid team working models to prepare students for diverse working environments (Chafi, Hultberg, & Yams, 2022).

Aims, Objectives and Methodological Approach of This Study

Whilst face-to-face (f2f) teamwork allows for important social nuances in communication, this becomes challenging when working remotely. The pandemic has forced educators to move to the online environment which has not only impacted the way we teach but also how students interact with each other and engage with teaching material, which has in turn highlighted gaps in staff support. As we return to f2f teaching, studies have shown that there are elements of online teaching that could be useful but in saying that, more understanding is needed on how this impacts the upskilling of our students.

Objectives:

- Understand the challenges 1st year UG students face with teamwork in remote settings vs. in-person vs. a blend of both
- Discern any difficulties in teamwork related to inclusivity (e.g. language/cultural barriers, mental/physical disabilities etc.)
- Gather information on how teaching staff could better support students working in teams for the first time at university (incl. how it can best feed into our current SoRA/EC system)

***Student Sample*:** students in first year who had experienced the blended approach in the first term partook in this study during the second term of studies, class size 41 students.

The first data collection method used was a survey. In this study a survey was selected as it enables quantitative analysis and also facilitates scalability, which will be useful for the next phase of this study which aims to scale-out to other engineering disciplines. The survey approach also allows researchers to collect data from geographically dispersed participants, which may also be useful in the next phase of this study (Jones, Baxter, & Khanduja, 2013). The survey questions for this study can be found in table 3.

Survey Questions	Options
1. What is your student status?	Home, International (EU), International (Non-EU)
2. Is English your first language?	Yes, No
3. If you answered 'No', please state your first language below	Open ended
4. What gender do you identify with?	Woman, Man, Non-binary
5. What are some of the challenges you have faced with teamwork? Select all that apply	Communication: language barrier, Partially-/non-engaged team member(s), Work allocation/splitting, Assignment assembling, Conflict of ideas, Some members remote working, Problems between other team members, Working with someone you do not get along with, Other(s)
6. If you selected 'Other(s)' please specify below	Open ended
7. What is the biggest challenge you have faced when working in a team? Provide a specific example (e.g. draw from your experience on the Challenges module) and what was done to overcome it? Provide details of any support you received (e.g. from fellow students/staff)	Open ended
8. Do you have an understanding of how SoRAs/ECs are applied with regards to teamwork assignments?	Yes, No
9. If you answered 'Yes', what about this process would you change or improve?	Open ended
10. What recommendations do you have regarding how staff can better support students whilst working in teams?	Open ended

Table 3- The survey questions

The second approach used is a case-study based workshop. In this workshop, students were assigned to randomised teams for each of the case studies in figure 1. They were tasked with noting down how they would deal with the situation described and the type of support they would need. The results were analysed using thematic analysis as described in Caufield, 2019; Nowell, Norris, White, & Moules, 2017.

Figure 1- Workshop case studies

Conclusion

Quantitative data from the survey shows that 65% of students have international student status and the same percentage are non-native English speakers (figure 2). As demonstrated by question 3, of the non-native English speakers, 70% had Chinese as a first language, followed by Korean (7%), Spanish (7%), Malay, Italian, Polish and Swedish (~4% each).

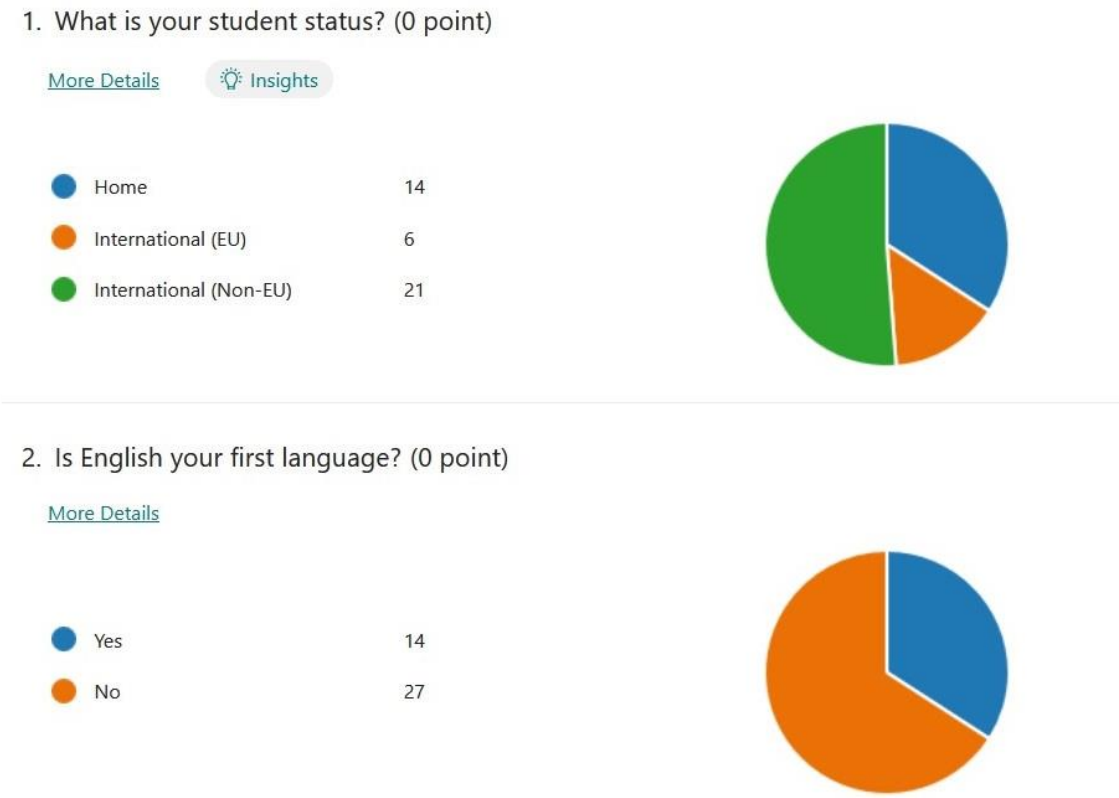

Figure 2- Survey questions 1 and 2: 1. 65% international student status.
2. 65% non-native English speakers

A study conducted by the University of Exeter in 2020 sought to understand international students' participation in teamwork and the main barriers that impact team cohesion and success (Straker, 2020). The main outcome suggested that English language competence was the main barrier. This corroborates the results gathered in this study, particularly in question 5 (figure 3) where 'Communication: language barrier' was the highest rated challenge faced by students working in teams (68%). This was closely followed by 'Partially-/non-engaged team members' (61%).

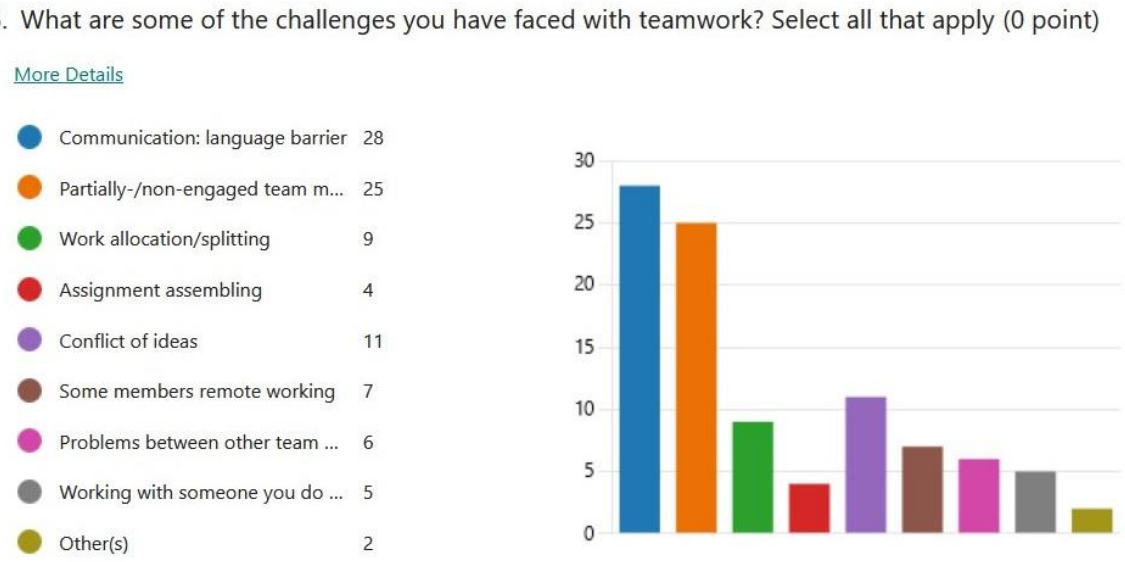

Figure 3- Survey question 5. 'Communication: language barrier' and 'Partially-/non-engaged team members' were the most highly rated challenges

A study conducted by Liu, Hu, & Pascarella, 2021 makes a link between communication/language and engagement and suggests that engagement of non-native English speaking students is impacted by challenges in language and further linked to that, reduced cognitive outcomes. Thematic analysis of question 7 corroborates this from the perspective of non-native English speaking students. There was a frequent occurrence of themes related to 'a lack of understanding of the work allocated' as well as a frequent occurrence of themes related to 'how this impacted team workload' from native-English students' perspectives:

Non-native English Speaker 1:

"Language problems. Sometimes I cannot understand what they are talking about."

Non-native English Speaker 2:

"Sometimes I can't express my idea in English correctly. I tried to use simple words to explain ideas."

Native English Speaker 1:

"When there is a language barrier involved, the distribution of work is not made simple, and often times team members do not contribute to discussions and cannot come up with solutions to the assigned problems. Also non cooperative teammates mean that the rest of the team has to undertake more work."

Native English Speaker 2:

> *"In the group project … last year, half of my team could not speak English which meant that only two of us did all of the work. The biggest challenge was during challenge 2 where I was paired with someone who also could barely speak English and barely provided any ideas of his own to solving the problem. Even though he was helpful at times, I did most of the research and all of the writing of the report. In this case, the other team members offered to help out but I ended up doing most of the work."*

Non-native English Speaker 3:

> "*My team members are so nice and they finished all things themselves without my help."*

The next phase of this study will involve further analysis into the link between these perspectives and teamwork grades to ascertain if there is a link between communication, engagement and desired cognitive outcomes.

Question 8 (figure 4) showed that 44% of student did not understand how the current UCL academic adjustments for those impacted by disabilities (incl. neurodivergence) applied to teamwork assignments. The current college regulations allow for assignments to be adjusted for the whole team if at least one team member has a SoRA or EC. However this can be challenging depending on the student's condition, therefore a common approach is a deadline extension. A good recommendation was proposed in a response to question 9:

> *"Sometimes a team wide deadline extension is not a proactive way of considering a SoRA, perhaps a different mark scheme could be beneficial, as well as perhaps removing certain penalties for tasks which don't correlate to academics. For example going overtime in presentations."*

This suggestion corroborates the Good Practice Framework report published by The Office for the Independent Adjudicator on Supporting Disabled Students (OIA, 2017) which advocates for the use of a range of assessment methods. Different universities have different applications of adjustments for disabled students, however not enough has been published on best practice in teamwork applications, especially within the context of Engineering.

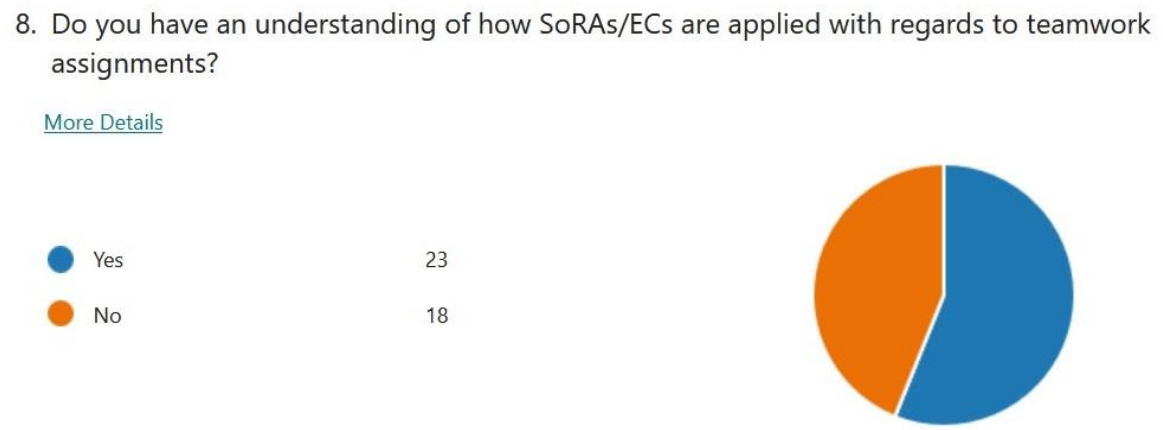

Figure 4- Survey question 8. 44% of students do not understand how SoRAs/ECs are applied to teamwork assignments

Question 10 used thematic analysis to evaluate suggestions made by students on how staff can better support students in teamwork contexts. Frequent themes related to more staff monitoring of teams, harsher penalties for non-contributing members, issues with space for teamwork:

> *"They can allocate a specific time to the team and make sure that they are all present but mostly it is the job of the students. The staff can monitor via meeting minutes and interfere if necessary."*
>
> *"Have rooms designated for project work and time allotted in timetables to see a lecturer/teacher as a team."*
>
> *"Making it more strict regarding the final grade if people are not involving."*

Another frequent theme identified was around language support:

> *"Provide better support for students who struggle with English and ensuring all the students are on the team allocations."*
>
> *"Help translate and surpass language barriers. Push students into contributing in the teams."*

As a result of some of these suggestions, a number of initiatives will be implemented for the next academic year and the next phase of this study aims to assess the impact of these changes on teamwork and student performance. With the opening of the UCL East campus, all teaching activities will go back to face-to-face and adequate teaching spaces for teamwork activities have been reserved as well as an increase in staff support (via the increased use and training of post-graduate teaching assistants – PGTAs), this will aid in more frequent staff check-ins and monitoring of team progress. After a successful pilot of the Academic Communication Centre's services in the department of Electronic and Electrical Engineering (reported in Nweke, 2021), this service will be made available to all departments across the IEP to help students improve their English language skills.

The qualitative data collected from the responses to the case studies used thematic analysis to evaluate the feedback provided by the students. The table below summarises the themes that occurred most frequently.

Case study	Main Theme/s	Quote/s
1.Remote working	• Use of shared documents • Time zone/time adjustments	*"Mia and Tolu could meet up in person and do part of the work, and give the rest of the work for Jihoon to work on remotely. Additionally, using a live google doc they could comment on each other's work."*
2.Unreachable student	• Consult staff • Adjust assessment	*"Approach the group leader / professors to discuss about the issue."* *"Do the project on their own with appropriate marking changes."*
3.Uneven distribution of work	• Seek help (from peers/staff) • Evaluate how work is distributed	*"Split up work differently: if done by splitting number of pages, could try splitting the number of chapters."*
4.Group bystander	• Understand if there are any ECs • Consult staff	*"As friends, you should warn them about bad behaviour. Talk to him directly and ask him why he isn't completing the work, if there are personal issues etc. If he doesn't respond well or continues not to do the work, tell a member of staff."*
5.Accessibility issues	• Meet closer to his/at his accommodation • SoRA should apply to team	*"He can invite his team members to his home and have a meeting."*
6.Language barrier	• Use of resources to improve language • Assign simpler tasks for Layla	*"Thomas and Xinpei should task Layla with something that does not involve much language (e.g. maths)."*

Table 4- Summary of outcomes of workshop case studies

One of the aims of this study involved exploring how students coped with teamwork in remote settings and compare this with in-person settings. One of the main themes identified in question 10 of the survey indicated the need for in-person meetings and dedicated spaces for teamwork. The outcomes from case study 1 in table 4 presented some challenges associated with time zones and how this impacts the team's ability to meet. This corroborates a study conducted by Wildman, Nguyen, Duong, & Warren, 2021 who reported on the challenges of remote teamwork for students and the challenges associated with team members in a variety of time zones. However what is less reported on are the positive impacts of remote working in teams, which have loaned themselves to the development of the hybrid approach of teaching and learning as staff and students return to face-to-face classes. Magomedov, Khaliev, & Khubolov, 2020 reported on the positive and negative impact of the pandemic in education and it was highlighted that the use of new technologies as well as more frequent and improved use of existing technologies (such as shared documents) was a major positive in collaborative work, as indicated in case study 1.

In conclusion, this study has fulfilled its project aims stated in the introduction. Through a combination of the survey and workshop, it was found that the main challenges student

generally face with teamwork with a high number of non-native English speakers is related to communication and English language issues. This is further exacerbated in remote settings where issues related to different time zones further impact team cohesion. A benefit of remote working has encouraged the use of collaborative technologies, which has enabled a hybrid approach of working in teams. The main issues related to inclusivity were related to language barriers and a lack of understanding on the application of SoRAs/ECs to teamwork assessments. There appears to be a correlation between English language competence, workload and type of work allocated among team members, impacting stresses on those members who have a higher workload. The main suggestions from students on how staff support can be improved were related to increased language support and increased staff monitoring of team progress. To address these, the faculty of Engineering will roll out the use of the Academic Communication Centre to all departments on the IEP to allow for equal and improved access to language resources. There is also an expansion of space to support teamwork activities (via the opening of the UCL East campus) and an increase in staff support (via increased support from PGTAs) to ensure better monitoring of team progress. The next phase of this study aims to assess the impact of these enhancements on student teamwork and general academic performance.

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Nexus Between Research and Teaching: Fostering Students' Expectations of Research-Informed Teaching Approaches

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Abstract
Integration of research and teaching in higher education can provide valuable ways of enhancing the student learning experience, but establishing such integrative links can be complex and problematic given different practices and levels of understanding. This study contributes to the pedagogical literature in drawing on findings from students' survey exploring perceptions of research-informed teaching, to examine how links between research and teaching can be suitably strengthened. The study employed a descriptive research design limited to the undergraduate students taking thesis/capstone courses in the tertiary levels as respondents of the study. The survey was undertaken within the remit of a broader institutional educational enhancement project of McLinden & Edwards, 2011. The findings noted that the students' responses from different disciplines: engineering, science, education, business related and computer on the nexus between research and teaching is remarkable in fostering student expectations of research-informed teaching approaches. Students' expectations on research-led, research-oriented, research-based and research-tutored are enablers in linking research and teaching. It is recommended that experimental studies should be conducted using the four different research-informed teaching approaches in the classroom namely: research-led, research-oriented, research-based and research-tutored.

Keywords: Research-Led, Research-Informed Teaching, Research-Oriented Teaching, Research-Tutored, Research-Based

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Introduction

Integration of research and teaching in higher education can provide valuable ways of enhancing the student learning experience, but establishing such integrative links can be complex and problematic given different practices and levels of understanding, (Cleaver et al. (2014). For many higher education institutions, the idea of a "symbiotic relationship between research and teaching constituting the very core of higher education" (Robertson 2007) has served as a crucial pillar. These two core strands of activity are frequently referred to as a "research-teaching" nexus.

Undergraduate education is thought to be fundamentally reliant on teaching strategies that are 'research-informed'. By combining the activities of "research" and "teaching and learning" within an institution, for instance, a recent publication by the Russell Group (Russell Group, 2014) notes that the experience of learning within a research-intensive environment can help students "take their thinking to a new level and develop skills they need for a wide range of careers." However, it is noted that this "experience" is not something that just happens and that "academics and universities must take proactive steps to bring them together."

Activities related to teaching and research at the departmental level are frequently organized in different committees, for instance. Incorporating undergraduate students into the departmental research community and engaging them in research and inquiry may therefore be hampered by structural and perceptual hurdles (see, for instance, Coate, Barnett, & Williams, 2001; Durning & Jenkins, 2005). As a result, Jenkins (2004) remarked that there might not be a straightforward functional relationship between "quality" in research and "quality" in teaching at the departmental level. As staff research may be too far ahead of the undergraduate curriculum, for instance in several sciences, it has also been noted that it may be challenging to draw clear connections between staff research and learning.

The purpose of this study is to determine the nexus between research and teaching towards fostering student expectations of research-informed teaching approaches such as research-led, research-oriented, research-tutored and research-based learning. Moreover, to determine the basis to keep the curriculum up to date and active and to engage with developments in the field and link to developments in the teaching of the faculty. It also purposely establish that courses are designed in ways that support the development of learning outcomes appropriate to the knowledge economy, including appropriate pedagogy – that is, students experiencing research and developing research skills. Further, embedding research –informed teaching in institutional structures, gives light in understanding the integration of research and teaching; cultivating student expectations and supporting transition and achieving pedagogic resonance through systematic embedding of research within a student curriculum. Hence, the study is propose.

Research Methodology

The study employed a descriptive research design limited to the 100 undergraduate students taking thesis/capstone subjects in the tertiary level in Bahrain. All quantitative data were gathered through Google forms. For the statistical treatment of data, frequency counts, means, and standard deviations were used to describe the data. Parametric test such as t-test was used to test the following: (a) difference between teaching approaches and enablers and barriers to linking research and teaching; and (b) difference between the perceived barriers to

linking research and the impact or research-informed teaching approaches. A 0.05 level of significance was used to determine the significance of the results.

Results and Discussions

The data presented include research-informed teaching understood and practiced, enablers and barriers to linking research and teaching, impact of research-informed teaching approaches on the student learning experiences, difference between teaching approaches and enablers and barriers to linking research and teaching.

Research-Informed Teaching Understood and Practiced

The integration of research and teaching in higher education can provide valuable ways of enhancing the student learning experience, establishing such integrative links can be complex and problematic given different practices and levels of understanding.

Research-Led Teaching

Research-led teaching is a teaching approach is all about where students are taught research findings in their field of study. It is a significant skill that students may possess to be future competitive professionals in their chosen field. As stated by Kelly (2020), to wit:

> *I believe research-led teaching can offer perfect conditions for learning. Some of the best research in the world goes on here, so there's an opportunity for us to have the best teaching in the world.*

Table 1 presents the means and standard deviations on the research-led teaching of learning about the research of others.

Table 1 ***Means and Standard Deviations on the Research-led teaching of Learning about the Research of others***

		Learning about the Research of others		
Indicators	*n*	*M*	*SD*	*Description*
Students learn about research findings through a curriculum content which consists largely of staff or current disciplinary research interests.	100	3.92	0.64	Agree
It can provide examples and ways of illustrating ideas, concepts and theories.	100	4.46	0.52	Agree
Some or a lot of the teaching may rely on information transmission, for example through traditional lectures or set reading.	100	4.08	0.76	Agree
There may be a focus on memorizing the key facts that have emerged from research in the discipline.	100	4.08	0.49	Agree
Also known as research-led teaching.	100	4.23	0.60	Agree

Note: A five-point likert scale, responses on this table - maximum score is 5 and the minimum score is3.

The students agreed that research-led teaching of learning about the research of others *provide examples and ways of illustrating ideas, concepts and theories* with a mean of 4.46

and a standard deviation of 0.52. In addition the students concurred that, *provide examples and ways of illustrating ideas, concepts and theories* and *there may be a focus on memorizing the key facts that have emerged from research in the discipline* considered as research-led teaching of learning about the research of others. Further, the students agreed that research-led teaching of learning about the research of others *learn about research findings through a curriculum content which consists largely of staff or current disciplinary research interests* with a mean of 3.92 and a standard deviation of 0.64. As reflected in the result, this is in contrast to the Jenkins (2004) reports that students tend to vary in their attitudes to staff research depending on their academic orientation to their studies, noting that disciplinary variations tend to occur in teaching-research relations which are shaped by how disciplinary communities conceive the nature of knowledge, research and teaching, the forms of pedagogy and curricula in different disciplines, and for some disciplines. On the other hand, the students agreed that research-led teaching of learning about the research of others *also known as research-led teaching* with a mean of 4.23 and a standard deviation of 0.60. This finding also validates the findings of Healey (2005), research-led teaching is a teaching approach is all about where students are taught research findings in their field of study.

Research-Oriented Teaching

Research-oriented teaching, this teaching approach is all about where students learn research processes and methodologies. Table 2 presents the means and standard deviations on the research-oriented teaching of learning about the research processes. The students strongly agreed that research-oriented teaching of learning about the research processes is significant in the teaching-learning, as stated in the indicator *the curriculum emphasises as much the processes by which knowledge is produced as knowledge that has been achieved, for example learning about, and critiquing, different research methods* with a mean of 4.54 and a standard deviation of 0.66. Moreover the students agreed that, *students learn about how to undertake their own research within their discipline and try to engender a research ethos through their teaching, for example by encouraging students to begin to think like researchers, and not simply accept others' research findings as given* with a mean of 4.38 and a standard deviation of 0.65.

Table 2: ***Means and Standard Deviations on the Research-oriented teaching of Learning about the Research Processes***

		Learning about the Research Processes		
Indicators	*n*	*M*	*SD*	*Description*
The curriculum emphasises as much the processes by which knowledge is produced as knowledge that has been achieved, for example learning about, and critiquing, different research methods.	100	4.54	0.66	Strongly agree
Students learn about how to undertake their own research within their discipline and try to engender a research ethos through their teaching, for example by encouraging students to begin to think like researchers, and not simply accept others' research findings as given.	100	4.38	0.65	Agree
Also known as research-oriented teaching.	100	4.46	0.52	Agree

Note: A five-point likert scale, responses on this table - maximum score is 5 and the minimum score is3.

The students confirmed that all the indicators mentioned in the table considered as research-oriented teaching of learning about the research processes. The students' responses coincided with Manu (2016), to wit:

The knowledge of methodology provides good training especially to the new research worker and enables him to do better research. It helps him to develop disciplined thinking or a 'bent of mind' to observe the field objectively.

Nevertheless, this finding could be attributed to the fact that research-oriented teaching is all about where students learn research processes and methodologies Healey (2005).

Research-Based Teaching

Research-based teaching approach is all about where students learn as researchers and develop research skills on actual projects led by academic staff. Table 3 presents the means and standard deviations on the research-based teaching or enquiry – based learning of learning as researchers

Table 3: ***Means and Standard Deviations on the Research-based teaching or enquiry – based learning of Learning as Researchers***

		Learning about the Research of others		
Indicators	*n*	*M*	*SD*	*Description*
The curriculum is largely designed around enquiry-based activities.	100	4.00	0.58	Agree
Enquiry-based learning can be described as learning that arises through a structured process of enquiry within a supportive environment, designed to promote collaborative and active engagement with problems and issues; examples include case studies, problem-solving activities, field trips and simulations.	100	4.08	0.86	Agree
The differentiation between teacher and student roles is minimized: both are participants in the enquiry process, with the teacher acting as the more experienced 'partner'.	100	4.38	0.65	Agree
Also known as research-based teaching or enquiry-based learning.	100	4.00	0.58	Agree

Note: A five-point likert scale, responses on this table - maximum score is 5 and the minimum score is3.

As reflected in the table above, in the research-based teaching or enquiry – based learning of learning as researchers, the students agreed that *the differentiation between teacher and student roles is minimised: both are participants in the enquiry process, with the teacher acting as the more experienced 'partner'* with a mean of 4.38 and a standard deviation of 0.65. This result also validates the findings of Healey (2005) which states that, research-based teaching means actively engaging students in research and inquiry.

Further, the students acknowledged the importance of research-based teaching, as the students rated the indicator *enquiry-based learning can be described as learning that arises through a structured process of enquiry within a supportive environment, designed to promote collaborative and active engagement with problems and issues; examples include case studies, problem-solving activities, field trips and simulations* with a mean of 4.08 and a standard deviation of 0.86. The claimed of the students coincided with the result of the study of Granjeiro, E.M. (2019) which cited that the students were able to express their difficulties during this process, as well as to give their views about the contribution of research-based teaching. The use of research-based teaching can increase the commitment and collaboration of the student during the teaching-learning process.

Research-Tutored Teaching

Research-tutored teaching approach is all about where students learn through critique and wide-ranging discussion between themselves and staff who can draw upon a deep understanding of thinking and knowledge in their field. Table 4 presents the means and standard deviations on the research-tutored teaching of critiquing others' research.

Table 4: ***Means and Standard Deviations on the Research-tutored teaching of critiquing others' Research***

		Learning about the Research of others		
Indicators	*n*	*M*	*SD*	*Description*
Focuses on the critical appraisal of research and moving research forward. This includes critical literature reviews and critical discussions about research papers.	100	4.46	0.66	Agree
Students typically participate in small group discussions with or without a teacher to consider research findings.	100	4.23	0.60	Agree
Also known as research-tutored teaching.	100	4.08	0.76	Agree

Note: A five-point likert scale, responses on this table - maximum score is 5 and the minimum score is3.

The result of the study posed valuable insight into the research-tutored teaching. Students confirmed that critiquing others' research also known as research-tutored teaching. Moreover, students' rate on *focuses on the critical appraisal of research and moving research forward*. This includes critical literature reviews and a critical discussion about research papers is high with a mean of 4.46 and a standard deviation of 0.66. Further, *the students typically participate in small group discussions with or without a teacher to consider research findings* is a great consideration in the research-tutored teaching with a mean of 4.23 and a standard deviation of 0.60. The claimed of the students coincided with the findings of Nicholson (2017) research-tutored" would be better described as "student-focused"; the emphasis is on students learning by doing.

Perceived Enablers and Barriers to Linking Research and Teaching

On the context of perceived enablers and barriers to linking research and teaching, as stated by (Nelson, Leffler & Hansen, 2009), to wit:

> *They need to be communicated in brief summaries showing: how findings fit into the wider context, with suggestions for action; using straightforward language without jargon, light on both referencing and statistics; having examples, illustrations, anecdotes and analogies that teachers can relate to their own experiences, and providing practical decision-making guidance.*

Table 5 presents the means and standard deviations on the perceived enablers and barriers to linking research and teaching.

Table 5: ***Means and Standard Deviations on the Perceived Enablers and Barriers to Linking Research and Teaching***

Indicators	*n*	*M*	*SD*	*Description*
		Perceived enablers to linking research and teaching		
Research attitudes of the learner.	100	4.38	0.87	Agree
Personal time management	100	3.62	1.19	Agree
Capability of teacher to link research and teaching	100	4.08	0.86	Agree
		Perceived barriers to linking research and teaching		
Lack of support	100	4.31	0.63	Agree
Lack of training/experience	100	4.31	0.63	Agree
Lack of resources	100	4.23	0.73	Agree

Note: A five-point likert scale, responses on this table - maximum score is 5 and the minimum score is2.

Table 5 indicates that, the students perceived *research attitudes of the learner* as enabler to linking research and teaching with a mean of 4.38 and a standard deviation of 0.87. Followed by *capability of teacher to link research and teaching* with a mean of 4.08 and a standard deviation of 0.86, the students agreed that appropriate knowledge of teacher is significant in linking research and teaching. Furthermore, the students confirmed that *personal time management* with a mean of 3.62 and a standard deviation of 1.19 is an enabler to linking research and teaching; the students agreed that appropriate time management will attain the goal of linking research and teaching. Further, the students perceived *lack of support* and *lack of training/experience* are barriers to linking research and teaching with a mean of 4.31 and a standard deviation of 0.63. Moreover, *lack of resources* is also acknowledged by the students as a barrier in linking research and teaching.

Research-Informed Teaching Approaches on the Student Learning Experiences

Research-informed Teaching may involve: • students learning about others' research; • students learning to do research; • students learning about their discipline in research or inquiry mode; and/or • research that informs staff about their teaching. Well designed, these activities assist students to understand the role of research in learning and how knowledge is constructed and produced within their discipline. This creates a bridge between teaching and research for teacher and student. An effective Research-informed Teaching approach means that all students studying for the degree award will develop the skills of critical inquiry, such as critical appraisal, reflection and analysis, problem-solving, and the ability to apply evidence-based solutions. Table 6 presents the means and standard deviations on the impact of research-informed teaching approaches on the student learning experiences.

Table 6: ***Means and Standard Deviations on the Impact of Research-informed Teaching Approaches on the Student Learning Experiences***

Indicators	*n*	*Impact of Research-informed Teaching…. M*	*SD*	*Description*
Providing first-hand, relevant and practical knowledge.	100	4.46	0.66	Agree
Stimulating students' trust in the lecturer and interest in the course.	100	4.23	0.60	Agree
Modeling expert thinking.	100	4.31	0.63	Agree
A new way of learning that is active and challenging.	100	4.38	0.51	Agree
Learning to learn through research skills.	100	4.15	0.38	Agree
In-depth and up-to-date knowledge.	100	4.46	0.78	Agree

Note: A five-point likert scale, responses on this table - maximum score is 5 and the minimum score is3.

As gleaned from the table, the students confirmed that *providing first-hand, relevant and practical knowledge* and *in-depth and up-to-date knowledge* as a research-informed teaching approaches have great impact on the student learning experiences with a mean of 4.46 and a standard deviation of 0.66. Moreover, modeling expert thinking and a new way of learning that is active and challenging are platforms on research-informed teaching that have challenging impact on student learning experiences. These findings accept the framework of Matheson (2010) teaching can be research-informed in the sense that it draws consciously on systematic inquiry into the teaching and learning process itself.

Difference Between Teaching Approaches and Enablers and Barriers to Linking Research and Teaching

Table 7 presents the independent sample t-test comparing the teaching approaches and enablers and barriers to linking research and teaching.

Table 7: ***Independent Sample t-test Comparing the teaching Approaches and Enablers and Barriers to Linking Research and Teaching***

Variables	*N*	*M*	*SD*	*t*	*p*
Research-led teaching	100	4.15	0.11	-0.09	0.93_{ns}
Enablers & Barriers	100	4.11	0.24		
Research-oriented teaching	100	4.38	0.26	1.79	0.58_{ns}
Enablers & Barriers	100	4.11	0.24		
Research-based teaching	100	4.12	0.13	-0.24	0.41_{ns}
Enablers & Barriers	100	4.11	0.24		
Research-tutored teaching	100	4.26	0.08	0.73	0.24_{ns}
Enablers & Barriers	100	4.11	0.24		

p<0.05, significant.

As reflected in the table there was no significant difference in the scores for research-led teaching (M=4.15, SD=0.11) and perceived enablers and barriers to linking research and teaching (M=4.11, SD=0.24) with; -0.09=t-value; 0.93 = p-value. There was no significant difference in the scores for research-oriented teaching (M=4.38, SD=0.26) and perceived enablers and barriers to linking research and teaching (M=4.11, SD=0.24) with; 1.79=t-value;

0.58 = p-value. There was no significant difference in the scores for research-based teaching (M=4.12, SD=0.13) and perceived enablers and barriers to linking research and teaching (M=4.11, SD=0.24) with; -0.24=t-value; 0.41 = p-value. There was no significant difference in the scores for research-led teaching (M=4.26, SD=0.13) and perceived enablers and barriers to linking research and teaching (M=4.11, SD=0.24) with; 0.73=t-value; 0.24 = p-value. Delving deeper into the result, the students' responses from different disciplines: engineering, science, education, business related and computer science on the nexus between research and teaching is remarkable in fostering student expectations of research-informed teaching approaches. Students' expectations on research-led, research-oriented, research-based and research-tutored are enablers in linking research and teaching.

Difference Between Barriers to Linking Research and Teaching and the Impact of Research-Informed Teaching Approaches

Table 8 presents the independent sample t-test comparing the enablers and barriers to linking research and teaching and the impact of research-informed teaching approaches.

Table 8: ***Independent Sample t-test Comparing the Enablers and Barriers to Linking Research and Teaching and the Impact of research-informed teaching Approaches***

Variables	*N*	*M*	*SD*	*T*	*p*
Enablers and Barriers to Linking Research and Teaching	100	4.11	0.24	-1.42	0.09^{ns}
Impact of research-informed teaching Approaches	100	4.31	0.15		

p<0.05, significant.

As gleaned from the table there was no significant difference in the scores for perceived enablers and barriers to linking research and teaching (M=4.11, SD=0.24) and impact of research-informed teaching approaches (M=4.31, SD=0.15) with; t-value=-1.42 and p-value = 0.09. The result establishes the fact that, the students' responses from different disciplines: engineering, science, education, business related and computer science confirmed that enablers and barriers to linking research and teaching and the impact of research-informed teaching approaches are factors on the nexus between research and teaching.

Conclusion

In particular, it offered insights into the ways in which research-informed teaching relationships were interpreted and embedded within disciplines, the enablers and barriers/difficulties to linking research and teaching and the perceived impact on the student learning experience. The findings noted that the students' responses from different disciplines: engineering, science, education, business related and computer on the nexus between research and teaching is remarkable in fostering student expectations of research-informed teaching approaches. Students' expectations on research-led, research-oriented, research-based and research-tutored are enablers in linking research and teaching.

In this study, it is recommended that the type of approaches that could support more active student engagement in the curriculum is important and call for the sharing of more curriculum examples from within the disciplines. Experimental studies should be conducted using the four different research-informed teaching approaches in the classroom namely: research-led, research-oriented, research-based and research-tutored.

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The Effect of Parental Attitude Depending on the Developmental Stages of Children

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Abstract
Parental attitudes have been the focus of research for many years. In this study, the effect of a dynamic parenting attitude as a function of the developmental stages of the children is discussed. Current parental attitudes, the evaluation of scientific studies and stages of development were examined in detail using the thematic synthesis method. Apart from the static understanding, the model that emerged as a result of the study is dynamically meaningful and three main parenting attitudes were developed; counseling, friendship and egalitarian. In this sense, the counseling attitude is understood as information, advice and focus on the needs, goals and preferences of the child; A friendly attitude also includes more togetherness, conversation, sharing and support. On the other hand, it seems crucial to feel as an individual, to get support, to consult their ideas and to ask for help, which requires them to take responsibility.The dynamic attitude to parenting, which includes counseling, friendship and libertarianism, makes it important for educators to show a more meaningful approach to individual development. However, since this is a qualitative study with this new attitude, it would be useful to explore these attitudes using different research methods such as multidimensional quantitative and experimental studies.

Keywords: Parenting Style, Child, Psychology, Teenager

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Introduction

Parenting plays a crucial role in educating future generations. Different parenting styles like authoritative, permissive, and democratic have varying impacts on children's development and behavior (Baumrid, 1968, 1971). Each style has its own approach and characteristics. Among these attitudes, the democratic parenting style is often approval in promoting healthy child development (Frick et al., 1999). In its practice, it addresses open communication and giving space to child. This approach encourages children to think independently, make decisions, and learn from their experiences, which can lead to well-rounded and confident individuals. This study sought to determine which parenting style can be more functional for child development support. In delving into the question, it is necessary to go into child development or understand child development.

Child development is influenced by various factors such as genetics, environment, culture, and parenting (Paikoff & Brooks-Gunn, 1991). However, it follows certain milestones and patterns that are physically grown stages and emotional maturity, which can provide a general framework for understanding how children grow. To figure out such systematic development, including children's unique development at their own pace, it provides some clues to develop more functional parenting styles. This is called the "dynamic model of parenting" to shape child health development. Reviewing child milestones into infant, toddler, first child, middle child and late child. Each stage has a unique challenge and development for children.

Child Development

There are many ways to evaluate life stages respectively. In this study, we adapted most likely recognized life stages beginning from infancy to adolescence: 0-2 infant; 2-3-toddler/early childhood; 3-6 middle child; 6-12 late childhood; 12-20 adolescent.

Let's review the stages in detail from the infant development. Infant development is evaluated with many aspects, physical, emotional, cognitive and social, which allow her to grow up respectfully (Zeanah etc., 1997). Physically, an infant has unlimited needs to be cared for by a caregiver such as food, clothing and health.

The first year of infancy is the most rapid period of development after the prenatal period. At 6 months of age, the baby's weight reaches approximately twice its birth weight, three times at one year of age, and four times at two and a half years (Bower, 1974). Because the prenatal development rate of the infant's head is higher than that of other organs, when the infant is born, the head-to-body ratio is more significant than that of adults. The infant's nervous system develops from the center to the ends and from the inside out, in accordance with the principles of development.

Similar to the importance of the mother's nutrition to the development of the infant during pregnancy, nutrition of the infant after birth is also very important. The more balanced and regular the infant is fed, the more positive their development will be. The physiological development of infancies is directly proportional to their food and sleep (Bathory & Tomopoulos,2017) . When the infant sleeps sufficiently during the day, his development continues in a healthy way.

The fastest period of physical development occurred between the ages of 0-2. For example, after the infant sits down, stages such as crawling and walking occur very quickly (Bower, 1974). During this period, the infant's psychomotor skills develop rapidly, infants begin to use their gestures and facial expressions and increase their number. Her muscles are starting to develop, and she is learning to follow, trying to catch the ball, and chasing the cat. She realizes the distance between himself and the ball, and takes action. She begins to eat his own food. In short, she learns and reacts to events quickly. It reacts to events. Toilet training is also initiated at this time.

The first emotional reactions of newborns were crying and satisfaction (happiness). after the 6th week, the infant begins to recognize the faces and smiles on them. After 3 months, it is observed that she is interested in colored objects. It has been observed that 4-month-old infants throw colored objects when trying to take them from their hands. Cameron and Schell (2021) stated that infants give a social smile response after the 6th week. For example, 6 weeks (1.5 months) infant smiles at familiar faces, but did not react to unfamiliar faces. The views of Fabes & Matin (2000) are that the feelings of pride and shame begin to develop after the 12th month. They even stated that the feeling of guilt develops after the 12th month. Fogel's (2001) view that sympathy and pity begins after the age of 2 supported my research. For example, a 2-year-old child shows her sense of closeness to her peers by hugging them. Fogel (2001) stated that the feelings of stubbornness and autonomy begin to develop at the age of 2 years.

In the preschool period, children can start learning by interacting with their peers. With this learning, children can adapt to society much more easily. They can learn how to live together by experiencing the social rules (Smetana, 1981). When children communicate with their peers in early childhood, the social adaptation process begins and can provide opportunities for them to acquire the necessary skills. As social behaviors develop, children's desire to be in the play environment may increase. In the opposite case, they may encounter problems in their interpersonal communication during their professional and emotional periods throughout their lives (Fucsh & Thelen, 1988).

During the social development stage in early childhood, children can acquire various social skills. Some sub-concepts of these social skills and some studies related to these concepts are given that they are social identity, problem solving, emotional skill, language development, identiy, participating games and asking questions.

The pre-school period, called the first childhood or early childhood period, is the period of significant physical development, covering the stage from the age of 2 to the age of 6 years. The preschool period can be explained by the increasing motor skills of children, the activities they perform and their inexhaustible physical energy. However, the changes in the physical development processes in this period are not like the newborn or infancy period. It takes place at a different speed and time interval in each individual. The development in this period is affected by the differences in individuals.

In almost all cultures, children develop physically in similar ways during the preschool period; However, when we compare the newborn period and infancy, the rate of development is slower in this process. In early childhood, there is a slow but serious increase in height and weight in children.

In early childhood, the most prominent physiological growth is in the limbs, that is, in the legs and arms. In this way, the center of gravity in the upper parts of the body (chest, etc.) during infancy shifts towards the lower parts of the body (belly button and its circumference), and thus, physical activities that are impossible to perform in the previous developmental period can be easily performed in this period (Atalay, 2015). In the transition from infancy to the first childhood, that is, at the end of the second year, the child's weight reaches about four times the first birth weight. In the first years of childhood, with the increase in the child's mobility, the increase in the weight of the child is slower than in infancy. By the end of the first childhood period, children's weight reaches about six to seven times their birth weight. It is difficult to give a clear figure about the increase in height and weight in children during this period. The reason for this is that the height and weight of children in the pre-school period differ even among individuals in the same social conditions due to their hereditary characteristics. Genetic features and social environment factors can be shown for the reason for this differentiation.

Bone development in infancy continues into early childhood. It can be said that between the ages of 2 and 6, approximately 45 new bone ends, or cartilage, harden from their ends to bone and form various parts of the skeleton. However, after the age of 4, children begin to lose their first teeth.

Children between the ages of 2 and 6 in the preschool period have a 20% increase in brain weight, and the brain goes through an intense remodeling and reorganization process with increasing weight. In this context, it can be said that children in this age group can develop many skills such as perception, attention, memory, language, logic and imagination.

The early or first childhood period, the period from the second year to the seventh year of the individual, is the period in which basic movements are acquired. Movements such as running, jumping, bouncing, jumping, catching and throwing, which can be performed with voluntary movements and body control, can be seen towards the end of this period.

Preschoolers have acquired most of their gross motor skills on a large scale (Timmons et al., 2007). These skills mostly occur in power points such as arms and legs. In the first years of this period, children make great efforts to recognize their own bodies and comprehend their movement abilities. During these movements, the body can be used in a very exaggerated or very limited way. As a result, clumsy behaviors can be observed. With the increasing level of control in the following years, harmony in movements increases.

In the preschool period, important developments occur in fine motor development. 2-3 year old children can perform small muscle movements such as opening a door handle, stringing beads on a string, turning the pages of a book, folding the paper in half with a little effort. Towards the end of this period, children aged 5-6 can perform behaviors such as holding a pencil, drawing letters, painting without exceeding the boundaries of the picture, and using a pencil sharpener.

In late childhood and adolescence level, according to Derman (2008), “Adolescence is a period that begins with sexual and psychosocial maturation caused by physical and emotional processes and ends when the individual gains independence, sense of identity and social productivity” (p.19). As in every period, changes occur in the person during this period. Adolescents (12-20 years old) seek to be an independent individual and an identity that they

have not noticed until now, and all this causes a difficult process for both their families and themselves (Gül & Güneş, 2009).

After this stage, a child entering adolescence begins to add new gains to the concrete operations of the current period. This makes it possible for the child, who is starting to become an adolescent, to start thinking at a higher level and reach a balance. (Ahioglu Lindberg, 2011). After this period, the child will realize his development in a way to better understand abstract concepts. Adolescents who begin to understand abstract concepts gain the ability to think abstractly. This causes emotional changes in them. They may feel as if someone is watching them all the time or as if everyone is emulating them. Adolescents have some duties related to accepting their sexual identity, social relationships and physical changes that they need to achieve in order to pass their periods in a healthy way and develop. Performing these tasks properly will make significant contributions to their cognitive development (Ahioğlu Lindberg, 2011).

Dynamic Parenting Style

As child development is dynamically growns, parenting style accordingly should improve. Especially every child milestone is critical and needs to care separately. In this study, mainly focus area of child continuous changes on many aspects requires additional effort and support. To clarify such background philosophy, we improved dynamic model of parenting style; counseling, friendship and egalitarian.

According to studies examining the impact of parental attitudes on children, children of authoritarian parents tend to follow rules, are responsible, authoritarian (authoritarian), and emotionally distant, while children of democratic parents are confident, responsible, and capable of establishing emotionally close relationships; Children of permissive parents avoid responsibility and have trouble following rules; and children of neglectful parents tend to have trouble establishing emotional intimacy (see Martinez & Garcia, 2008).

While the most qualified democratic (authoritarian) attitude is seen, parental attitudes directly affect the child's behavior depending on the age group (Frick et al., 1999). It seems important that parents' attitudes change as their children age and develop. Recent studies and theories on this understanding show broad agreement in this direction. Therefore, although the democratic attitude has been considered by many researchers to be the most appropriate attitude for each age group, it seems that different age groups have different needs and it is appropriate to change the parenting attitude accordingly. This study is important because it presents a different perspective from parenting attitude studies and suggests that parental attitudes should be dynamic, not static. Based on the studies we have benefited from, it is recommended that parents shape their attitudes in parallel with their children's development.

This result means that different parental attitudes are more functional and contribute more at different ages. In particular, the advice and friendly and egalitarian parental attitude developed in this context is suitable for the development of the child. Existing parental attitudes are generally studied at all stages of life, and according to research, the democratic attitude is the most accepted. In this sense, the advisory attitude is understood as informative, communicative advice, recommendation and presentation; A friendly attitude also includes more togetherness, conversation, sharing and support. On the other hand, it seems crucial to feel as an individual, to avoid interventions, to receive support, to consult their ideas and to ask for help that requires them to take responsibility.

Additionally, the fundamental step for any group is to effectively manage the ongoing and consistent ability to communicate. Although four different parenting attitudes are defined, and according to many researchers, the democratic parenting attitude is the most appropriate for the child's development, it seems to make more sense for different age groups to apply the dynamic parenting attitude, regardless of the individual development of the culture. A democratic upbringing can meet this need, and eventually the need to have an identity when young, to know that one's identity will be accepted, and a permissive upbringing can meet that need. Therefore, the attitudes of parents towards their children and the development and shaping of children parallel to their development makes sense for this study. The lack of such a clear definition and classification in the literature will also make a very valuable contribution to the literature of this study. The dynamic parenting attitude that is being developed and revealed makes it important for educators to show a more meaningful approach to individual development. In summary, this study discusses the impact of parental attitudes as a function of children's developmental stages with emerging perspective.

The importance of this study is due to the fact that in recent years the impact of the developmental period and parenting attitudes has been clearly emphasized. Current parental attitudes, the evaluation of scientific studies and stages of development were examined in detail using the thematic synthesis method. The model that emerged as a result of this study was dynamic in addition to the static understanding and three main educational attitudes were developed: advice, friendship and equality. The sub-indicators of these attitudes, as well as their psychological, affective, social and individual implications, have been discussed in depth and have brought a new perspective to the literature.

Conclusion

Changes in parental attitudes that are consistent with the age and development of their children appear to be important. Recent studies and theories on this subject have shown broad agreement in this direction. Therefore, although democratic attitudes have so far been considered by many researchers as the most appropriate attitude for all age groups, it seems that different age groups have different needs, and it is appropriate to change parenting attitudes accordingly. This study is important because it presents a different perspective from parenting attitude studies, and suggests that parental attitudes should be dynamic rather than static. Based on these studies, it is recommended that parents shape their attitudes in parallel with their child’s development. This result indicates that different parental attitudes are more functional and contribute more at different ages. In particular, the counseling, friendship, and libertarian egalitarian parental attitudes developed in this way are suitable for the development of the child.

In this sense, the guiding attitude involves accepting information, explanations, advice, hints, and presentations. A friendly attitude also includes togetherness, conversation, sharing, support, and togetherness. However, it seems crucial to feel as an individual, to avoid interventions, to receive support, to consult their ideas, and to ask for help that requires them to take responsibility. Additionally, the fundamental step for any group is to effectively manage their ongoing and consistent ability to communicate. Although four different parenting attitudes have been defined, and according to many researchers, the democratic parenting attitude is the most appropriate for the child's development, it seems to make more sense for different age groups to apply the dynamic parenting attitude, regardless of the individual development of the culture.

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Insights on Innovation in Education: A TPACK Experience in Continuing Teacher Education in Southern Brazil

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Abstract
Pedagogical practices at different levels of education, especially in basic education, demand proposals capable of developing autonomy and innovation skills. Considering the Latin-American scenario, especially in Brazil, the (post) pandemic context has contributed for information and communication technologies to move from supporting to protagonists in the pedagogical process, with their limitations and potential being the object of investigation in different spheres. In this regard, it is essential to consider the teaching role and, more than pointing out gaps in pre-service teacher education, or teachers' lack of technological knowledge, it is crucial to establish dialogues and proposals resulting from understandings involving a teaching and learning process with, through and about technologies, which still seems to be far from pedagogical practices in the Brazilian context. To this end, we conducted a survey with forty K-12 teachers from southern Brazil engaged in continuing education course on educational technologies based on the TPACK framework. A questionnaire was used in order to evaluate their self-perception regarding content, pedagogical and technological knowledge. Results suggest important variations in understanding among different areas of knowledge, especially regarding technological integration and awareness of teachers' practice, with impact on research and curriculum proposals. The results also show that the participants are uncertain about their knowledge involving the use of technologies in an integrated way for educational purposes. If there is, on the one hand, greater confidence in solving technical problems, on the other hand, there seem to be limitations regarding technological experimentation and metacognition involving their teaching role.

Keywords: TPACK, Continuing Teacher Education, Teacher's Knowledge

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Introduction

Pedagogical practices at different levels of education, especially in basic education, demand proposals capable of developing autonomy and innovation skills with working teachers and their students. From this perspective, the Brazilian educational context has shown a certain shyness with regard to theoretically based practices around Information and Communication Technologies (ICT) that, in fact, translate the potential of these instruments in dialogue with the historical-cultural context with the which students interact.

However, it is clear that, often, there is some resistance and/or difficulty in understanding the presence and true role of ICT in education, be it distance, blended, or even face-to-face teaching, both on the part of basic education educators, as well as by teacher trainers in degree courses. This movement has generated consequences that involve the so-called learning "deficit", which can and should be urgently addressed and based on academic research in partnership with basic education, as we seek to develop through the project entitled "Smart Schools: exploring possibilities for innovation in the pedagogical process in a blended context" (Fapergs/Sebrae Funding Call).

The issue has proven to be urgent, to the point that UNESCO (UN Brazil, 2020) has pointed out some of the systemic repercussions in this regard, which involve numerous aspects beyond education itself and which demand collective and collaborative efforts between governments, the private sector and civil society. But, more than pointing out gaps in initial teacher training or even theoretical and methodological lack of knowledge when it comes to educational technologies, it is crucial that partnerships be established in order to establish dialogues, training, and methodological proposals regarding their practice in the classroom with with a view to feeding public policies in line with current demands.

There are, indeed, weaknesses in initial teacher training, as we could see in recent studies, in which the purely instrumental character involving ICT and education, that is, the emphasis only on the use and on "teaching about ICT" as something divorced from the process Pedagogical training in all areas is a reality arising from the initial teacher training itself, with very significant consequences for the performance of these professionals in basic education.

Thus, "learning with" ICT, in a transversal way and integrated with social practices and current demands in the 21st century, with a strong theoretical basis regarding its character as a cultural instrument that alters the flow of human actions, remains quite latent in the investigative scenario academic in the educational area in Brazil, as our studies have pointed out for a long time (Kurtz et al, 2020; 2021; 2022; Silva et al, 2020).

Therefore, concepts and frameworks typical of the technological sphere have been almost "naturally" associated with the perspective of innovation in education in several areas. The dimensions involving Artificial Intelligence (AI) in education (LUCKIN et al, 2016), Computational Thinking (CP) (Wing, 2006; 2014; Bower and Lister, 2015; Duncan et al, 2017) and TPACK (Technological Pedagogical Content Knowledge) (Mishra and Koehler, 2006) are dimensions that have been gaining ground in the national literature, not only linked to the scope of innovation, but the knowledge necessary for all teachers, in all areas of knowledge (Leone et al, 2022; Ferreira et al, 2022).

Therefore, as ICT are human creations, we consider their role in enhancing students' thinking to be crucial. They are not tools that are only at the service of the population or teachers, but

“intellectual partners” that help subjects to position themselves and act in the world. Thus, the objective of the research carried out was to propose a methodological parameter that would guide teaching in different areas in basic education, based on the continuous training process of teachers so that they qualify and, ultimately, revolutionize their immediate practices in the classroom.

This objective was built keeping in mind the fact that the so-called 21st century skills make the role of the teacher stand out. One cannot think about the pedagogical process without associating it with technological fluency, whether of the teacher or the student. Thinking, from this perspective, is no longer limited to a self-absorbed activity, but a collective one. The computer, if understood as a cognitive tool, amplifies certain skills, like any other cultural tool, from the Vygotskian historical-cultural perspective. Following this perspective, both cognitive processes and human actions are oriented, directed or “molded” by cultural instruments used by subjects.

Research Methods

This is an applied research that involves an analytical dimension in a theoretical-conceptual scope and also an empirical one - qualitatively and quantitatively -, in the sense of investigating teachers' perceptions regarding the role of technologies in teaching, in different areas, as well as degrees of involvement, adhesion, resistance, teaching knowledge around technological competences in an educational perspective. These dimensions are combined with the participatory action-research process.

As for the qualitative and quantitative dimensions of the research, we adopted, in the first one, the Discourse Textual Analysis (DTA) proposed by Moraes and Galiazzi (2011), considering that this qualitative approach provides the content analysis articulated to the discourse analysis, being the data from the descriptive research. In this way, we seek the so-called data triangulation from the theoretical and empirical dimensions. The qualitative dimension manifested itself in the conceptual analysis of the publications compiled and analyzed regarding the topics investigated around innovation in education through technology according to experiences in several countries, as well as teaching methodologies adopted in these studies that are considered innovative.

After this stage, perceptions, prior knowledge, experiences and degree of adherence to innovative technologies and methodologies were mapped with the teachers (elementary and high school in public and private schools) participating in the research by requesting a response to a questionnaire. Through DTA, both the theoretical-conceptual and empirical material (interview responses) were analyzed in search of points of contact and conceptual divergence regarding the way in which experiences involving ICT and education are presented and based on which concepts, as well as as well as to the meaning processes of these elements as aggregators to the educational area as innovation. The Atlas.ti qualitative analysis software was fundamental for this.

The quantitative dimension is related to the analysis of the questionnaire used to investigate perceptions, prior knowledge, contact, etc. of participating teachers involving educational technologies. The analysis was performed based on descriptive statistics from the Likert school adopted.

Unlike an action-research, participatory action-research starts from a dense analysis of the context involved – either in the literature or in the investigative field, together with a preliminary analysis of the context and the needs of the participants. Hence the relevance of a preliminary, investigative, quali-quantitative mapping, as presented through mapping through questionnaires and interviews.

The cycle foreseen in the action-research predicted changes in the practices in question, within the scope of its joint and collaborative planning – between researchers and participants, and also the change in practice when it was implemented throughout the project, which actually happened. As the beginning of the participatory action-research cycle, after the composition of the group of participants (teachers-schools) the collective and collaborative planning of the planned activities (agenda, tasks, etc.), follow-up process, elaboration and implementation of Objects of Learning designed by teachers. The proposal carried out involved eight theoretical and methodological training meetings carried out remotely with the participants and the availability of tutorial videos.

The course involved the following themes: Cyberculture, Multimodality and Education, Practice and implementation of TPACK, Development of Computational Thinking in Basic Education, Experiences and possibilities involving AI in basic education, Gamification and use of applications for mobile devices in basic education, among which MathGo and PortGo applications, developed by the project team, Blended teaching methodologies in basic education. It also involved making tutorial videos available on Scratch, PortGo and MathGo applications, Augmented Reality/Metaverse, Appinventor and Curriki.

Throughout the period of formation and (preliminary) implementation of the proposed methodology, guided by a process of reflection-in-action about the pedagogical process in the perspective of innovation throughout the entire cycle of the research, a systematic movement of evaluation and mapping of potentialities, limitations and contributions of the proposal for future movements with the schools and classes of participating teachers, considering the return/feedback of the participants. After the training cycle, the developed learning objects were shared with the group, as well as reports of experiences regarding their elaboration and implementation, which will also be materialized in an e-book of the project.

Thus, the research had 45 basic education teachers, who effectively participated in the continuing education course with remote meetings held monthly between April and December 2022, always on the last Saturday of each month, and, of these, 22 participants concluded the course. The participation of teachers in remote meetings, when this was not possible, could be validated by their written evaluation, delivered at the end of the course, in December, in a hybrid meeting (face-to-face and remote). However, many showed difficulty in following the course due to the high number of activities and personal commitments, which meant that we had a small number of graduates.

Among the 45 participants, 93% are female and mostly aged between 40 and 50 years old (58%) and 30 and 40 years old (29%). The least representative age groups were 20 to 30 years old (11%) and over 51 years old (1%). They are linked to the areas of Literature (31%), Mathematics (15%), History (8%), Pedagogy (7%), Chemistry and Biology, both with 6% of the participants. Among the participants, 44% reported having a postgraduate degree, 24% an Academic Masters, and 11% a Doctorate. The remaining 21% reported that they did not have a graduate degree.

We report below elements verified both in the conceptual and empirical dimensions throughout the research, without dwelling on the punctual analysis of the instruments in order to enable a general look at the research and the evidence arising from it.

Results and Discussion

After carrying out the research, we were able to develop an outline of parameters that can help implement proposals aligned with the field of educational technologies and that consider the teacher's knowledge as based on the content, pedagogical and technological dimensions based on the TPACK.

Such parameters, still in the design phase, involve:

- Consider teaching in all areas from an effective interdisciplinary process in effective dialogue with the multimodal context with which subjects - and the school - interact on a daily basis. For this reason, the context and hybrid teaching are envisaged as a scenario for implementation and redefinition in methodological terms in a strong association between theory and practice.

- To develop the effective exercise of interdisciplinarity, with the expansion of the work from a “discipline” to a “pedagogical program”, involving conceptions of a conceptual and methodological nature of the areas of knowledge in their points of approximation, giving them an effective process of “ change in pedagogical behavior” based on solving real problems in an integrated way with ICT. A kind of active methodology, even if it has already been systematized, which considers contextual variables directing the dialogue between disciplines, naturally, towards each other.

- Incorporate and feed new public policies in effective harmony between the agents of the school institution - such as principals, pedagogical coordinators, teachers, etc., in a perspective of mediation regarding what the legal documents provide and how the areas of knowledge, sciences and disciplines are materialized in school knowledge.

- Implement proposals based on the TPACK in a spiral, that is, start its integration into the curriculum from elementary school with simpler technologies that teachers and their students are more familiar with, followed by more elaborate applications over the years until the end of the high school. The content to be worked on should not be defined by ICT - the content - based on an interdisciplinary basis - associated with pedagogical knowledge should be a parameter for choosing a particular technology to be worked on, enhancing student learning, in favor of solving real problems/authentic situations.

- Validate proposals and activities developed in the educational context through digital learning objects (DLO) to be systematically publicized inside and outside the school.

It is also important to highlight that, through activities carried out with primary, secondary and youth and adult education classes reported by the concluding participants, it was evident, in the textual analysis carried out in the reports, the category The continuing education course contributed to the re-signification of teaching practice and the role of ICT for pedagogical purposes. The units of meaning that make up this category relate to how much the course challenged them to effectively rethink the role of technologies in their lives and that of their students.

Final data from the analyzes carried out suggest that the participants began to develop more consolidated understandings with regard to the integration between technology and content. We were also able to verify responses regarding gaps in their initial training regarding the pedagogical processes associated with the technological context, beyond the instrumental sphere, of use, suggesting that teachers perceive the lack of opportunity for reflection and critical thinking in this regard in their initial training , as well as uncertainties about the selection of technological resources “at the service” of the object or teaching methodology adopted.

With this proposal, we believe that ICT will no longer be underused at school (and even in undergraduate courses), simply because of fear or lack of knowledge on the part of teachers. Computers arrive at homes and institutions equipped with programs and applications that are examples of cognitive tools, allowing them to be used transversely in curricula, and not in one or another discipline, becoming, even more, an element that does not require large amounts of effort. financial investments, considering that most schools and degree courses have computer labs, many of which are not used by all areas in the same way.

In a context in which network computing has been understood as “cloud computing” for some time, it seems evident that these concepts should be part of the list of discussions in undergraduate courses and teaching in general, something still somewhat distant from the reality of many Brazilian teachers.

Conclusion

The research carried out enables an understanding that technologies and education must be conceived far beyond a utilitarian logic or in a fragmented way in their formation, whether in teacher training courses or in basic education. They should, however, be considered in an integral and transversal way in curricula from a critical perspective of empowerment and social inclusion.

Aspects verified are still linked to the metacognition process as a strategy for the development of computational thinking, as xx points out, which is the basis for sustaining concepts and practices supported by an epistemological field that distances the educator's gaze from extremist and quantitative positions, such as the neo-Vygotskian Wertsch (1985; 2002) already highlighted, moving to a qualitative understanding, that is, what changes and why it changes in the educational process from the introduction of these new cultural instruments in the flow of human actions. It is, then, a process of cognitive education in which metacognition enhances the pedagogical process by enabling processes that stimulate and produce meanings that facilitate the meaning carried out by the subjects, which, according to Vygotskian theory, contributes to conceptual elaboration. It is, therefore, a condition for debate in undergraduate and continuing education courses in basic education.

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The Effect of Teacher Immediacy as Leverage Technology on Online Students' Participation, Academic Achievement and Knowledge Retention

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Abstract
COVID-19 pandemic has led to a major shift towards online learning, emphasizing the importance of teacher immediacy in promoting students' participation, academic achievement and knowledge retention. The transition to online learning has become increasingly prevalent, necessitating a deeper understanding of the factors that influence students' academic performance in environment. One such factor is teacher immediacy, which refers to the perceived psychological closeness between teachers and students. This study investigates the effect of leveraging technology to enhance teacher immediacy on online students' participation, academic achievement, and knowledge retention. A systematic review of relevant literature was conducted, and data were collected from 150 postgraduate students through online survey, achievement test (open book test) and retention test. The study used a quasi-experimental nonequivalent posttest design, with participants assigned to either an experimental group (n=75) or a control group (n=75). The experimental group received online teacher immediacy interventions, which included instant responses, feedback, asking questions, use of personal pronouns etc, while the control group received normal intervention. The experimental group reported higher levels of engagement, motivation, higher levels of participation, academic achievement, and knowledge retention than the control group. The findings of this study suggest that teacher immediacy is an essential factor in online learning environments that positively affect overall students' performance. Teachers may employ language and communication strategies that convey warmth, approachability, and availability to students to enhance student outcomes in online learning environments. The results have implications for educators and instructional designers who are interested in enhancing student engagement, academic achievement, and learning outcomes in online learning settings.

Keywords: Verbal Immediacy, Nonverbal Immediacy, Participation, Academic Achievement, Knowledge Retention

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Introduction

In recent times, there has been a rapid advancement in computing and telecommunications technology. Concurrently, the utilization of online education for teaching and learning has become increasingly prevalent in higher education. This trend is expected to continue in the future (Garrison, Anderson, & Archer, 2000; Ni & Aust, 2008). While e-learning brings forth various opportunities, it also presents challenges for both educators and students. These challenges arise from the potential increase in geographic, temporal, and psychological distance. Online courses, especially those primarily reliant on text and lacking audio and video components, often have limited means of conveying non-verbal messages. The lack of verbal and nonverbal communication in online courses, particularly those without audio or video elements, can make students feel isolated and disconnected. This can create challenges in establishing positive relationships between students and teachers, ultimately impacting student learning outcomes. One effective approach to address this issue is through the use of teacher immediacy behaviors. These behaviors involve teachers adopting communication strategies that minimize the perceived psychological distance between themselves and their students (Ni & Aust, 2008; Woods & Baker, 2004). By employing such strategies, teachers can potentially enhance student learning outcomes by fostering a sense of closeness and engagement in online interactions.

The term "immediacy" was initially defined by social psychologist Albert Mehrabian (1969, p. 203) as referring to "communication behaviors that foster a sense of closeness and nonverbal interaction with others." Mehrabian argued that individuals are naturally inclined towards people and things they like, hold in high regard, and prefer (Mehrabian, 1969, p. 1). Later, Andersen (1979) introduced the concept of teacher immediacy in the context of higher education, describing it as the nonverbal expression of strong emotions, demonstrated through actions such as maintaining eye contact, leaning closer, and smiling. Gorham (1988) further expanded upon teacher immediacy behaviors to include verbal actions such as responding promptly, addressing students by name, and providing personal examples. Teacher immediacy comprises the actions taken by an instructor to enhance students' perception of human interaction, the presence of the instructor, their caring attitude, and a sense of connectedness (Kim & Bonk, 2010).

In a study by Yang, Liu, and Wei (2021), the authors explored the effects of instructor immediacy on online learning outcomes among Chinese college students. The authors found that instructor immediacy was positively associated with students' perceived satisfaction, motivation, and academic achievement in online courses. The authors also found that the use of multimedia to enhance communication was an effective strategy for promoting immediacy and improving online learning outcomes. Similarly, a study by Kim, Kim, and Lee (2021) explored the effects of instructor immediacy on online learning outcomes among Korean college students. The authors found that instructor immediacy was positively associated with students' perceived satisfaction, motivation, and academic achievement in online courses. The authors also found that the use of multimedia to enhance communication was an effective strategy for promoting immediacy and improving online learning outcomes. Lee (2020) in a meta-analysis of 60 studies found that social presence had a significant positive effect on online learning outcomes, including participation rates, academic achievement, and satisfaction. The author also found that immediacy strategies, such as providing clear expectations, offering feedback, and creating a supportive learning environment, were positively associated with social presence and improved online learning outcomes. J. Reneski (2017) conducted research on a study using a non-equivalent control group in a quasi-

experimental design. The researcher tried to explore and measure how having access to synchronous weekly teacher content affected online students' sense of community, social connectivity, and perceived learning. The findings revealed that the ability of weekly instructor content to foster a sense of community was not significantly different across synchronous and asynchronous distribution methods. This study added to current knowledge of the attitudes, goals, and activities of online learners, which is important for the area of education and particularly for distance and online higher education.

Overall, recent research has consistently highlighted the importance of immediacy strategies for promoting students' participation, academic achievement, and knowledge retention in online learning environments. These findings have significant implications for educators and policymakers interested in improving online learning outcomes and promoting the use of effective teaching practices in online courses.

Research Problem

Extensive and intensive development in the field of ICT and sudden eruption of COVID-19 pandemic has caused a rapid shift towards online learning, which has highlighted the importance of effective teacher-student communication in digital learning environments. One key factor in promoting student engagement and learning outcomes is teacher immediacy, which refers to the degree to which teachers create a sense of closeness and interpersonal connection with their students. However, there is limited research on the effect of teacher immediacy, which involves using technology to create this sense of closeness, on online students' participation, academic achievement, and knowledge retention. Therefore, the research problem addressed in this study is to investigate the effect of teacher immediacy on these outcomes in online education. While teacher immediacy has been identified as a key factor in promoting engagement and learning outcomes in traditional face-to-face education, there is limited research on the effectiveness of online teacher immediacy in promoting these outcomes in online education. This study aims to fill this gap in the literature by investigating the effect of teacher immediacy on online students' participation, academic achievement, and knowledge retention.

Rationale of the Study

The rationale behind conducting this study was to gain a deeper understanding of the potential effects resulting from the combination of teacher immediacy and technology within the online education context. As the prevalence of virtual learning environments continues to grow, it becomes increasingly important to explore how the personal connection between teacher and students, facilitated by technological means, can influence the level of active engagement displayed by students in their learning process. Additionally, this study seeks to examine how such a combination can affect students' academic performance and their capacity to retain and apply acquired knowledge over a sustained period. Through the investigation of these dimensions, the intention was to offer valuable insights that can aid teachers and educational institutions in refining their approaches to online instruction, ultimately leading to enhance outcomes in student participation, academic accomplishments, and the retention of learned material.

Research Objective

The research objective of this study is to investigate the effect of incorporating teacher immediacy, facilitated by technology, on the participation, academic achievement, and knowledge retention of students engaged in online learning environments.

Research Hypothesis

H_o: There is no significant difference in the levels of student participation, academic achievement, and knowledge retention when teacher immediacy is combined with technology in online learning environments.

H_1: There is a significant difference in the levels of student participation, academic achievement, and knowledge retention when teacher immediacy is combined with technology in online learning environments

Conceptual Framework

The study was based on Transactional Distance theory and social presence theory. Transactional distance theory focuses on the importance of minimizing the transactional distance to foster the meaningful engagement and effective learning in distance learning. Similarly, the social presence theory, learners perceive a sense of social presence when they feel connected, engaged, and socially connected with others in an online environment. Teacher immediacy plays a crucial role in creating and enhancing social presence which Figure 1 depicts conceptual framework of this study.

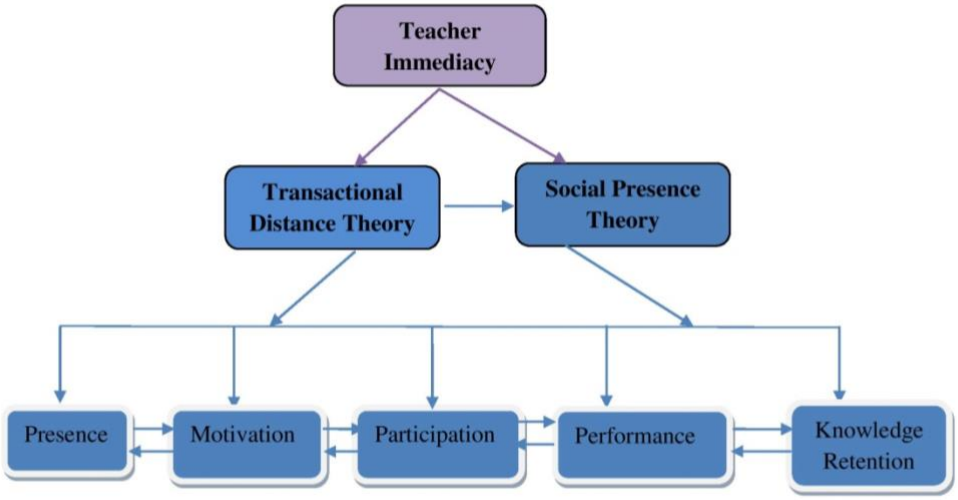

Figure 1: Conceptual Framework of the Study

Research Methodology

Research Design

This study adopted a quasi-experimental nonequivalent control group with posttest research design, which involves comparing two groups of online students who received different levels of digitized teacher immediacy. Verbal and nonverbal teacher immediacy practices were independent variables and the dependent variables were online students' participation and knowledge retention. The participants in this study were online students who were enrolled in a post graduate programme MA Edu. / M.Ed in Allama Iqbal Open University, Islamabad. Research design of this study is mentioned in figure 2.

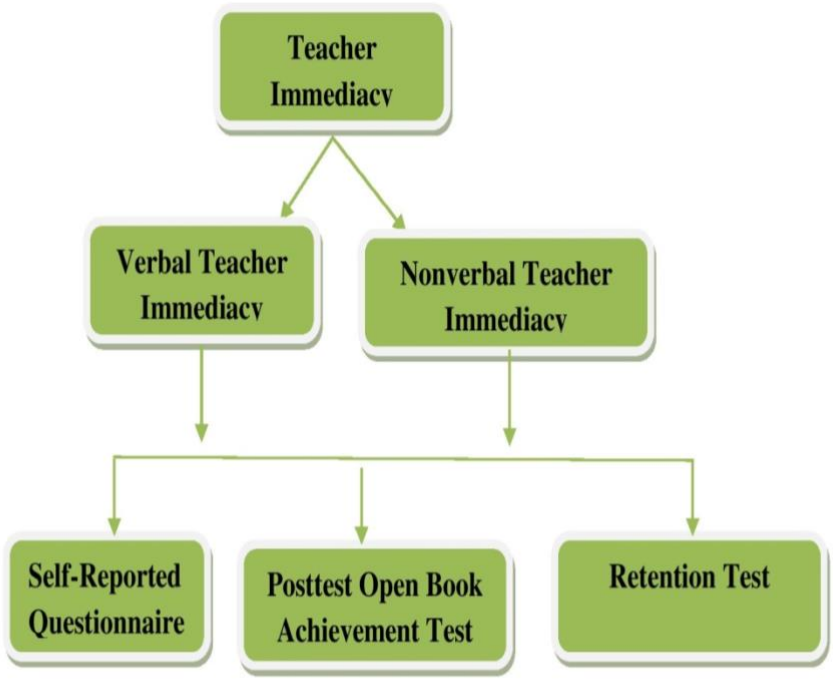

Figure 2: Representation of Research Design

Subjects: The study involved 150 graduate students enrolled in public university in Pakistan. The subjects were parts of intact groups and divided into two groups: an experimental group that received teacher immediacy cues, and a control group that did not receive any immediacy cues.

Sampling Technique: A cluster random sampling technique was used to select the participants because subjects were already a part of intact groups. Subjects were divided into two groups, i.e., experimental and control group (75 x 75).

Procedure: The treatment group (experimental) received a set of teacher immediacy interventions, including personalized and prompt feedback, personalized and empathetic communication, and the use of multimedia tools to enhance the learning experience. Figure 1.3 reflects verbal and nonverbal teacher immediacy practices. The intervention was carried out using university's learning management system (LMS). The research sample consists of

online students enrolled in a postgraduate program. The study incorporates different measures of teacher immediacy like 5-point likert scale questionnaire, open book essay type test and retention test which captures students' perceptions of their instructors' immediacy behaviors, academic achievement, and knowledge retention. Online participation of students was determined through using survey questionnaire by asking questions related to their engagement and interaction in the course during 6-days online workshop (Appendix-A). Participants indicated the frequency of their participation or the extent of their agreement with the statements. Students' academic achievement and knowledge retention was determined through achievement test (open book test) and retention test (Appendix-B).

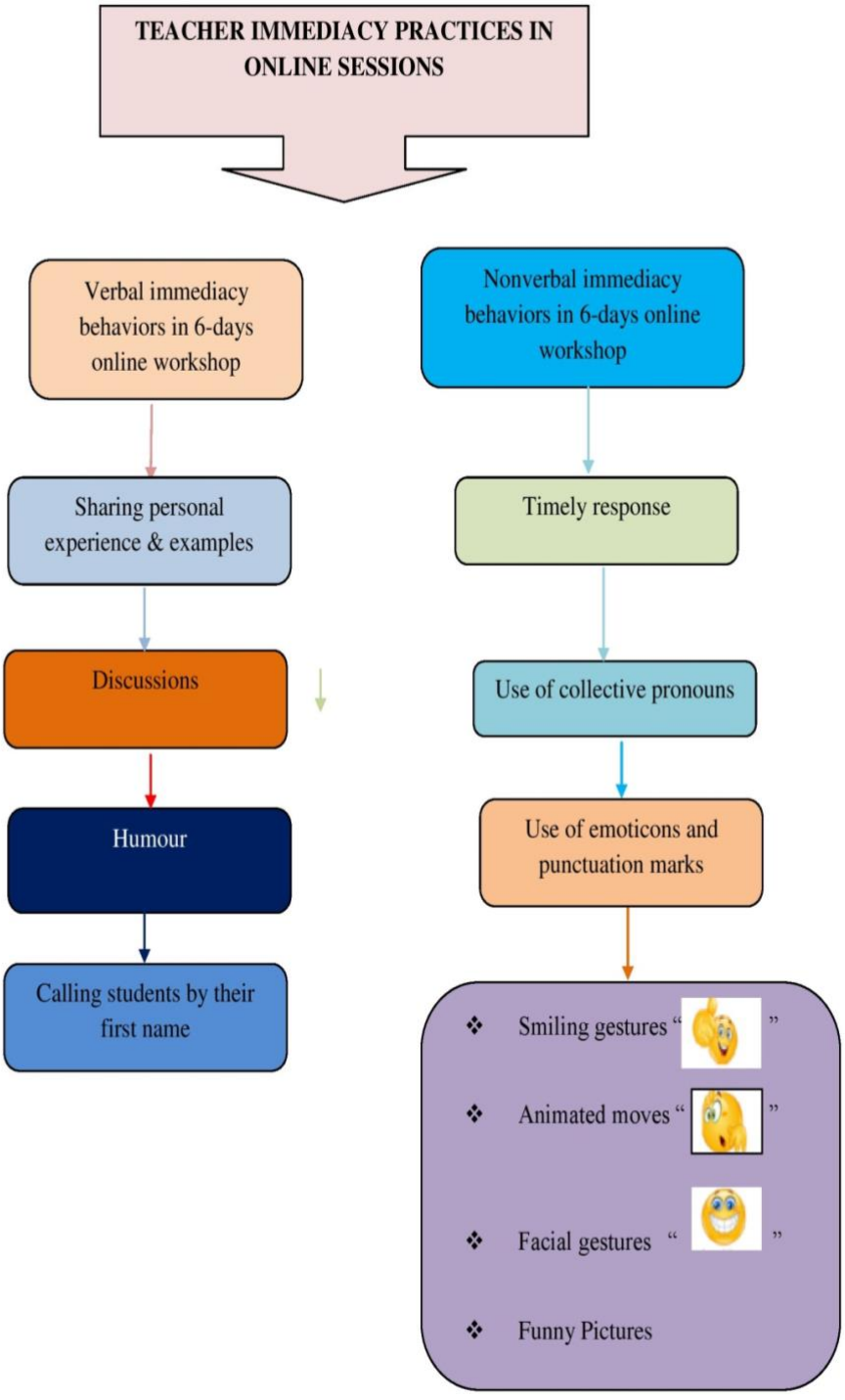

Figure 3: Verbal and Nonverbal Teacher Immediacy Practices

Results

The data collected from the surveys were analyzed using descriptive statistics and inferential statistics. Descriptive statistics were used to analyze the mean, standard deviation, and frequency distribution of the data. Inferential statistics were used to test the research hypotheses using independent samples t-tests.

	N	*Test Value*	*Obtained Means*	*Mean Difference*	*df*	SD	t-value	*p*
Total	35	96	155.91	59.91429	34	4.06	10.18	0.000

Table 1.1: One sample t-test on students' views of teacher immediacy practices (TIP) in terms of participation in online learning

The t value (10.18) with (Mean = 155.91, SD = 4.06) in Table 1.1 was found significantly higher than the test value (96) at p.005. Students' mean immediacy practices score at the conclusion of the intervention period is obviously higher than the test value (96). The result supported the alternate hypothesis (H_1) which indicates, there is a significant difference in the participation of the experimental group in online learning after receiving teacher immediacy interventions. The findings demonstrated that there is a statistically significant difference between the test value and the mean score for students (96). The results of the one sample t-test demonstrated that the method of treatment used during the online teaching sessions had a significant effect on the treatment group's post-test responses. From the viewpoint of the student, the research's conclusions provide evidence that the treatment group's exposure to the teacher's immediacy techniques (both verbal and nonverbal) caused them to perform better when participating in online sessions' discussions. Following the intervention, it was determined that students experiencing immediacy practices did not only participate in discussions, but they were more comfortable at studying and leaning the content during online classes

	Condition	*N*	*Mean(¯X)*	*SD*	*t-value*	*df*	*Sig.(X)*	*Mean difference*
Posttest	Experimental Group	35	37.68	4.589	5.96	63	.000	9.544
	Control group	31	28.16	8.810	5.823	46.85	.000	

Table 1.2: Independent sample t test for comparison of experimental and control groups of students

Table reflect that students mean achievement scores is 37.68 and SD = 4.589 of experimental group with thirty five participants and for control group students' mean achievement scores is M = 28.16 and SD = 8.810 with number of participants 31**.** It reflects that experimental group secured outperformed achievement than control group. Table 4.2's findings show that the t value (5.96) is significant with a p-value of 0.00. The experimental group's mean score (M = 37.68, SD = 4.589) is significantly higher than the control group's mean (M = 28.16, SD = 8.810). The effect size of two compared groups was also determine by Cohen'd formula and found out as 1.07.

	N	*Mean*	*Mean difference*	*SD*	*df*	*t*	*p*
Achievement test	35	37.7	.40908	4.52296	34	0.698	o.o5
Retention test	35	37.4		4.01614			

Table 1.3: Paired sample t-test for comparison of achievement and retention tests of experimental group of students

Table 1.3 demonstrates that a paired sample t-test was used to determine whether there was a significant difference between the two tests. A significant mean difference was reported at $t = 0.698$ with $p < 0.05$. The accomplishment and retention tests' mean scores have a small difference. In contrast to the retention exam, which has a mean score of 37.4, the achievement test has a mean score of 37.7.

	Condition	*N*	*Mean(¯X)*	*SD*	*t-value*	*df*	*Sig.(X)*	*Mean difference*
Retention tests	Experimental Group	35	37.62	4.087 .	6.48	56	.000	9.063
	Control group	23	28.56	6.57	5.90	33.22	.000	

Table 1.4: Independent sample t tests for comparison of retention tests of experimental group and control groups of students

The findings of Table 1.4 revealed that the t value (6.48) is significant at p=0.00. The mean score for the experimental group (M = 37.62, SD = 4.08) was considerably higher than the mean score for the control group (M = 28.56, SD = 6.57). The effect size of two compared groups was determined by applying Cohen d formula and it was found 1.37. The findings showed that the mean scores of the two groups differed significantly.

Discussion

The results of this study indicate that the use of teacher immediacy practices along with technology has significant positive effect on students' participation, academic achievement, and knowledge retention in online learning. This study is consistent with previous research on the importance of immediacy in online learning environments (Hartnett et al., 2021; Lee, 2020; Swan & Ice, 2010). The findings of this study support previous research that has highlighted the importance of immediacy in enhancing online learning experiences.

Firstly, the results of the one-sample t-test showed a significant difference in participation rates between the groups with and without immediacy strategies. This finding supports the notion that immediacy strategies, such as timely feedback and frequent communication with students, can increase students' engagement and motivation in online learning. This is consistent with previous research that has shown that students who receive frequent feedback from their instructors are more likely to participate in online discussions and complete assignments (Lee, 2020; Swan & Ice, 2010).

Secondly, the independent t-test indicated a significant difference in academic achievement between the two groups. This finding suggests that immediacy strategies can improve students' academic performance in online learning. The use of immediate feedback and communication with teachers can help students to clarify concepts and address areas of

difficulty, leading to improved academic achievement. This finding is consistent with previous research that has shown that immediacy strategies can enhance students' academic performance in traditional classroom settings (Anderson & Shannon, 1988; Frymier & Houser, 2000).

Finally, the paired t-test revealed a significant improvement in knowledge retention in the group that used immediacy strategies. This finding suggests that immediacy strategies can enhance students' knowledge retention in online learning. The use of immediate feedback and communication with instructors can help students to reinforce their understanding of course materials and retain information better. This finding is consistent with previous research that has shown that immediacy strategies can improve students' knowledge retention in traditional classroom settings (Frymier & Houser, 2000; Witt et al., 2004).

Overall, the results of this study suggest that immediacy strategies can have a significant positive effect on students' participation, academic achievement, and knowledge retention in online learning. So, alternate hypothesis can be justified because this hypothesis suggests that leveraging technology to improve teacher immediacy can lead to notable improvements in student participation, academic achievement, and knowledge retention in online learning environments. The study's findings reveal statistically significant differences and meaningful effect sizes in these aspects as a result of the integration of teacher immediacy with technology. So, the alternative hypothesis is supported.

The findings of this study also have significant implications for educators, policymakers, and researchers interested in improving online learning experiences. The results suggest that instructors should consider incorporating immediacy strategies, such as frequent communication and timely feedback, into their online teaching practices to enhance students' learning experiences and improve their academic performance. Further research is needed to explore the most effective immediacy strategies for different student populations and subject areas. The findings of this study have significant implications for educators, policymakers, and researchers interested in improving online learning outcomes. Educators can incorporate immediacy strategies into their online teaching practices to enhance students' learning experiences and promote better academic outcomes. Policymakers can use the results of this study to design policies that promote the use of immediacy strategies in online learning environments. Finally, researchers can use the findings of this study to conduct further research on the effectiveness of different types of immediacy strategies in online learning and to identify best practices for incorporating these strategies into online teaching practices.

Conclusion

In conclusion, the quasi-experimental nonequivalent control group posttest study examined the effect of leveraging technology with teacher immediacy on online students' participation, academic achievement, and knowledge retention. The findings of the study suggest that integrating teacher immediacy strategies with technology positively influenced these outcomes. Online students who experienced higher levels of teacher immediacy through technology demonstrated increased participation levels, improved academic achievement, and enhanced knowledge retention compared to those who did not. The study's results underscore the significance of establishing a strong teacher-student connection in online learning environments, facilitated by the thoughtful incorporation of technology. Teacher immediacy, demonstrated through real-time interactions, timely feedback, and personalized communication, appears to be a crucial factor in promoting engagement and learning

outcomes in online education. It is important to acknowledge the limitations of the study, such as the specific context and sample size, which may impact the generalizability of the findings. Future research could delve further into the nuances of various technological tools and immediacy strategies, as well as explore their long-term effects on sustained engagement and retention. In light of these findings, educators and instructional designers are encouraged to consider the integration of teacher immediacy techniques alongside technology to enhance the online learning experience. By doing so, they may effectively bridge the physical gaps inherent to online education and create a more interactive and productive learning environment for students.

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Appendix-A

SURVEY QUESTIONNAIRE FOR STUDENTS

Part 1: **Background Information**

Instructions: Please provide the following information by ticking (✓) the appropriate box.

1. **Master Programme:** ☐ **MA Education** ☐ **M.Ed**

2. **Rate your expertise in using virtual learning tools:**
   ☐ **Beginner** ☐ **Moderate** ☐ **Experienced**

Please indicate each practice used by teacher during 6-days workshop of subject, by entering a tick (✓) in the appropriate box.
1=Strongly disagree; 2=Disagree; 3=Neither agree nor disagree; 4=Agree; 5=Strongly agree

S. No.	Statements	1	2	3	4	5
1.	The teacher addressed students by their first name					
2.	The teacher was always available during the online class.					
3.	The teacher always encouraged students to interact with other peers.					
4.	The teacher was accessible and easy to reach when students have questions.					
5.	The teacher communicated course objectives, goals and procedures.					
6.	The teacher explains course concepts by sharing his personal experiences					
7.	The teacher reassured students by giving feedback on discussions, postings, etc.					
8.	The teacher used humour when delivering lectures and communicating with students during online					

	class					
9.	The behavior of teacher during online workshop was exemplary.					
10.	I enjoyed my teacher's style of teaching.					
11.	Online teaching session was interesting for me during discussion					
12.	Online teaching session kept me involved throughout the workshop					
13.	My teacher showed appreciation for my questions and contribution during online class					
14.	I feel confident for my teacher's constant support.					
15.	Online discussion during workshop was ensured					
16.	The teacher ensured involvement of students during online teaching session.					
17.	A quality of teaching-learning process was ensured during online environment.					
18.	My teacher explained how to respond to posts, messages or emails.					
19.	The teacher monitored the students performance throughout the workshop					
20.	My teacher responded to my comments immediately					
21.	The teacher called out each student individually					

	through the use of discussion boards.					
22.	My concepts were clearly built up during online workshop.					
23.	Online discussion helped me to learn things related to the course.					
24.	The online teaching session enabled students to think and retain knowledge about subject.					
25.	I got the opportunities to participate in the class discussion.					
26.	The teacher linked the course concepts with personal experiences.					
27.	Students were asked to raise hands for their query.					
28.	The class teacher used emojis during online class.					
29.	The class teacher used textual images i.e., "LOL," “Greaaaat Idea” during online teaching session.					
30.	The teacher provided me feedback on my discussion, comments during the workshop..					
31.	My teacher guided me for attempting course related tasks.					
32.	My teacher attempted to answer questions or queries about course contents.					

Appendix-B

Subject: TEACHING STRATEGIES
LEVEL: MA EDU/M.ED
COURSE CODE: 846

OPEN BOOK EXAM

Total marks# 50 = 2*25

Read the instructions carefully and attempt questions.

You have to write your answers in your own words and according to the nature of question. Copied content will not be acceptable. Do not exceed word limit of 500 words for each question. Plagiarism will be checked of every student.

Q1: Differentiate between technique, strategy and method of teaching? You have to teach 9th class English subject, topic# Active voice/Passive voice which teaching, method, technique and strategy will you use to teach the particular topic and why you will use it. Support your answer with reasoning. Can any listen simulation technique be used or not?

OR

Q1: How do you view teaching as a system? Support your answer by explaining important teaching variables. Classify the pedagogical models of teaching.

Q2: Develop a model lesson plan on the topic of your own choice by following the steps of any specific approach which you are following throughout your lesson plan with all details mentioned properly?

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Traditional Seeds Saving Learning Site: An Experiential Learning for Food Security and Community's Sufficiency Economy in a World Heritage Site, Thailand

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Abstract
This research aims to study the design of the local seed conservation learning centre of the Pwo Karen community and to study a learning model through villagers' experience in maintaining food security and community economy in the world heritage. Data were collected by a survey and interviews with nineteen people and then analysed. The results showed that the process of designing a community learning centre consists of 1) Selecting learning centre areas 2) Collecting data in the community areas, 3) Coordinating with experts to exchange landscape design ideas 4) Sharing experiences in developing the learning centre 5) Proposing indigenous tradition seed saving as a learning centre for people in the community. They learn through planting practice and experience, preserving local seeds with traditional wisdom of ethnic group, developing a learning site bringing cultural capital to generate income and engaging in sharing the form of learning through experiences from four communities: 1) Ui Kure Learning site teaches about plants from the forest, seed collecting, coffee production and cooking 2) Lung Joong Learning site teaches about medicinal plants, herbal medicine preparation and natural healing health care(workshop) 3) Aoy Learning site teaches to grow local food crops, cooking the traditional Karen food style, food processing from local vegetables, beliefs, traditions, eating cultures and food in Karen ritual. 4) Srifah(blue) Learning site teaches to process naturally used items. Make food and drinks from local seeds and plants. This education leads to sustainable development, reducing inequality for people in the community and supports lifelong learning.

Keywords: Learning Sites, Seeds Saving, Experiential Learning, World Heritage

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Introduction

This study was under the Conservation of Traditional Seeds and Local vegetables Project for economic development and cultural ecology of communities in Thungyai Naresuan-Huai Kha Khaeng Wildlife Sanctuary, a World Heritage Site in Thailand. This research promotes local people to learn through their experiences. Cultural capital in the community was implemented to create an economy as a sufficiency economy and interdependence based participatory using natural resources to generate income and prestige. The community has a geo-cultural database including community history, cultural traditions, local plays and games, costumes, way of life and natural resources community map. These are the ways to raise awareness of the production to distribution of traditional seeds, which are the source of food and security for the community. The design of the local farm was created by an expert to connect education and learning of local people to make an effect for the preservation of local seeds. Including the production of food processing linkage to the way of preserving local vegetable and traditional seeds of the ethnic group "*Pwo Karen*" (Malisa Marchitelli, 2019) in areas located in the natural world heritage, Thailand. Learning experiential was promoted in their community. The ethnic learns through diverse methods to conserve the local seeds as classification species, preservation, utilization, consumption, food processing, cooking local food as herbs and medicine and health care healing to save tradition and generate local income. This research collected data to analyse the strengths of the design of learning resources and the experiential learning process to conserve the traditional seeds of the ethnic group. This study studied cultural landscape management process that develops learning centres to save local plants and seeds in their experience. Twelve plots of agricultural farms, traditional seed sources, were areas of local peoples dream and wisdom. Learning through experience starts from thought, an interest of the owner of an agricultural farm who's ready to develop areas and management which lead to a learning place base. Every farm owner is ready to develop their own land to transform the original farm into a learning space that tells stories and lives of ethnic people and their culture community, they’re a source of learning and convey the meaning of seed capitals and Pwo Karen culture. The traditional seeds conservation of ethnic linked to community’s nonformal education system. Learning sites that leads to social entrepreneurship and food security, co-existence, survival, value living. The experiential learning model from this research will be applied to the practice agriculture and live in nature to maintain food and economic security of the community through learning from the experiences of people in the community. This will be beneficial to the farmer and local people that conservation of traditional seeds will sustain the food and economic security for the future.

Objectives

1. Design the learning site to promote traditional seeds conservation of the ethnic group in wildlife sanctuary, world heritage site, Thailand.
2. Develop the experiential learning model in the community’s learning site to promote food security and local community sufficiency economy.

Program and Study Context

1. Scope of content of the study consisted of; 1) the conservation of traditional seeds and their utilization for food security and community-based economy 2) the concept of learning resources management, model patterns and components of local vegetable and traditional seed preservation in learning centres 3) experiential learning processes

and community participation in designing of learning centres site activities based on cultural ecology of the community.
2. Scope of study area was farmland of ethnic group, Pwo Karen, people in Thungyai Naresuan-Huai Kha Khaeng Wildlife Sanctuary, world heritage site, Thailand, there were agricultural areas in four communities.
3. Scope of time: Research project was action between August 2019 to July 2020.

Mutual Partnership and Mutual Benefits

This research collaborative with the Royal Initiative Area-Based Rural Development Program, invites provincial and district staffs to act as the focal points of the project with active contribution of people which are from an ethnic group in each community to participate in all levels from brainstorming to conducting all activities such as indigenous and local people capacity development, career development, community network building and sustainable living.

Benefits from this research were 1) A model of learning process through experience and the participation of people in the community in designing a learning centre for traditional seeds saving. It is a continuation and extension of the economy by cultural capital generating income. 2) Guidelines for usage of natural resource capitals, traditional seeds, local vegetables in the community and learning management for raising awareness of traditional/indigenous seeds and preserving in ethnic people culture including the well-being of local communities. 3) The community of ethnic groups, Pwo Karen, had learning sites to conserve their traditional seeds and maintain local vegetables' biodiversity in the local farms as a food security area and conservation activities, which will be a kitchen of the world, which will support and reduce poverty and achieve sustainable development SDGs.

Literature Review

There are many diverse types of learning. Experiential learning is an activity in multi-level education settings. Learning takes place in the classroom, to learn from communication, interaction between people. Learning takes place in the physical space, or the virtual space contributes to learning. There is an exchange of learning from grouping together, exploring, creating cooperation, discussion (Oblinger, 2006:12). Learning can be done throughout life anytime, anywhere. From experiences in life through different ages and times, there is the development of knowledge, management, creation of things. Learning site is a place to study and discover new things that cause learning. Learning resources will have learning activities through hands-on, play or both and extra-curricular activities, both formal and informal, learning activities e-learning, lectures, and presentations (TK Park, 2015: 34). Components of learning resources are content or sources of knowledge, learning process, learning place, learning materials. The knowledgeable person who educates the learners and evaluates what the learners get and what needs to be improved and developed the learning resources. The National Education Act of Thailand, Section 25 mentions legal learning resources as the state must promote the operation and establishment of all forms of lifelong learning resources, such as public libraries, museums, art galleries, zoos, parks, botanical gardens, science and technology park, Sport and recreation centres, information sources, and other sources of learning adequately and efficiently (Education Act Thailand, Prime Minister’s Office, 1999). Learning spaces are both physical spaces and virtual spaces. Physical spaces are to display light, have sound, and the quality of the environment and atmosphere for learning. Virtual spaces will show availability and how to access information technology. Present learning and

future learning are connections between physical and virtual spaces. Outside the classroom that should be considered are the space between “in-between” spaces, which may be between classrooms, between buildings on campus or even between cities as social spaces where learners can interact to each other, support informal and formal learning (Jiroj Sorapun, 2013).

Information about Indigenous seeds or traditional seeds savings shown since 1903, ninety-six percent of vegetable seeds had been lost from the earth. Seed collectors, farmers, scientists, and indigenous peoples can't fight with a few big seed business corporations. Which are controlling the food production in the world. In Thailand, more than seventy types of seeds that the seed collectors have preserved and still exist, there are a few seeds left. By this, the seeds ninety-four percent already lost, and lost along with wisdom, nutrients, medicine. These may be the cause of the extinction of other species. The seed must have been saved and maintained as an inheritance for human beings.

The search about Seed Saver Exchange (SSE) is a non-profit seed bank based in northeastern Iowa. The research focused on how SSE conceives of seeds and nature more broadly. The analysis moves to understand how the ideas of nature shape the materiality that is conserved. Understanding of traditional seeds and nature must be learnt in a wilder range. Determining what to preserve and the document analysis shows the value of seed conservation. All policies and practices guidelines are based on norm and normative assumptions about the types of nature that should be conserved. The description of documents that show the value associated with the Seed Saver Exchange (SSE) will be used as content to instill people's commitment to conservation together. Specifically, seed conservation consists of 1) the concept of nature, 2) the materiality being conserved, and 3) the values embedded in all conservation practices. This is a trialectic of conservation (Michael S. Carolan, 2007: 739). As learning process to achieve the preservation of traditional seeds.

From the review document, it was concluded that the storage, conservation of local seeds caused persistence of a variety of seeds cultivation for livelihood with a variety of plants. It is a source of food for people in the community and the world, reducing hunger and creating sustainable development. Local communities can be self-sufficient from the diverse resources in nature. This will prevent a monopoly planting economy that causes the loss of seeds. In addition, the creation of community learning. Preserving cultural traditions, cultivation and food will help strengthen the community through learning from practical experience and designing learning resources that meet the needs of people in the community.

Methodology

1. Area of study; four agriculture farms in the communities in Thungyai Naresuan-Huai Kha Kheng wildlife sanctuary, world heritage site, Thailand was selected.
2. Keys Informants from purposive sampling were farm owners, they were divided and in the first group were five villagers that do farming and homestay businesses. And they gave importance to saving the traditional seeds, the second group were 14 villagers who were interested in developing their farm area to be a learning site and develop the local economy as a sufficiency economy based on cultural ecology.

Data Collection

The research's tools were **Community Mapping**, where the selected target groups learn together, bringing their experiences together to create a community map. The map shows the production and distribution of local traditional seeds in the community. **Community cultural calendar**, the target group participation, brings their experiences and information to share and learn the community's cultural traditions, they would have to review the important rituals and traditions in the community they had during the year including planting period in the calendar. These are learning source and development information to promote the conservation of local vegetable, traditional seeds through the year. In **in-depth interviews**, the researcher interviewed key informants to get information about area details and the needs of agricultural plantation of farm owners for developing learning centres to promote traditional seeds saving. The farm owner has expressed their ideas for developing a learning centre. The researchers also share their ideas and analyse the needs of people in the community to create a community learning centre. **Transect Walk,** to explore community areas together with the villagers and the farm owners, learned from eye seeing to gain experience in designing and share what stakeholders learn from the community by walk and observation. **Stakeholders Analysis,** both insider and outsider to make a clearer goal. To start the network and cooperation on seed saving and make learning sites and think more about learning activities and experiential learning. This creates an analytical experience for the villagers, who have done it, who will be able to take advantage of the learning resources. **Photography,** to record the farm place, spaces, which are agricultural fields will become a learning site. Record learning activities in the sites. All record photos would be reflected for the target group to review the learning of the community. Photos were visualized and created an understanding of learning activities to gain more experience. **Sound recording,** interviews with the target group were recorded. This was taken to remove the details of the information that match the truth by both recording images and sound recording. Researcher will obtain informed consent from the informants and community members who participate in all activities.

Data Analysis

Interviews were analysed by content analysis followed by research purpose. 1) Design of learning sites. Using the information from the experiences of the target groups as information to design and present traditional seed conservation learning centre model. 2) learning from farming experiences, seed conservation learning process and the actual learning experience of the target group as a way of life and learning participation in research projects. Descriptive data analysis results were presented.

Findings

1. The Design of a Learning Centre to Promote the Conservation of Traditional Seeds of Pwo Karen Ethnic Communities

The process of designing the Pwo Karen Ethnic Community Seed Learning Centre and learning from the experiences as follows:

1.1 Area’s selection by a meeting with people in the community. Develop guidelines of work for designing learning sites. Started from selecting suitable areas to developing a learning based preserving traditional seeds, plants and vegetables. Upgrading to be a learning site in

the community with areas selection criteria; 1) Area linked to the use of traditional seeds of the Pwo Karen people, preserve biodiversity of local species 2) Area that the farm owner is interested in development to preserve the seed and local wisdom knowledge, wisdom of caring seeds and plants according to ethnic folkway. 3) Area that the farm owner has a dream and want to develop their farm to a learning site. 4) Prototype area, using existing cultural capital or costs from the community to generate local people's income to support community economy and culture. 5) Area that creates participation of local people to get direct and indirect benefits sharing for landowners, people in the community, and people outside the community. Four locations can tell stories about seeds, planting, and utilization in different contexts in ethnic culture according to the areas of interest of agricultural farm owners. From surveys, interviews, areas, and ideas were found to be developed as learning centres. See in Table-1.

Table- 1: Community Learning Site's Content for Traditional Seeds Saving

LS	Learning Site Content	Farm Owner	Location
1	Forest Recipes	UK	Ban Taiy Community
2	Herbs Pots	LJ	Ban Khlong Salao Community
3	Pwo Karen Kitchen	AO	BanMai Khlong Angwa Community
4	Traditional Seeds-Food processing	SF	Baan Emad-Esai Community

1.2 Contact an expert in architecture and landscape design, who came to design the research area's landscape and bring the wisdom of the community to design and communicate the stories and contents in the community learning centre. The process was to explore the target areas and design the community learning centre.

1.3 Data were collected from key informants. The researcher had explored the landscape of the farm and the trees and the planting of all agricultural farm and transfer the surveyed data to a specialist to design the farm areas and encourage people in the community to participate by holding regular meetings with researchers, experts and villagers. They were participating in the research project periodically to share and exchange their experience.

1.4 Space design specialist surveyed communities' areas to examine information and discussion with the selected farm area's owners and draw up a landscape plan design of the learning sites with content and details in each site. Four learning centres already designed and handed over to the researcher to fulfil 1st objective of the research project.

1.5 Present learning sites area maps. The preliminary draft of the learning site was considered in a focus group of specialists and stakeholders. The learning site area maps were sent to the farm owner for initial consideration, and to reflect their opinion on the learning site area map. Then the focus group managed to discuss and exchange the search results together with the management team of The Royal Initiative Discovery Foundation, Integration of the Royal Initiative Projects for the Country's Sustainable Development (*Phid Thong lang Pra*) who granted funding support for this research project.

1.6 Search the guideline of learning sites. In the meeting, there was an analysis showing the further development of agricultural farms in the selected areas, the guidelines, and methods that will lead to the development of traditional seeds saving learning sites in substantial.

2. Experiential Learning Model in Community Learning Sites to Promote Food Security and Sufficiency Economy in Wildlife Sanctuary, World Heritage Site, Thailand

Learning Sites, Concepts, Design and Experiential Learning of people in the community "Pwo Karen" ethnic group whose way of life depends on natural and agricultural environment. Traditional seeds in their community are for sufficient use. This research has proposed learning from experience in traditional and present ways of ethnic life as follows:

2.1. Ui Kure Learning Site (LS1-UK)

Experiential learning by planting fruits and trees, people in the community or outsiders learn how to grow fruits and trees by themselves. Learn how to live in nature and in the forest, also people can learn about food from forest in all seasons.

The materials in this learning site were provided 1) First Ponds show fertile water sources, edible plants, vegetables, and ornamental plants. Which is an ecosystem of plants around the pond. 2) Second Pond shows local traditional plants brought for food is the main purpose. 3) Coffee pavilion surrounded by the beautiful view and the areas full of coffee trees and fruits. 4) Traditional seeds pavilion for meeting and exhibition.

Learning Process and Activities

Experiential learning on Ui Kure learning site, learners will learn about plants from forest, and ways how to collect the seeds in the forest. Cooking from ingredients picked up from the forest. Learn how to make coffee products and various local fruits. Learn how to make coffee from picking coffee seeds from trees, dry, roast, crush, brew, and drink as self-service. This is the cultural ecology lifestyle for a sufficiency economy. Meeting also as part of experience that learners can learn from network and action. Exhibitions provided by raw material and poster exhibition tell stories and development of Pwo Karen's community. See photo 1- 2.

Photo-1: Forest recipes, LS1-Ui Kure.

Photo-2: Design of Ui Kure learning site.

2.2. Lung Joong Learning Site (LS2-LJ)

Experiential learning by planting herbs for traditional treatment. People in the community or outsiders can come and learn the pros and cons of monoculture(monocrop). Search for a variety of herbs in the forest. Plant herbs. Build a herbs house on a farm. Learn how to produce herb medicine and treatment from local wisdom.

The materials in this learning site were provided 1) herbs food and herbs medicine plant site. Design categories as main herbs, herbs tea, herbs foods from forest grow with fruits along

wetlands 2) garden near little creeks, plant various herbs from lower level to high level farm area. Growing plants as steps access to the top of the high area, and flat area on top of the farm. Banana trees around a star watching area. 3) herbs pavilion and traditional seed saving space for research and study.

Learning Process and Activities

Experiential learning in Lung Joong learning Site. Learners will learn about herbs and food from the forest by walking to natural study trails. Learn how to collect the various herb seeds. Learn how to develop the site in the local area, plant banana trees, and in the future will be a place for stars watching. Listen to Pwo Karen stories telling. Health and body healing and training for local people. Studying and doing research, exhibitions, demonstrating how to make herbs, medicine process, herb food process, herb tea and beverage process. Outsiders can learn by doing, get experience about herb plants, natural disease cure, herb medicine process (crush, boil, sauna). Learning how to build *Karen* traditional bamboo house without nails. Workshop on herb; natural therapy for body and health (facial spa, hand spa, feet spa, herb sauna, herb meal, herb medicine) and basic healthcare. **See photo 3- 4.**

Photo-3: Herb pots, LS3-Lung Joong.

Photo-4: Design of Lung Joong Learning Site.

2.3. Aoy Learning Site (LS3-AO)

Experiential learning by cooking traditional food, joining and participating in "*Pwo traditional food*" cooking in small groups or in class. Learn to start up business by opening the local restaurant "Krua Karen" that services indigenous food. Tell stories about indigenous plantation products and cooking recipes. Natural food for medicine. Create a tiny space of seeds and plants networking in the local community and product market. Indigenous food processing (fruits, bread, and syrups). Indigenous botanical learning centre for local people and visitors.

The materials in the learning site were 1) vegetables plantation plots and indigenous veggie nursery greenhouse. 2) Antique Karen Kitchen pavilion and cooking stuff.

Learning Process and Activities

Experiential learning in Aoy learning Site. People learn through folklore, stories of indigenous food. Taste of indigenous food. Learn how to cook, food processing, processing fruits, wildflowers and plants parts for main dishes and beverages. Join the meeting on the topic "plant genetic conservation". Learn to produce local products and local market management.

"*Karen kitchen*" is a space for learning about ethnic food and participation in cooking, social entrepreneurships, share experiences, indigenous herbs food and medicine, culture, and lifestyles of *Pwo Karen* that related plants and believe, eating tradition, food in ritual, traditional seeds saving process, this is support lifelong learning for everyone. **See photo 5-6.**

Photo-5: Design of Aoy Learning Site.

Photo-6: "Karen kitchen" experiential learning, LS3-Aoy.

2.4. Srifah Learning Site (LS4-SF)

Experiential learning by surveying organic vegetables farms. Area design for indigenous seed saving model. Winter plantation plots design. Indigenous seed saving check-in points and local culture environment.

The materials were provided 1) Organic vegetable and fruits plots pick and resting area. 2) Vegetable and fruit pavilion in a farm.

Learning Process and Activities

Experiential learning in Srifah learning Site. Learner will have relaxing activities in this site where they can sit and drink juice while they listen to the stories of traditional seeds and Pwo

Karen ways of life from local wisdom. Learner can visit organic strawberries plots and pick them. Knowing seed saving and traditional plants and products. Learn how to grow traditional seeds and practice local plants processing as soap, scrub, herbs, foods syrups, herbs, and strawberries drink. See photo 7-8.

Photo-7: Food processing, LS-4 Srifah.

Photo-8: Design of Srifah Learning Site.

From the four farms to the design of learning sites centre to promote conservation of traditional seeds of Pwo Karen communities had steps to design the seed saving learning sites based participatory and learning from experiences as follows:

1. **Area's selection** by community participation.
2. **Contact learning spaces designer** as an architect and a landscape designer to design research areas landscape from applied local community wisdom as contents in learning sites.
3. **Researchers and villager's participation in data collected** by exploring the selected farms in the research, survey landscape, the maintaining and planting trees in the areas.
4. **Space design by specialist** to draw four map plans of 4 learning sites.
5. **Presenting** the learning sites design on areas map.
6. **Guidelines** to detailed learning resources lead to the development of traditional seeds saving learning sites in substantial amounts.
7. Learning sites based experiential learning showed the learning process and activities that guide people to learning freely and able to save their traditional seeds and culture in local and non-formal education. See in Table-2.

Table-2: Learning Sites Based Experiential Learning

Learning Sites (LS)	Experiential Learning	Learning Processes & Activities
LS1-UK	-Plant fruits and trees -Live in forest & nature -Find food from forest in all seasons -Learn cultural ecology lifestyle &sufficiency economy	-Collecting seeds in the forest -Cooking ingredients from forest -Make coffee products and various local fruits
LS2-LJ	-Plant herbs& traditional treatment -Know herbs in the forest -Produce herb medicine & treatment for local people	-Walking on natural study trails -Collect the various herb seeds -Pwo Karen stories telling -Health and body healing and training -Research, exhibitions, demonstrating local herbs -Medicine, herb food & beverage produce -Natural therapy -Build a traditional house without nails

LS3-AO	-Cooking traditional food (indigenous food) -Natural food selected for medicine -Startup business, local restaurant "*Krua Karen*" (Karen Kitchen) -Create Tiny space of seeds and plants network in local community & product market	-Tell stories of indigenous food -Taste indigenous food -Community participation -Social entrepreneurships creating -Share experiences in culture and lifestyles
LS4-SF	-Survey non-toxic safe vegetables farm -Observe indigenous seed saving model in a world heritage -Winter plantation plots & checkpoint for tourist	-Relaxation activities -Visit organic strawberries plots and pick them -Grow traditional seeds and local plants veggies fruits processing

An experiential learning model for food and economic security of communities in wildlife sanctuary, world heritage site. "Pwo Karen" ethnic group whose way of life depends on nature, environment and agriculture. They are keeping and saving traditional seeds for sufficient use. This research has proposed learning from experience in traditional and alternative learning choice to their ways of life.

Conclusion

Traditional seeds and plants learning sites design process in Pwo Karen community, natural world heritage site, Thailand has a process for designing a learning centre as follows: 1) Select areas in research criteria by farm areas linked to local wisdom, emphasize traditional local seeds usage as plantations, preserving local species and biodiversity in the community where location is in natural world heritage site. There were four farms, where the farm owner was interested in traditional local seeds saving. He/she had knowledge and wisdom in caring for their seeds and plants of Pwo Karen in ethnic ways of life. There were spaces where the farm owner had a dream and needed to develop his/her own space as a source of learning to a learning site. To make a model area for using existing social capital in the community to generate income for local people in the community. It is an area that encourages people to save seeds and learn participation in the community. And to share the benefits from the research activities. 2) Contact a landscape design expert for plans to integrate local community wisdom to design seeds conservation landscape in the selected farms. 3) Collecting data and analysing. 4) Designing the farm areas 5) Proposing a map plan of the farm that is to be designed for learning sites 6) Guidelines as finding ways to develop learning site and activities of learning to support local people in the community to lifelong learning through their traditional seed, saving for food security and sufficiency economy. According to the research on crop diversity in Japan which is on the ebb, eroded by factors such as the raise of industrialised agriculture and a dearth of knowledge transmission between generations. Japanese farmers follow a practice vital to fostering agrobiodiversity: seed saving. Researcher tracked diverse seed governance and sharing system across four groups of producers: traditional, organic and lifestyle farmers and local community members, found difference in the way seeds are valued-cultural, economic, right-based, familial, or personal-that influence approaches to saving and sharing seeds. Organic and traditional farmers and

community growers, for instance, tightly regulate seed distribution, and part-time producer are far keener to actively share seeds. The researcher concluded that a plurality of practices, like crop diversity itself, builds in resilience by spreading risk and offering a range of responses to future uncertainties (Ayako Kawai, 2022). The seed saving learning designed from this research aim to support people in the community to active learning and learning from their experience to reduce risk of food security to future uncertainties as the same, learning experiential from this research should be promote.

Pwo Karen ethnic group, seed saving learning centre in natural world heritage site. This research, learning sites and areas were distributed in four villages. There were four learning sites in four agricultural farms to promote experiential learning local people in community and outsiders and together with the researchers and those who are involved. Data Collection were started from learning together with the farm owner and the local wisdom people in the village to cultivate local seeds, native plants, and diversity of seeds. Design of seed storage areas according to the Pwo Karen culture and the way of utilizing seeds and products from planting in agricultural fields and bringing it to further learning and more experience. Developed a learning site to maintain knowledge and the way of life of Pwo Karen and their culture. Encourage local people through Learning from experience, exchange information, ideas, knowledge among each other. Learning to develop self-awareness in nature, appreciating the value of culture and wisdom related with nature and environment which are existing in their community. Develop seed saving learning sites and natural resources to promote the community-based sufficiency economy. Learning centre that provided ethnic culture, wisdom, knowledge and creative design in natural world heritage site to further learning and biodiversity conservation to reduce global warming crisis. Indigenous people bring cultural capital in their community to learn and develop their community and save the natural environment through culture. This is an experiential learning, an alternative model for developing the economic and education and learning for local community, that directly corresponds to solving the problems and the needs of the local community, which are obtained from findings from this research.

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Improving Educational Management in Developing Countries Using an Operational Research Approach

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Abstract
Educational management requires equal rigour and meticulousness as any other management obligation. Efficiently administered education, training, and growth strategies can provide developing nations with proficient individuals with the knowledge and expertise necessary to fulfil various governmental goals and aspirations. This research paper aims to a) present an enhanced practice model for educational management procedures and b) cultivate a learning culture to improve educational results. This statement purports to furnish a framework of audit criteria for future research endeavours within this field. In recent years, various countries have demonstrated substantial efforts to align their learning and development strategies with their respective societal requirements. Low-income nations have yet to exhibit the efficacy and cost-efficiency of their educational investments in learning and developmental outcomes and their contributions to the overall education system outcomes. Identifying crucial determinants that significantly enhance educational outcomes, specifically in increased literacy, numeracy, and critical thinking, amongst children experiencing extreme poverty prevails as a fundamental pursuit. The factors to be considered encompass assisting student enrollment and retention and enhancing the accessibility to educational institutions. Also, facilitating the standard of education dispensed within schools and revamping the efficacious institutional funding and management strategies to reduce adequate incentives directed towards advancing the abovementioned factors. The innovative educational capability management model through delineated contours is introduced and discussed. This model is based on the operational research approach. In developing countries, the Ministry of Education controls policy decision-making processes and administrative & financial responsibilities.

Keywords: Educational Management, School Administration, Educational Policy, Capability Maturity Model, Operational Research

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Introduction

The management notion relates to coordinating institutional activities to successfully and economically accomplish their goals with the resources. These resources consist of financial, natural, and human capital. In the 20th century, management science emerged as a field of study connected to social sciences and organisational studies. This science applies human public relations by allocating authority effectively and identifying responsibilities in problem-solving, making wise judgements, managing change, developing business philosophy, and presenting ideas, laws, and business principles, including organisational procedures and practices.

The capacity to create formal institutions that mandate achieving goals and performing administrative duties has also been connected to management. Social, educational, and healthcare institutions, as well as the police, military, and succession planning, are examples. A team of people or a single person, such as the teacher in charge of the classroom, handles the administrative tasks. We draw attention to the fact that just like the other ministries' government structures, educational management affairs can designate governors, senior officials, and school committees to create sub-departments. Managers must perform their jobs effectively and be trained in management science, ongoing decision-making, planning, and problem-solving. The managing director has five crucial duties: arranging, commanding, coordinating, and controlling. Future action plans are included to ensure that human and physical resources carry out tasks and perform their jobs efficiently and effectively. Conversely, the success of administrative work depends on the interaction and collaboration with personnel and the processing, analysis, and information needed to make the right judgements [1-17].

Educational Management

The previous report discussed aspects of educational management in Egyptian pre-university education[17]. According to West and Wolfe [10], educational institutions use individuals, material resources, and scholarly administrative plans to compose, coordinate, and screen all informative teachers to carry out instructing errands effectively and proficiently. In this regard, all nations work to improve education programmes that develop all aspects of social, economic, and cultural advancement. These programmes include the following: 1) implementing the policy and achievement goals, 2) planning, organising, and coordinating, 3) regulating human resources, 4) issuing the right decisions, and 5) achieving the goals and objectives of the institution. This arrangement had connected to the energetic capacity to pring almost social alter to protect social personality and national having a place. Proficient administration to realise the adequacy and effectiveness of instructive education requires a) developing institutional strategies, b) qualifying the educational leadership, c) Identifying the tasks and responsibilities of the education managers in all educational stages, d) Making the proper choices to handle data, communicate, unravel issues, and make an effective team, and e) arranging for all programmes, scholarly evaluations, developing educational programmes and surveying understudy execution, and setting up a budget and making the finest utilise of monetary assets. In this framework, the previous report discussed aspects of educational management in Egyptian pre-university education [17]. The educational management functions are summarised and shown in Figure 1.

The Development of Educational Management

Management science gave birth to the field of research and practice known as educational management. It initially applied to business and industry. The use of industrial management techniques in educational settings has increased dramatically. The growth of this subject as an academic field has been constrained, and it generates substitute models based on student observations and experience. By the twenty-first century, the primary ideas had either been developed in the context of Education or modified from industrial models to suit the unique needs of educational institutions. From a new field based on concepts created in other environments, educational management has expanded into research and theories. Urban schools have replaced small rural elementary schools as the predominant type of educational institution. It also concerns various school issues, each calling for a unique strategy. It reflects the different theoretical facets of social sciences and Education.

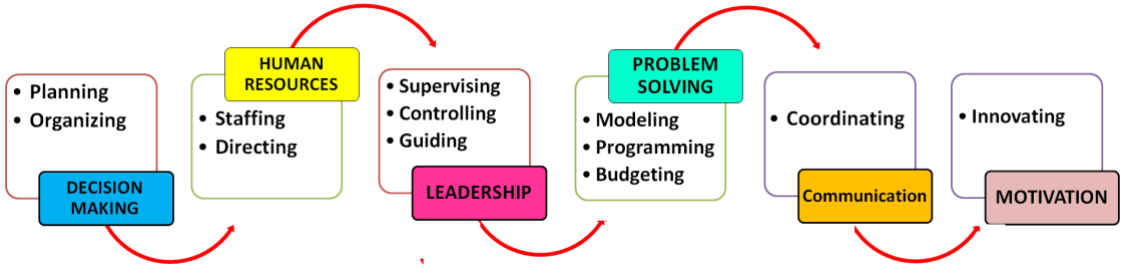

Figure 1: The functions of the educational management (The figure is recalled from Ref.[17])

A specific activity known as educational management organises all aspects of the educational programme, including its human and material resources, to achieve an effective and positive end. Academic institutions operate in a dynamic environment that supports ongoing plans and improvement implementation. Administrators, teachers, and employees must receive training to improve administrative proficiency. Educational management tasks require stakeholder follow-up, persistent observation, problem-solving, and problem identification. Academic management looks after the staff and human resources, establishes the educational institution's vision and mission, promotes teamwork and goal-setting, and assures the effectiveness of the job. It is important to note that educational management is concerned with its personnel's effectiveness, commitment, and goal-setting.

Its primary responsibilities include monitoring fieldwork completion, ensuring planned plan application and fulfilment, and offering advice to enhance working procedures. Identifying strengths and flaws and developing other options for ongoing improvement also increases the work's effectiveness. All facets of an institution are covered by educational management, including planning procedures, targeting, making the best use of available resources to avoid wastage, duplication of effort, unhealthy behaviours, and systematic implementation of plans. Education planning is done at the central level in developing nations by the Ministry of Education, the province, and the school levels. Budget preparation is one of the key components to the administration and success of the company. It requires estimating revenue and expenses, maybe accounting for emergencies as necessary. Education planning is done at the central level in developing nations by the Ministry of Education, the province, and the school levels. Budget preparation is one of the key components to the administration and success of the company. It requires estimating revenue and expenses, maybe accounting for emergencies as necessary.

The centralisation system oversees institutional control about the availability of physical resources, infrastructure, and human resources of stakeholders.to ensure efficiency, productivity, effectiveness, and benefit in the teaching and learning environment.

The main functions of the education department include:

- Preparing the curriculum for different educational stages according to its various capacities.
- Scheduling the academic calendar,
- Designing joint courses,
- Organising schoolwork,
- Constructing and completing the school infrastructure,
- Organising and conducting examinations,
- Guiding educational institutions,
- Managing community outreach programs,
- Providing auxiliary services such as student nutrition, school uniforms, books, medical examinations, etc.

The effectiveness and quality of management are reflected in its capacity to utilise and focus people and material resources on meeting set goals. The following are the most crucial elements:

- Strong leadership that can communicate with followers to foster responsiveness and respect for authority figures,
- Organisation and sound direction, and
- decision-making.

Educational Management in Developing Countries

Developing countries have various activities and processes, from planning to budgeting. The formal government executes the fundamental administrative procedures within the confines of the educational system. Following its policies, aims, methods, and educational philosophies, the Ministry of Education is concerned with scholarly work at the national level. The Ministry of Education, which represents the policy and is adopted at the regional or provincial level, describes the administrative processes achieved for educational objectives and execution of the educational approach. The regions take on middle-level management responsibilities for educational activities at the educational district level and put the senior leadership policy into practice. It often gives the academic Department of Education some financial and administrative authority that aids in completing the task and implementing operations. The executive powers must oversee the local schools and create local regulations. Education is the interaction between the school and the community and its association with its ideas, plans, and data for senior management and procedural work areas.

Centralisation Versus Decentralisation of Education Management

The self-determination approach of the government is a vital step in making a modern instructive framework, which is the procedure for making the family and ensuring that the kids can take an interest in their development. The service of Instruction habitually serves as the sole specialist beneath which all instructive teaching and operations are subjected. Notwithstanding their conclusion or interesting circumstances, nearby specialists and sub-departments are included in the implementation handle this way.

In our previous report [17], the duties of the Ministry of Education under a centralised regime are given and discussed. The primary responsibilities include Choosing the educational policies, issuing the government laws, training academic supervisors and teachers, and improving their knowledge and expertise through specially designed rehabilitation and training programmes. Also, Employing adult education programmes to eradicate illiteracy and stop its causes, conducting educational studies and research to improve the educational process while taking into consideration global modern practises and trends that don't contradict societal values, heritage, and traditions, putting into practice initiatives that lay the groundwork and guidelines for the teaching and learning process at all public education levels, Completing the thorough cooperation with all public and private educational institutions involved with technical and public Education to combine academic and educational efforts and accomplish higher educational goals; technically, according to national education legislation. As well as providing the necessary teachers, curriculum, facilities, school supplies, and educational technology for the educational process, Collaborating with other governmental agencies, organisations, and members of civil society to advance science and culture to further the advancement of humankind, completing any additional tasks imposed by the nation's political leadership.

It is worth noting that there is a global trend towards decentralisation in Education; studies have shown that the more decentralised or less centralised the industry and educational decision-making, the more rigid the system of academic authority becomes, leading to the creation of innovation. Countries that have been quick to decentralise the education system have made great strides in improving educational outcomes and quality. Figure 2 illustrates the main structure of the decentralised educational management system.

The Evolution of Educational Administration

To tackle global problems and join the knowledge society, developing education in developing nations became necessary and rational at the beginning of the twenty-first century. It was required to move towards decentralisation in education with the chance for the community to play a bigger role and engage in educational management.

A new structure with the following traits emerged in several nations:

- Decentralisation facilitates task completion and accelerates decision-making,
- Extending and activating delegates, achieving seamless communication in all directions between various departments, sectors, and management levels,
- Increasing communication between departments and individuals by exchanging ideas and perspectives.
- Applying the principle of accountability and clarifying the boundaries, roles, responsibilities, and follow-up processes

A Reaffirmation of Educational Vision

The reaffirmation of educational vision requires an alter of attitude, allowing the advancement of objectives, approaches, and programs supporting the concept. Moreover, the Arranging Commission's 'Vision 2030' contends that such a mentality commits to modern societal goals. The instructive framework must give quality education to children and youth to figure out their potential and contribute to the advancement of society and the country. They ought to make a sense of nationhood, the concepts of resistance, social equity, popular government, territorial nearby culture, and history. Below, we present the future-oriented

proposals for education development at all stages. These suggestions are based on using tools from statistical modelling and operations research. The capability maturity model and operations research scenarios [16] will cover the following topics:

- Reviving the current educational system to meet the social, political, and spiritual demands of individuals and society,
- Fostering a sense of nationalism and solidarity, as well as the desire to establish a welfare state for the people,
- Promoting national unity via mutual respect for one another's beliefs, culture, and ethnicity,
- Providing and ensuring equal educational opportunities for all citizens and giving minorities access to adequate cultural and religious development facilities to contribute effectively to the overall national effort.
- Establishing social and cultural harmony through the deliberate use of the educational process.
- Developing a self-reliant individual, capable of analytical and original thinking, a responsible member of society, and a global citizen.
- Nurturing the individual's total personality is dynamic, creative, and capable of facing the truth as it emerges from the objective study of reality.
- Educating people who are dedicated to democratic and moral principles, conscious of basic human rights, receptive to new ideas, responsible for their actions,
- Engaging in beneficial social activities, increasing the quality of Instruction offered in government-owned institutions by establishing standards for academic inputs, processes, and outputs, and institutionalising the process of monitoring and evaluation from the lowest to the highest levels,
- Enabling the fulfilment of the commitments to achieve the action education for all Goals.
- Widening the access to Education for all and improving the quality of Education, particularly in its relevance to the economy's needs.
- Equalising access to Education by providing special facilities for girls and boys, underprivileged/marginalised groups, disabled children, and adults.
- Eradicating illiteracy within the shortest possible time through universalising quality elementary education coupled with institutionalised adult literacy programs,
- Enabling an individual to earn livelihood honestly through skills contributing to the national economy and making informed life choices.
- Emphasising diversification from general to tertiary Education transforms the educational system from supply-oriented to demand-oriented.
- Preparing the students for the work world,
- Encouraging research in higher education institutions will contribute to the country's accelerated economic growth.

Capability Maturity Model Application

In Educational Management, It is claimed that a process model with enough flexibility to direct learning development is required to improve educational performance in developing nations. Promoting appropriate educational technology resources independent of technical platforms, organisational structures, and pedagogical frameworks is essential. To guide advances in their work while maintaining flexibility in implementation, technology, and business models, software engineers have long realised the limitations of traditional ad hoc practices. The Capability Maturity Model (CMM), a framework for driving process

improvements in an organisation's software development processes, has become a widely accepted standard [5].

A. Capability Maturity Model Overview

The Capability Maturity Model addressed problems resulting from enterprises' incapacity to control the software development process. They couldn't see the advantages of more advanced techniques and equipment since they were always stuck in firefighting mode. The capacity Maturity Model is a five-level framework for assessing the maturity of software development processes at educational institutions and outlining the essential procedures or actions needed to improve the efficiency or capacity of those processes [5].

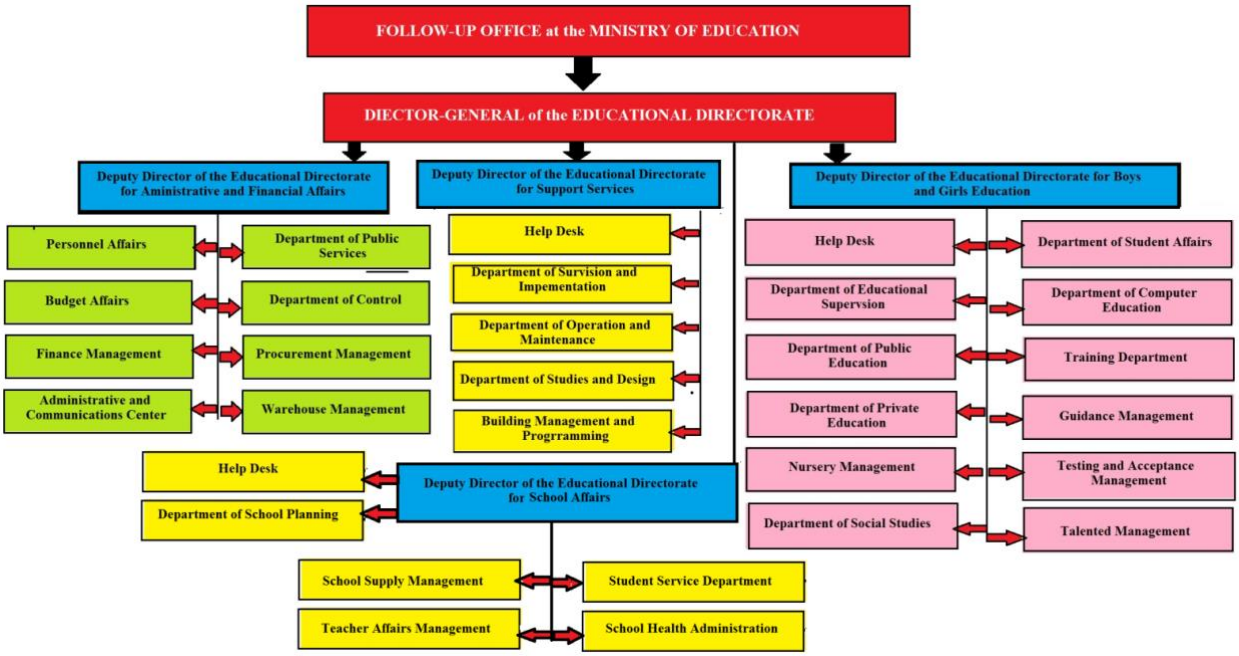

Figure 2: The decentralised educational management structure

1. The capacity Maturity Model is a five-level framework for assessing the maturity of software development processes in educational institutions and outlining the essential procedures or actions necessary to improve the efficiency or capacity of such processes. The model's five tiers can be summarised as follows: 1) Initial (The software development process is sometimes described as ad hoc and even chaotic. 2) Repeatable (Basic project management processes are established to track cost, schedule, and functionality, and the necessary process discipline is in place to repeat previous successes on projects with similar applications), Few processes are defined, and success depends on individual effort and heroism, 3) Defined (The software process is documented, standardised, and incorporated into a standard software process for both management and engineering operations, 4) Managed (Detailed data on the quality of the software development process and the final product is gathered, 5) Optimised (Continuous process improvement is possible by quantitative input from the process and through piloting novel ideas and technologies). Both the software process and products are quantitatively understood and managed. The model offers a roadmap for enhancing an organisation's software development processes [5].

2. The framework provides several waypoints for changing from an ad hoc method of software development to one that is more integrated and always improving. The model also offers a standard by which an organisation may assess its capacity plan and gauge potential future advancements. Additionally, it enables an organisation to determine how well it performs compared to other businesses in the same sector.
3. It helps a company identify and prioritise changes that should be made to its current procedures. The model's recognition of the crucial main process areas required for the advancement of software development, as outlined by present industry experts, is its last advantage. This model provides an ongoing list of key practices and provides the software engineering industry with an everyday basis for discussing and disseminating good practices.

B. Determination of the Education Strategy Processes

Education development in developing countries faces many obstacles; it is necessary to disassemble the strategic educational plan into its components from the core and the subsidiary processes. The core of the education strategy consists of ten pillars, namely: 1) Educational Policy, 2) Educational Management, 3) Educational Economy (Budget), 4) School/University Construction and Equipment, 5) Educational Curricula (Programmes and courses), 6) Educational Teaching Methods, 7) Educational responsibilities, 8) Educational Human Resources, 9) Evaluation, 10) Media and Educational Development Intensive work should be performed to classify the key educational areas (KEA), including all activities and processes. In a previous report [17], these education pillars have five thousand processes. A tree model was suggested to present the pillar's processes.

C. Assessment and Measurement Issues

Unfortunately, there is a lack of assessment data in many developing countries. Significant effort-intensive quantitative data about education in these countries was found. As mentioned above, this data was collected by UNESCO, UIS, and International Bank. It is based mainly on the information provided by the official governmental agencies, the Ministries of Education, and each country's statistics institute. These data cover only 5% of the identified processes in all educational pillars. Accordingly, the performance of the academic core structure, including the components of all activities and processes, is missing. The Education modelling (EDUMOD-EGYPT) guide was introduced in a previous report to improve education management, reduce educational waste, and diminish input errors [16]. The execution of this model is based on the selected appropriate mathematical models of the operations research. The design of this model requires valid and reliable data, with clearly analytical measures that can drive all policy changes and considerations. Referring to the EDUMOD-Egypt model described in Ref.[16], Figures 3-8 show the methods of solving problems in education, selected educational management activities, processes, guides, strategies, and plans, respectively.

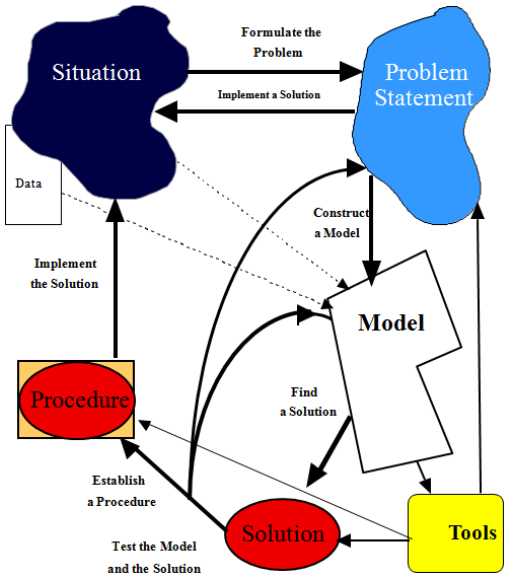

Figure 3: Method of solving a problem in Education using the Operational Research Approach

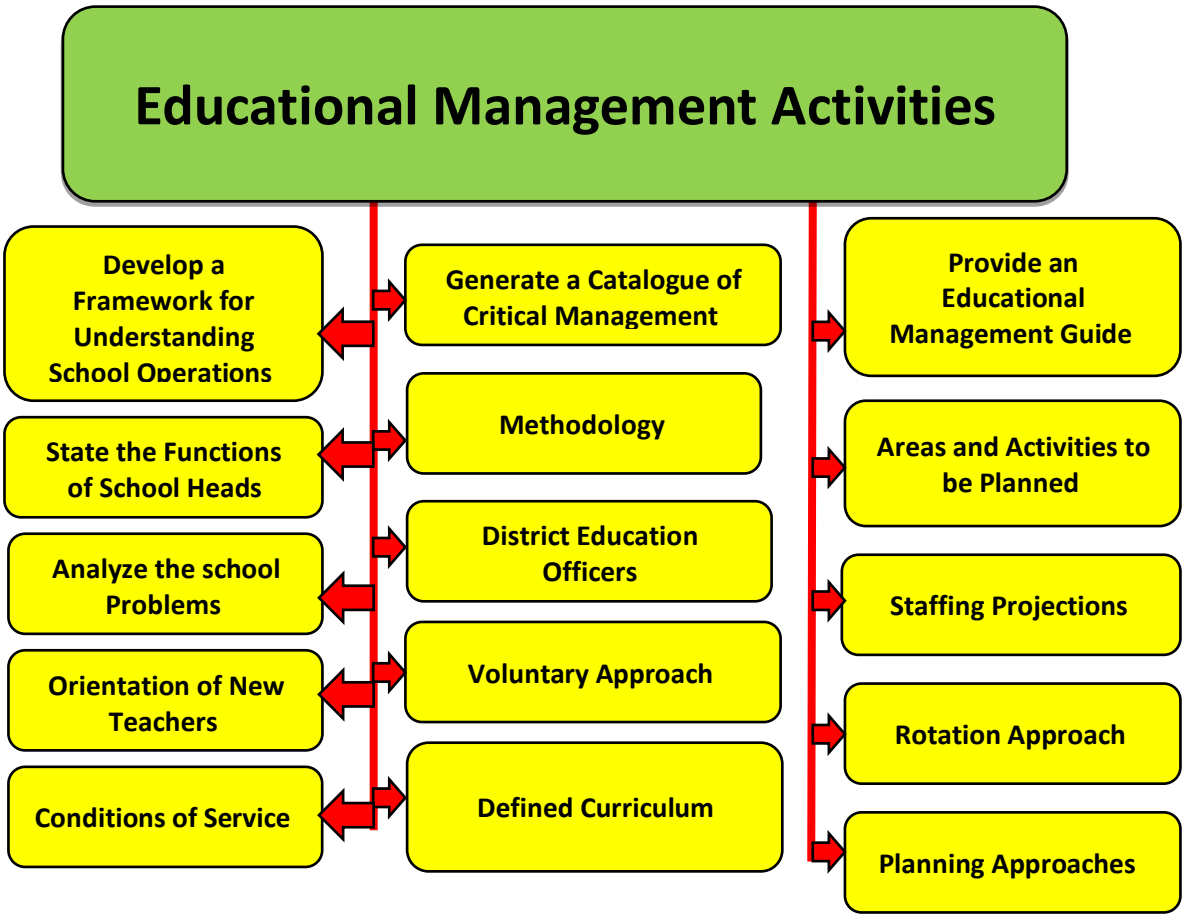

Figure 4: Educational Management Activities

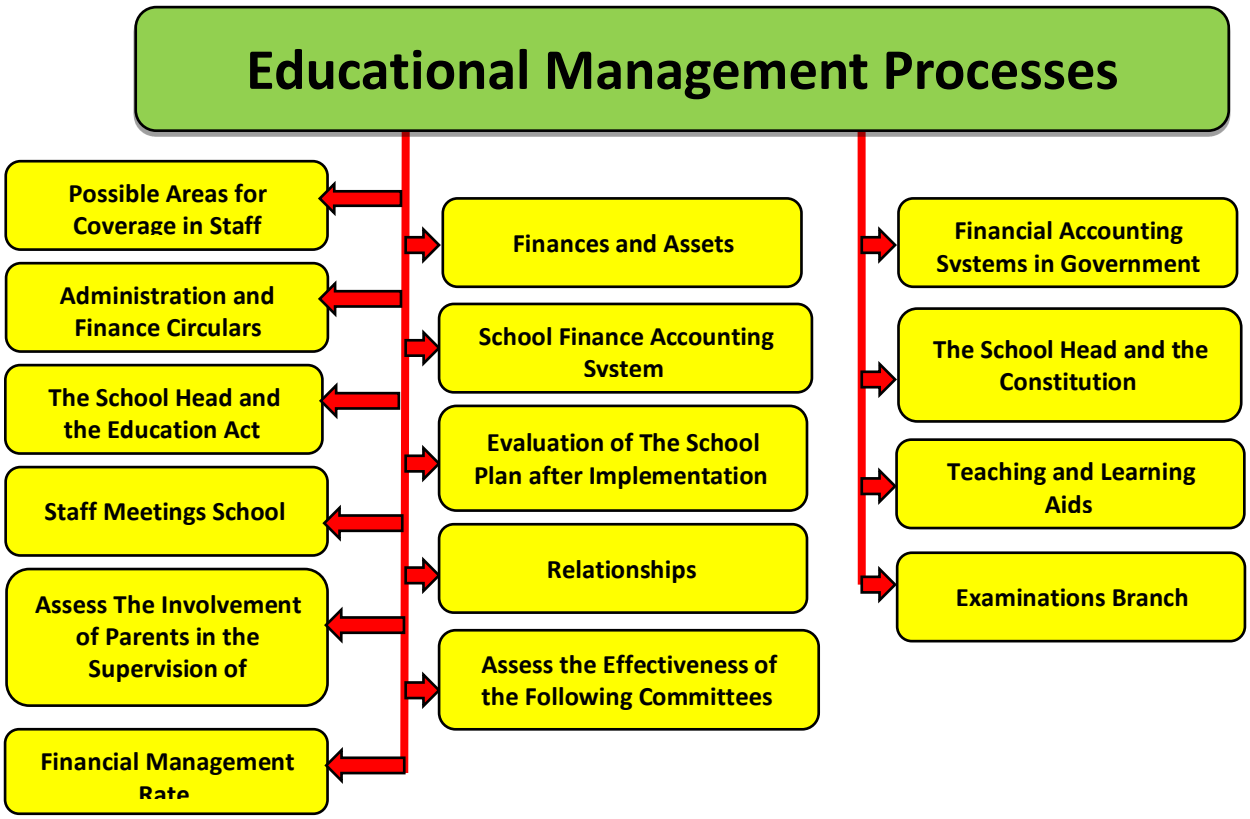

Figure 5: Educational Management Processes

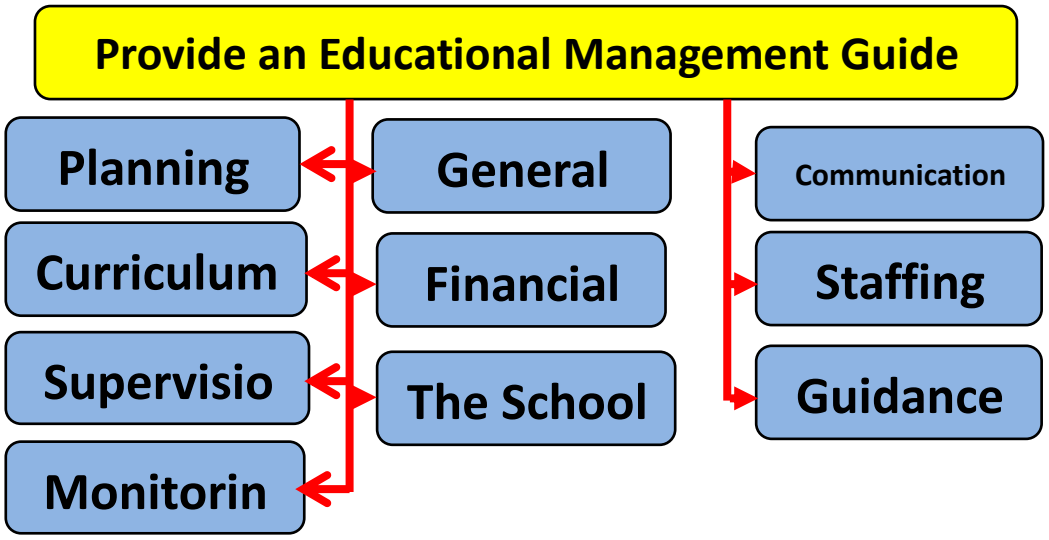

Figure 6: Educational Management Guide

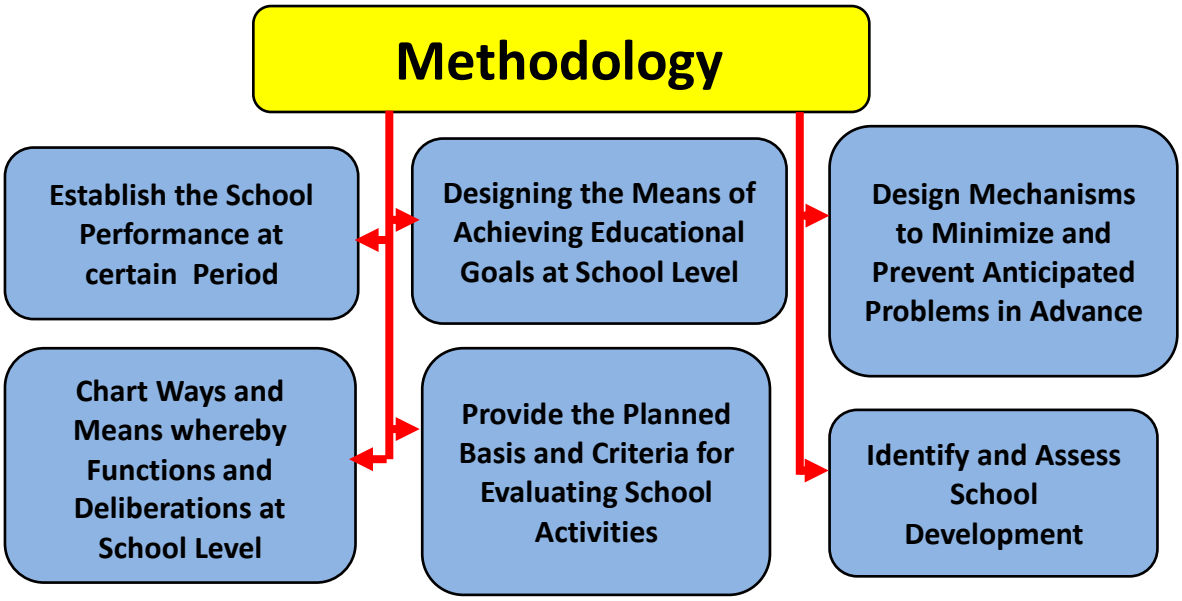

Figure 7: Educational Management Methods

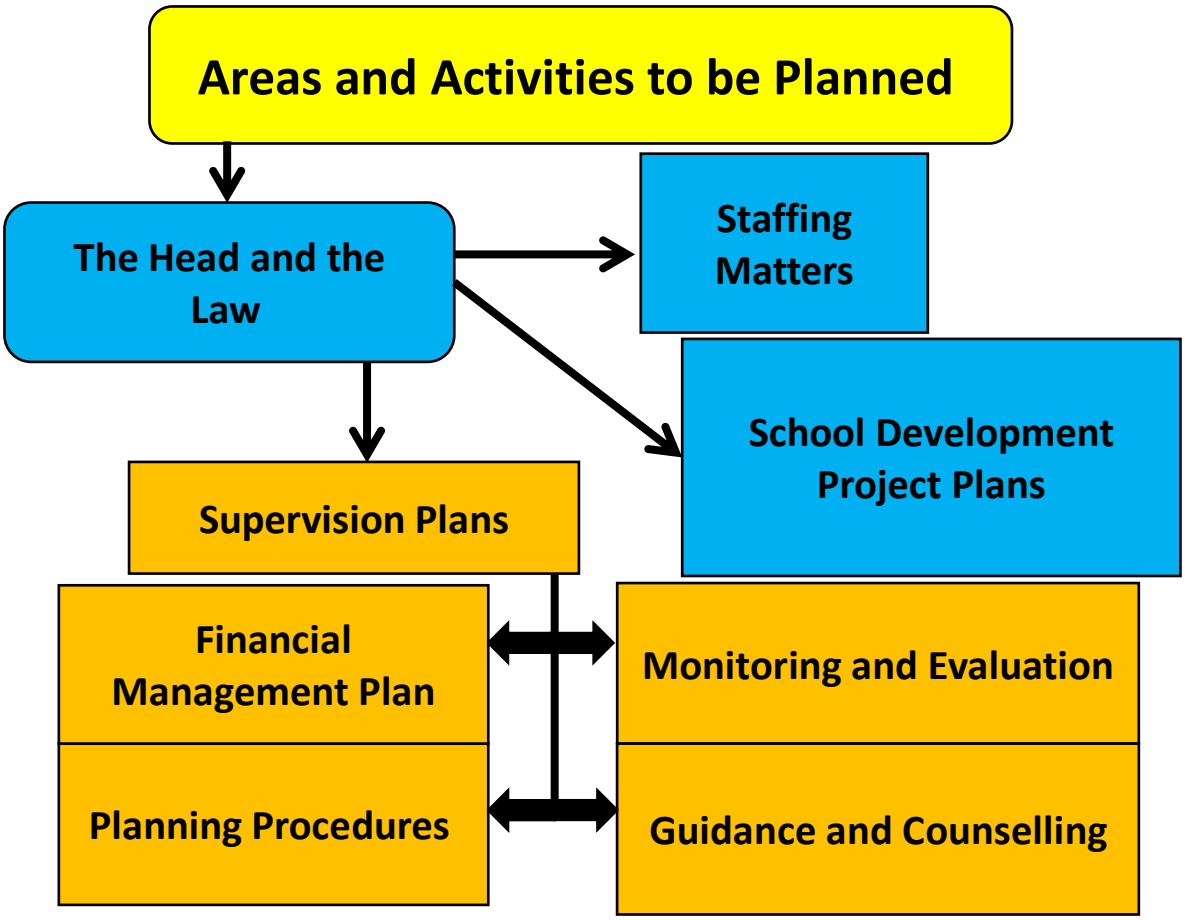

Figure 8: Areas and Activities to be Planned

Conclusion

From the discourse, we conclude that the official specialists directing the Division of Education's issues are in futile circles in developing nations. They cannot alter the current authoritative structures to keep pace with the fast advancement in education all-inclusive. Existing education management is continuously encompassed by centralism and bureaucracy, driving to clashing choices and squandering of time, materials, and human assets. Lost open conclusion interest, guardians, instructors, and other instruction experts debilitate the competition's chances to address their root issues. Instruction supervisors may end up detainees of schedule, reflected within the design of thought, concealment of actualities, and need for straightforwardness.

Authorities give numerous reasons not to overcome unremitting issues, such as tall student-teacher proportions, need for back staff, need for budgetary assets, school buildings, disregard of foundation support, etc. The part of data innovation in learning overlooks the reality that these classic and exceedingly changed strategies are regularly at the heart of students' dismissal of Instruction. Too, the need to keep up with schools' administration and responsibility frameworks and amplifying the part of compelling oversight and assessment influences instruction and learning results basic to creating society's information. Education directors cannot take duty for the instruction system's disappointment in its current shape. The country must choose what instructive disciplines society needs in maintainable advancement through the national exchange. These disciplines are what understudies ought to learn. Specialists must create fitting educational programmes at each arrangement, decide the pace of learning, agree to age, and distinguish ways to control the learner's execution. It requires, at least at first, a noteworthy authoritative exertion. The Central Instruction supervisors are straightforwardly capable of this lamentable result of schools' inexplainable association, open Instruction, abilities securing, individual improvement, and understudy direction.

Additionally, overlooking basic concerns like individual independence, communication capacities, collaborative learning, information application, and the advancement of values relating to the centrality of a mental get a handle on human issues and circumstances is unsatisfactory. The authoritative work inside the system of applying the rules has no meaning without genuine follow-up, particularly in school upkeep, foundation completion, classroom security, and other instructive exercises. In its current shape, informative administration does not serve instructive destinations, consider programs, asset improvement, appraisals, and intelligence between understudies and instructors. Understudies learning and progress have been prevented through classrooms at all stages. These classes were not outlined for understudy investigations, inventive ventures, collaborative work, or co-teaching. Subsequently, the conventional instruction framework has become unsteady, and the specialist of instructive administration has ended up constrained. Breaking the ancient concept of cognitive control and the basic school framework column. It requires auditing present-day regulatory structures past teachers' capabilities, such as people. At long last, we request that the Ministers of Education in developing countries donate this vital subject with extraordinary accentuation. No sufficient instructors can make a contrast in organisational settings without qualified and empowering bosses working with vision, information, and commitment. Still, it's uncommon to discover top-level policymakers and instruction supervisors who speak this dialect. We require a greater picture to spur those at all levels of administration to meet the instructive desires of the 21st century. We will arrange more

benchmarks and measures for the informational administration framework shortly, helping system execution headways and continuing to explore its common applications.

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The Challenges in Producing Social Entrepreneurs Among Graduates From the Indigenous Community in Malaysia

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Abstract
To support the sustainability of entrepreneurship agenda within the Higher Education (HE) institutions in Malaysia, the Ministry of Higher Education (MOHE) launched the Entrepreneurship Action Plan 2021-2025 and the HE Integrated Entrepreneurship Education Guide. This is because, it has been the aspiration of the Malaysian government through these entrepreneurship policies, that Malaysia starts to produce balanced and holistic graduates with entrepreneurial mind-sets and to nurture job creators rather than just grooming jobseekers. Social entrepreneurship which is a type of entrepreneurship has been recognized to create job creators among graduates and contribute to the socio-economic development of the country. However, this aspiration might pose challenges to individuals in marginalized communities such as the indigenous community. Data shows that entrepreneurial activities among graduates from the indigenous community are still limited. This study aimed to explore the challenges in producing entrepreneurs particularly social entrepreneurs among graduates from the indigenous community in Malaysia. It was conducted as a qualitative study based on sixteen respondents who participated in the study. Data were collected through a combination of observation and semi-structured interviews. The findings revealed significant challenges categorized into internal and external challenges. Internal challenges include knowledge, awareness, and attitude, whereas external challenges comprise of support, location, and tradition. This study provides one of the many solutions in combating poverty and building economics for young Malaysians, especially those in the marginalized communities.

Keywords: Indigenous Community, Marginalized Community, Social Entrepreneurship

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Introduction

The government aims to encourage graduates in Malaysia to pursue entrepreneurship as their preferred career choice through entrepreneurship policies. The Ministry of Higher Education (MOHE) has set various aspirations, including the Entrepreneurship Action Plan and the Malaysia Education Blueprint 2015-2025 (Higher Education), to develop graduates with a balanced and holistic approach and cultivate an entrepreneurial mindset. The goal is to nurture individuals who can create job opportunities rather than solely seek employment. MOHE's objective is to produce entrepreneurs with strong entrepreneurial values, attributes, and resilience in the global market, thereby contributing to the country's economic growth. However, this only applies to students of higher education in anticipation that they will be creating more job opportunities for themselves and others as they venture into entrepreneurship.

Graduates from the marginalized communities such as the indigenous community are also given the same chance as those in the HE institutions to engage and to be involved in entrepreneurial activities. The HE institutions help graduates by providing support that can take a variety of forms, from business plan competitions, social enterprise engagements, to mentoring, conferences and workshops. Moreover, the Entrepreneurship Action Plan 2021-2025 agenda has suggested for HE institutions to cultivate entrepreneurship aspects in the curriculum, promoting entrepreneurship as a career opportunity, providing assistance and support to start a business and highlighting graduate entrepreneurship success stories.

Social entrepreneurship which is a type of entrepreneurship has been recognized to contribute to the socio-economic development of countries all over the world. The interest in social entrepreneurship has grown exponentially in Malaysia but, social entrepreneurship is still considered new and uncommon among Malaysians as the business model for social entrepreneurship is based on applying business solutions to social problems. The Malaysian government has expanded its focus on social entrepreneurship through strategic plans such as the National Entrepreneurship Policy 2030 (NEP 2030) and PENJANA stimulus. With the uncertainties in the economic and financial activities, Malaysians are starting to consider social entrepreneurship as either their fixed or side income.

In 2018, the Prime Minister of Malaysia announced a fund of RM20 million. However, the number of social enterprises that emerged as a result was relatively low, with only over 20,000 compared to neighbouring countries like Thailand and the Philippines, which have over 700,000 and 30,000, respectively (British Malaysia, 2018). This suggests that social enterprises in Malaysia are not yet widely recognised and should be taken seriously. It's important to acknowledge their potential as a source of employment and sustainable support, with the backing of the government and society (Malay Mail, 2020).

Before students are exposed to social entrepreneurial activities, they need to fully understand the concept of social entrepreneurship and subsequently harbor aspirations to be social entrepreneurs. In reference to this situation, literatures pertaining to social entrepreneurship activity research are still limited globally, including in Malaysia. The terminology ‘social entrepreneurship’ is still uncommon in Malaysia; nonetheless, its execution can be long traced through the establishment of cooperation for urban and rural dwellers (Rahman et al., 2016). Social enterprise is defined as organizations which use business opportunities to attain social goals. In general, social entrepreneurship is about addressing community needs and bringing about social change rather than just focusing on making money. It aims to improve

the lives of marginalized groups and protect the environment. Research in this area focuses on empowering disadvantaged individuals, such as the unemployed, single mothers, homeless people, and those living in poverty, to improve their lives through their own efforts rather than relying solely on external financial support. By promoting social entrepreneurship among young people, including graduates, the socio-economic disparities among Malaysians can be reduced, creating a more balanced society (British Council, 2018).

Purpose

In 2015, it was estimated that the indigenous peoples of Malaysia, known as Orang Asli, made up approximately 13.8% of the total population of 31,660,700 million. The government of Malaysia has introduced the Orang Asli Education Transformation Programme to improve leadership and management skills at all levels. This initiative aims to address the issues and challenges faced by Orang Asli children more efficiently. Additionally, the programme aims to strengthen collaboration with relevant government bodies that are directly involved in projects and initiatives related to the Orang Asli community.

Social entrepreneurship can play a supportive role in achieving the goals of the Malaysian Higher Education Sector Blueprint: Higher Education Sector (PPPM-PT 2015-2025) by producing well-rounded graduates in education and technical and vocational training (TVET) (Rahman et al., 2016). This education platform focuses on equipping students with knowledge, skills, and an entrepreneurial mindset, creating an environment that encourages social entrepreneurship as a career choice after graduation. Events like the International Conference for Youth Leaders (ICYL 2015) and social innovation competitions promote the development of social entrepreneurs and socially oriented products. Social entrepreneurship shares similarities with traditional business entrepreneurship and spans various fields of study. However, there is a lack of research specifically focused on social entrepreneurship, particularly in Malaysia. Existing studies indicate a moderate level of social entrepreneurship activity in the country.

Data also shows that entrepreneurial activities among graduates from the indigenous community are still limited. There is a lack of involvement in social entrepreneurship among graduates from indigenous communities. The number of successful graduates, including those from indigenous backgrounds, has been increasing. However, youth unemployment rates in Malaysia are rising, making social entrepreneurship an alternative for these graduates. This increase in unemployment highlights the marketability and employability issues faced by both public and private university graduates in Malaysia. Consequently, students are motivated to be more creative, leading them to create social innovations that benefit their communities rather than seeking personal gains. This effort indirectly addresses the problem of unemployment among graduates. Therefore, this study aimed to explore this issue by identifying the challenges faced by graduates from the marginalized communities, particularly the indigenous community in Malaysia, in becoming social entrepreneurs. This study focused on graduates from indigenous communities residing in rural areas in three states with high levels of absolute poverty.

Literature Review

The term 'social entrepreneurship' was created by William Drayton and others to describe businesses that have the purpose of helping people who are left out and giving power to certain groups of people who face disadvantages (Drayton, 2006; Leadbeater, 1997).

According to Drayton (2002), social entrepreneurs notice something in society that is not functioning properly and imagine a big change that will enable them to transform society into a new and improved state. According to Roberts and Woods (2005), social entrepreneurship is about recognizing, evaluating, and pursuing opportunities to bring about significant social changes. It is carried out by visionary individuals who are deeply committed to their cause. Unlike traditional or business entrepreneurs, social entrepreneurs prioritize their explicit and central social mission when considering opportunities. They assess the impact of these opportunities based on how they align with their mission, rather than solely focusing on creating wealth. While social entrepreneurs view wealth creation as a means to accomplish their mission, business entrepreneurs see wealth creation as the ultimate goal (Dees, 2001).

Education in higher education institutions should extend beyond academics and encompass real-world experiences. Fitzgerald et al. (2016) emphasize the importance of students engaging with diverse social issues and developing skills through university-community partnerships, which enable them to make a positive impact on society. Introducing social entrepreneurship education in higher learning institutions is a crucial step in fostering innovation and empowering communities (Halberstadt et al., 2019).

The youth play a significant role in communities and are crucial for the future of community development. Ogamba (2019) suggests that young people can drive innovation in profitable business ventures. For example, young entrepreneurs in Africa have the potential to identify untapped opportunities and create groundbreaking innovations that benefit consumers. This not only adds value to the market but also generates employment, increases government revenue, and promotes economic growth and sustainable development (Ogamba, 2019). Chigunta (2002) categorises youth entrepreneurship into three groups: pre-entrepreneurs, budding entrepreneurs, and emergent entrepreneurs. Pre-entrepreneurs, typically teenagers aged 15–19, are inexperienced and lack business ownership knowledge or experience.

Damoah (2020) presents a different perspective, stating that being born into entrepreneurial families significantly increases the likelihood of young individuals considering entrepreneurship as an attractive life path. However, it is important to explore how youth entrepreneurs can elevate social entrepreneurship to make a significant impact on communities. Countries like the USA and Canada have already started focusing on social entrepreneurship education, and the demand for it is growing. Specifically, there is a focus on cross-campus programmes that highlight the demographics of students in higher learning institutions (Solomon, Alabduljader & Ramani, 2019). The authors argue that social entrepreneurship education should address key questions such as: (1) who social entrepreneurs are; (2) what factors contribute to the success of social entrepreneurs; (3) what benefits and challenges are associated with different organisational models; and (4) how to identify and capitalise on various social opportunities.

According to Waghid (2019), social entrepreneurship is not adequately integrated into the business education curricula in secondary schools in South Africa, both as a concept and an ideal. Furthermore, the schools where pre-service teachers conducted their teaching practise did not include activities related to social entrepreneurship in their business education curricula. In contrast, there is a clear demand for such knowledge among the Taiwanese population. Taiwanese universities are increasingly offering entrepreneurial programmes; the Taiwanese government actively promotes entrepreneurial education; and numerous books on entrepreneurial experiences have been published (Chen, Weng & Hsu, 2010). Kirby and Ibrahim (2011) discovered that students in Egypt are unsure about the role and activities of

social entrepreneurs and are largely unaware of existing Egyptian social entrepreneurs. While most students aspire to work for multinational corporations, a significant number are interested in establishing social enterprises. Thomsen, Muurlink, and Best (2018) investigate the potential impact of university-based social entrepreneurship ecosystems (U-BSEEs) from a political ecology perspective. Their research reveals criticisms of the role of higher education in society, the financial resources and impact of universities on stakeholders, the potential of student-led initiatives and programmes that incorporate adult learning theories, and the changes universities can make to become key players in U-BSEEs. Successful development of university-based ecosystems seems to rely on student engagement and cross-disciplinary collaboration.

Methodology

This study is qualitative in nature where data collection was conducted in two phases: 1) observations, and 2) semi-structured interviews with relevant stakeholders. First and foremost, a list of needs for social entrepreneurships was drafted using available literature. The population comprised of participants from the indigenous communities in Malaysia, particularly on the Orang Asli communities, concentrating on areas in 3 states in Malaysia, namely Kedah, Perak and Kelantan. This identified areas centred in Gua Musang and Jeli in Kelantan, Gerik and Lenggeng in North of Perak and Baling and Yan in Kedah. Since it is beyond reachable areas, approval, assistance, guidance, and training were sought from the Department of Orang Asli Development. From this Department, the key persons for the Orang Asli communities were identified and contacts were established with them through the department's officers. Due to the limited access to indigenous settlements, snow-balling sampling technique was used. The respondents were gathered from the respective higher education institutions, from the heads of villages as well as word-of-mouth. The Semang was one of the sampling targets also known as the Northern Aslian or Sakai. The low-land Semang tribes are also known as Sakai, although this term is considered to be derogatory by the Semang people and are normally found in northern part of Peninsular Malaysia. They are concentrated in the highlands of Kelantan, Terengganu and the northern regions of Perak, Kedah and Pahang.

The observations were conducted in the indigenous communities' settlements surrounding the area. As an observer, the process involved gathering direct information by closely observing the people, their environment, and their surroundings. This method was particularly useful for capturing the actual behaviours of individuals who face difficulties in expressing their ideas, such as the aborigines or orang Asli. Through these observations, preliminary findings were obtained regarding the issues and challenges faced in nurturing social entrepreneurs in marginalised communities.

In this phase, findings from the observations were validated. From the observations that took place in the settlement areas, more specific robust questions were able to be generated and asked directly to the interviewees. Semi-structured interviews comprising various stakeholders such as academicians, other social entrepreneurs, government bodies (the Department of orang Asli Development, Ministry of Rural and Regional Development, Ministry of Education leaders and youth leaders from the marginalized communities were conducted. A total of 16 respondents participated in the study and all the face-to-face interviews were conducted at specific meeting spots agreed by the interviewer and the interviewees. All the interviews were transcribed, and the data were then analyzed thematically.

Findings

Based on the overall experiences of the respondents, it can be established that the graduates from the indigenous communities might have the willingness to be a social entrepreneur, as they are very committed to create social innovation through the social entrepreneurship activities, but it is not easy as there are challenges. A comprehensive understanding on the challenges concerning producing social entrepreneurs among graduates from this marginalized communities can be represented in two categories which are internal challenges comprises of knowledge, awareness, and attitude, as well as external challenges which comprises of support, location and tradition.

Due to the rapid spread of COVID-19, many young people, including graduates, have had to take temporary jobs such as being food or goods runners through platforms such as Food Panda, Grab Bite, and Grab E-hailing to support themselves and their families. However, these jobs are temporary and unpredictable. As these youths grow older, these jobs may no longer be attractive or provide enough income. It is more practical in the long run for graduates to pursue stable and predictable jobs. However, most of the respondents claimed that there is still lack of knowledge on social entrepreneurship among students in general. Graduates from the indigenous communities are reluctant to venture into social entrepreneurship due to lack of knowledge in this area. They claimed that they do not have the confidence to start such an enterprise as they are not good at it. They argued that they lack the specific skills required for a successful social entrepreneurship. Although they have been exposed to entrepreneurial activities and curriculum at the university, they felt that they still need more exposure in terms of knowledge and guidance from the relevant parties.

Most of the participants in the study expressed a low level of awareness regarding social entrepreneurship. Despite being exposed to various social entrepreneurship activities during their time at the university, the graduates feel that they still have limited knowledge in this area. This aligns with the perspective of Abdul Kadir (2014), who noted that although interest in social enterprise and social entrepreneurship has grown in Malaysia, the concept of social enterprise remains relatively unexplored, and many are still unaware of such an enterprise. While respondents were aware of the concept of social entrepreneurship, they had not considered venturing into it as it has been perceived as different in nature from the conventional business endeavors. The main reason was risks associated with starting own businesses particularly economic and financial aspects. In reality, the respondents lack solid understanding of the concepts of social entrepreneurship, and the knowledge acquired during their university courses was not retained.

It has been discovered that the graduates from the indigenous community lack the right attitude to become social entrepreneurs. Lack of confidence is one of the reasons contributing to this unfavorable attitude towards social entrepreneurship. Most of them felt that they do not have the passion for social entrepreneurship as they claimed that being a social entrepreneur carries a lot of responsibilities, as it is not an easy job. They would prefer to find something “easy”, and it is difficult to change the way of their thinking. Besides, the respondents also claimed that most female graduates in their indigenous community prefer to become housewives than as entrepreneurs.

It can be clearly established that the mentality of “jobseekers” is still strongly ingrained among the graduates from the indigenous community in Malaysia. Thus, limits the opportunity for initiating their own social entrepreneurial projects or engage in community

initiatives. By actively participating in projects that address social issues, the graduates can develop a first-hand understanding of the challenges faced by social entrepreneurs. This experiential learning approach promotes awareness, empathy, and the development of problem-solving skills.

In Malaysia, there are many opportunities provided to people from marginalized communities including the graduates from the indigenous communities. However, it was found that despite these opportunities, some of the graduates are still hesitant to move forward and venture into something new such as entrepreneurship as they feel that they are unprepared. This is because indigenous graduates are often perceived to have a considerably lower level of adaptability and a greater vulnerability to psychological challenges, including low self-esteem, when compared to their non-indigenous counterparts. Ultimately most of the graduates prefer to come back to their families after graduating, and live closer to their families. Hence the opportunity for them to venture into a new environment is limited as they are stuck in their remote settlement areas. Furthermore, accessibility to resources and supplies is also limited as these are more readily available in the cities. This is often due to the transition from the security of the home to the workplace and they tend to experiment with various activities before some of them attempt to set themselves up in business.

This study revealed that graduates from the indigenous communities in Malaysia need to acquire the right knowledge, expertise and skills required to successfully engage in any social entrepreneurship activities or projects. Through the establishment of the social entrepreneurial unit under the Malaysian Global Innovation and Creativity Centre (MaGIC), social entrepreneurs can take advantage of easy financing, skill and discussion services which are offered. Apart from that, the cooperation of Government Linked Corporation (GLC) and other private firms are involved in performing their corporate social responsibility (CSR) to high-impact social entrepreneurial projects (Rahman et al., 2016). Other than this, The Department of Social Welfare Malaysia (Jabatan Kebajikan Masyarakat-JKM) and the Department of Orang Asli Development (Jabatan Kemajuan Orang Asli-JAKOA) are also actively assisting the indigenous communities. However, the participants of this study felt that there is still lack of support particularly in terms of financial support. According to Mohd Hasril et al., (2020), the success of youth indigenous entrepreneurs is hindered by external factors, namely a lack of financial capital and the complexities of bureaucratic financial lending processes. Other concerns include technological support, promotional and marketing support.

The government's Short-Term Economic Recovery Plan (PENJANA) includes a stimulus package that emphasizes the importance of supporting social enterprises to diversify economic activities. This aligns with the theme of "Propel Businesses" and recognizes the significant role of social enterprises in creating employment opportunities in the country. As part of the PENJANA stimulus package, the Malaysian Global Innovation and Creativity Centre (MaGIC) has allocated RM10 million in matching grants for social enterprises. These grants aim to support social projects that address challenges faced by specific communities in innovative ways. Social enterprises can also crowdsource contributions and donations to fund these projects (MaGIC, 2020; Malay Mail, 2020).

Location was found to be one of the challenges in producing social entrepreneurs among graduates from the indigenous communities in Malaysia. This is because most indigenous communities' settlements are located in rural areas with limited accessibility. This affects the transporting and delivery of goods and services into and out of the settlement areas as well as

other resources. Other than this, digitalization of business transactions is also affected as wireless coverage and internet connection are limited in some places. The indigenous communities who expressed a willingness to start their own businesses encountered difficulties in effectively marketing their products to customers residing outside their settlements. Despite their willingness to become entrepreneurs, they faced challenges in reaching and attracting customers who were located beyond their immediate communities (Doris et al., 2012). Due to location, it was found from the interviews that most of the successful graduates who used to live in the villages of the indigenous community areas would move away from the village to get better job opportunities. These graduates may choose to move to urban or more developed areas where there are more job prospects and career opportunities. Economic conditions in their home settlements may be limited, leading them to seek better employment prospects elsewhere.

It was discovered that people from the indigenous communities hold strong belief on their distinctive traditions and cultural identities. They look up highly to the Head of the indigenous community also known as Tok Batin or the Village Head. The position of Tok Batin holds great importance in preserving and protecting the customs, culture, and traditional way of life for the Orang Asli community under their care (Alizah et al., 2020). Additionally, Tok Batin's role and responsibilities include various social tasks such as creating a village profile, registering births and deaths, supervising marriage registrations, documenting visits by government officials, monitoring the migration of non-aboriginal people to the villages, reporting on programmes conducted by JAKOA, and providing monthly reports to the state JAKOA Director regarding any ongoing issues (Jabatan Kemajuan Malaysia, 2011).

The respondents were of the opinion that the Village Head plays an important role in helping to promote entrepreneurial activity especially when the activities are held at the settlement areas. The respondent also claimed that they are still inclined towards maintaining the rich culture and tradition in art and craftworks but lack of support in terms funding to get supplies and materials has affected their business. They added most of the craftsmen use forest products such as wood, bamboo, rattan, mengkuang, pandan, bemban, and coconut shell to create a variety of weaved and craft. However, in today’s modern world, it is sometimes challenging to find materials due to deforestation activities. In addition to this, the production of craftworks is based on demand of which the income generated is not sufficient to sustain the business. Some of the graduates have experiences helping their families to clear land for agricultural activities such as growing crops. They also claimed that they would help their parents by collecting agricultural produce and looking for forest products to be sold, and so, the entrepreneurial skills have been nurtured among them by their parents.

Conclusions

The education platform is an important strategy aimed at mitigating the impact of economic instability by exposing students, particularly those in higher education, to social entrepreneurial activities. Various efforts have also been made by HE institutions to promote the culture of social entrepreneurship in Malaysia through various initiatives. Equipped with the knowledge and skills they acquire during their studies, supported by an entrepreneurial culture and environment on campus and off-campus, students might be more likely to consider social entrepreneurship as a career option after graduation.

Overall, this study aimed to uncover the difficulties faced by graduates from the indigenous community in becoming social entrepreneurs in Malaysia. The study discovered that despite being exposed to various social entrepreneurship activities during their university years, the graduates face both internal and external challenges that limit their involvement in social entrepreneurial activities. Although they possess some level of willingness, the challenges must be addressed and minimized first.

The implication of this study can be contributed towards the HE institutions' authorities in predicting the tendency of students in becoming social entrepreneurs. Thus, the opportunities and facilities for realizing the courses related to social entrepreneurship must be created extensively so that the vision of creating as many social entrepreneurs as possible can be achieved. Early emphasis at the tertiary level needs to be conducive to stimulate students' minds and attitudes to be more creative in product creation or services to combat poverty and other social issues, and ultimately transpire them to become social entrepreneurs. This would also help in building economics for young Malaysians, especially those in the marginalized communities.

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Online Voter's Education, Change of Voting Perceptions, Awareness and Social Media Use of Fake News and Fact-Checking Behaviors Among Tertiary Students

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Abstract
Voter's education is an avenue which engages student-voters into political socialization. However, their exposure to social media and lack of keenness in verifying information can make them vulnerable to spread of fake news which in the long run may affect voting perceptions and behavior. Others may not be conducting fact checking behaviors that are necessary before they share information. This study aimed to determine the relationship of voter's online education, awareness and social media use of fake news and fact-checking behaviors among university student-voters (N = 446). Using male and female participants, results showed that majority of the respondents share fake news in social media to provide understanding of a particular event or situation. Consequently, sex and monthly gross income is not related with watching online voter's education program, perception of change in voting candidates among key positions in national elections, awareness and checking of fake news, social media use of fake news, and fact-checking information on social media. Findings reveal that fact-checking information increases awareness of fake news in social media (r= .534, p <.001). Implications of this study are also presented with regards to conducting online voter's education program, raising student voter's awareness, utilization of fake news in social media and fact-checking behavior.

Keywords: Online Voter's Education, Awareness of Fake News, Social Media, Fact-Checking

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Introduction

National elections are critical as more Filipinos, especially the youth who comprise 40% percent of the population in the Philippines are taking an active part in electoral politics. The Commission on Elections (Comelec) underscores the significant impact of voters aged 18-41 who are under the youth vote category (CNN, 2022). Their participation in elections can help redefine the political landscape and national development of the country.

Pew Research Center (2019) explains that the youth is the highest internet user of today, who navigate at least one social media site (Metzger et al, 2015). Social media platforms have given their users the power of clicking—and sharing information across hundreds of people. This can also expose them to disinformation and misinformation of the electorate, which impacts election or voting perceptions of youth. Consequently, uninformed, and misinformed voters end up casting ballots for the wrong "leaders".

To guide them, academic institutions try to actively engage students to learn information about politics, candidates and the electoral process through voter's education programs. By doing this, they hope to actively shape students in terms of their role in the country during elections and how elections can be powerful in shaping the country. Therefore, it is relevant to study online voter's education and its relationship with change of voting perceptions, awareness and social media use of fake news and fact-checking behavior of students.

Voters' Education

Values and beliefs regarding politics as well as views on government and community service begin to take form or develop during the emerging adult stage. In short, college period is where political values and preferences are formed. To help students be introduced into political socialization, academic institutions can introduce voter's education program. These programs are designed to provide students practical information that they can use for meaningful discussion on various social issues and topics related to voting. With the advent of the pandemic, academic institutions offers the online modality to teach and reach out to students. Likewise, programs on voter's education were conducted online by colleges and universities in the country.

In conducting voter's education program, students are provided opportunities to learn and take part in politics and its various related activities (University of the Philippines, 2022). This means that to academic institution, voter's education is a crucial activity which help inform and provide knowledge that would influence voters, particularly swaying them to vote or not for a certain candidate. Therefore, it is important to study how students voter's education programs impact students.

Change of Voting Perceptions

Election campaigns draw considerable attention as it helps shape public knowledge and attitudes towards voting of candidates and supporting policy stands (Wang, 2013. In terms of change of voting perceptions, research seems to be lacking in the Philippines.

To be able to vote, individuals must perceive information that would help them choose a political candidate (Wang, 2013). Voter's education, and presidential debates may cause people to change mindsets in terms of choosing a candidate. Bowler and Donovan (2002)

states that voters need information to be aware of propositions, which helps them form opinions. Individuals who are exposed to information, may begin to use that information as part of the process of choosing a candidate.

Change of voting perception in this study is defined as how they were influenced in looking at their candidates and changing them. Individuals' view of their candidates or how they perceive who they are most likely affects their vote. Those who view their candidates favorably would be voted in the elections. There are many factors that affect change of voting perceptions. Several of these factors are exposure to voter's education, the influence of family or peers, educational attainment, race, gender, and socio-economic status (Merck, 2019). Considering that change of voting perceptions are relevant in elections, studying this will help us understand what influences the voting behavior of young people.

Awareness and Social Media Use of Fake News

As the internet enables students to be constantly connected with the world around them, they also have an abundant amount of information from many different sources such as Instagram, Facebook and Twitter. Social media platforms have given their users the power of clicking—and sharing information across hundreds of people. Moreover, since the youth are the highest internet users, the tendency to come across fake news-- information that is disinformed or misinformed is highly probable. Studies have shown that social media platforms' use of spreading misinformation has increased since 2016 (Courchesne et. al, 2021). Social media platforms can also show and hide information due to algorithms (Gardner, 2019). In addition, statistics in US show that two out of three individuals admit having shared fake news story, knowingly or not, on social media (Metzger et al, 2015). Considering this, studying the awareness and the use of social media in spreading fake news will help us find ways on how to help students became critical thinkers specially in relation to the election process.

Fact-Checking Behavior

Fact-checking is a process of investigating or varying the accuracy of information (Brodsky et al, 2021). To effectively fact-check, it is important that individuals move beyond reading narratives of news and information. Fact-checking can be helpful in informing opinions or combatting misinformation.

However, studies have shown that students lack critical thinking ability to evaluate the quality of information online nor take them to verify them (Brodsky et al, 2021). College students often read laterally to evaluate the quality of the information they encounter online and do not often engage in fact checking behaviors (McGrew et al, 2018).

Since fact-checking plays a critical role in diminishing or balancing extreme views due to perception bias (Park, et al, 2021), it is important to understand the fact-checking behavior of student voters since they are frequently exposed to misinformation, especially during elections.

Research Objectives

The authors of this study presented results after the voter's online education program has been conducted. It aimed to determine the relationship of online voter's education to change of voting perceptions, social media use of fake news and fact checking behavior. The

association of fact-checking behavior and social media use of fake news was also measured in this study.

Methodology

Research Design

This study utilized quantitative analysis, using the descriptive correlation research design. It aimed to measure the relationship of online voter's education, with change of voting perceptions, awareness/checking of fake news, social media use of fake news and fact-checking behavior of university students in reference to the election issues and political candidates.

Sample

A total of 446 College students from 1st year to 4th year belonging to any degree program participated in the study. Purposive and convenience sampling was used. The inclusion criteria for the participants were 1) those who are currently enrolled in the University; 2) a registered voter; 3) have watched the JRU webinar series; 4) those who have been exposed to fake news in any social media account.

Research Instruments

The study participants answered a socio-demographic profile sheet and a researcher made self-report questionnaire. The generation of questionnaire items were derived from a small focused group discussion of student leaders interested in issues on voting, and elections in May 2023. The instrument was validated by 2 English experts and 2 History and Social Science Experts before utilizing it.

The researcher made self-report questionnaire contains items related to their views on online voter's education program, change of voting perceptions, awareness and checking of fake news, social media use of fake news, and fact-checking behaviors. The various items were answerable through a Likert scale of 1-not at all and 5-Very much. A sample item for awareness and checking of fake news is "After watching the online voter's education program, I take time to check the political news I am reading". A sample item for change of voting perception is "My option on a presidential candidate was influenced by the online voter's education program". A sample item for social media use of fake news is "My attitudes about political candidates have been influenced by fake news on social media". A sample item for fact-checking behavior is "I fact-check the information I am reading on social media".

Research Procedure

This study involved two steps. One is the implementation of the E-Leksyon Serye, an online voter's education program, in which students were invited to join. Then, it was followed by a survey questionnaire. The E-Leksyon Serye program was composed of four separate events that were geared towards a practical and effective voters' education which ran between December 2021 and April 2022. The first webinar was called "Mga Aral sa Nagdaang Eleksyon, Gabay sa Susunod na Henerasyon (Ang Lihim, Kasaysayan at Kahalagahan ng 1987 Eleksyon), (The Lessons of Previous Elections, Guide for the next generation (The

Secrets, History & Importance of 1987 Election). This webinar aimed to go back in time and abstract valuable lessons for students to ponder and apply in their time as voters for the upcoming May 2022 elections. The second webinar was called "GenLit: Rizalianong Maalam, May Pakialam,", a webinar in partnership with PinasForwardPh, "a nation-building movement which organizes fora, talks and camps for youth empowerment, transformational leadership and nationalism" (Garcia, 2020). Next, there was a Miting de Avance participated by two Presidential candidates showing their plans and promises if elected. And finally, a senatorial forum was held last April 2022 which featured different senators or their representatives.

The online survey question was administered via a secured link after the students have attended the E-LEKSYON program. The informed consent was given to student prior to answering the survey, which contains explanations of purpose, benefits and risks of the study. The survey lasted for 10-15 minutes.

Data Analysis

The frequency, percentage, mean and standard deviation was used to measure the views on online voter's education program, change of voting perceptions, awareness and checking of fake news, social media use of fake, and fact-checking behaviors of university students. The correlation statistic of the variables was measured using Pearson r and Point bi-serial through JASP (University of Amsterdam, n.d.).

Results

Table 1. Sex and Monthly Gross Income of Voter's in Tertiary Education

Characteristics	Frequency	Percentage	M	SD
Sex			1.59	.49
Male	183	41		
Female	263	59		
Monthly Gross Income			2.99	1.80
Below 10,000 PHP	100	22.4		
10,001 - 20,000 PHP	125	28.0		
20,001 - 30,000 PHP	81	18.2		
30,001 - 40,000 PHP	41	9.2		
40,001 - 50,000 PHP	49	11		
50,001 - 70,000 PHP	30	6.7		
80,001 – 100,000 PHP	10	2.2		
100,001 And Above PHP	10	2.2		

Note: (N = 446)

Table 1 study shows that majority of the respondents, 263, 59%, are female registered voters, while the minority of the respondents, 183, or 41%, are male registered voters. The monthly gross income illustrates that there were 125 or 28% voters earns a money of 10, 0001 - 20,000 PHP, 100 or 22.4% voters obtain an average of below 10,000 PHP, 81 or 18.2% voters receive a salary of 20,001 - 30, 000 PHP, 49 or 11% voters gain a mean of 40,001 - 50,000 PHP, 41 or 9.2% voters earn an income of 30,001 – 40,000 PHP, 30 or 6.7% voters receive a wage of 50,001 - 70,000 PHP, and 10 or 2.2% voters obtain a salary of 80,001 - 100,000 PHP and 100,001 and Above PHP.

Table 2. Participants Watching Voter's Education, Perceptions of Voting Change on Key Positions in the National Elections, Awareness and checking of fake news, Social media use of fake news, Fact-checking information on social media

	M	Sd
Watching Voter Education	1.59	0.49
Change of Voting Change for a Presidential Candidate	2.53	1.24
Change of Voting Change for a Vice Presidential Candidate	2.43	1.21
Change of Voting Change for a Senatorial Candidate	2.66	1.28
Awareness and Checking of Fake News	8.31	1.91
Social media Use of fake news	9.50	2.75
Fact-checking information on social media	4.05	1.12

Note: (N = 446); M = Mean, SD = Standard deviation.

In Table 2, watching voter's education series has a mean of 1.59 and a standard deviation of 0.49. The mean for change of voting perceptions for a Presidential candidate is 2.53 while it has a standard deviation of 1.24. The mean for change of voting perceptions for a Vice-presidential has a mean of 2.43 and a standard deviation of 1.21. The mean for change of voting perceptions for a Senatorial has a mean of 2.66 and a standard deviation of 1.28. The Awareness and checking of fake news has a mean of 8.31 and a standard deviation of 1.91. The social media use of fake news illustrates a mean of 9.50 and a standard deviation of 2.75. The reading fact-check information on social media has a mean of 4.05 and a standard deviation of 1.12. The viewing of fact-check information on social media has a mean of 3.39 and a standard deviation of 2. 64.

Table 3. Participants Sharing of Fake News

Choices	Frequency	Percentage
It is interesting.	126	28.3
It is eye catching.	70	15.7
It is funny.	89	20
It is current.	72	16.1
It provides understanding of a particular event or situation.	232	52
It seems useful.	148	33.2
It seems important.	149	33.4
It comes from my close friends or family.	39	8.7
It is consistent with my belief or assumption.	65	14.6
It seems inaccurate.	0	0
It comes from authoritative sources.	126	28.3
It looks frightening.	43	9.6

Note: (N = 446)

Table 3 explains participants sharing of fake news. Majority of the respondents, 232 or 52% choose to share fake news as it provides understanding of a particular event or situation, 149 or 33.4% respondents share fake news as it seems important, 148 or 33.2% respondents share fake news as it seems useful, 126 or 28.3% respondents share fake news as it is interesting and it comes from authoritative sources, 89 or 20% share fake news as it is funny, 72 or 16.1% share fake news as it is current, 70 or 15.7 share fake news as it is eye catching, 65 or 14.6% share fake news as it is consistent with my belief or assumption, 43 or 9.6% share fake

news as it looks frightening, 39 or 8.7% share fake news as it comes from my close friends or family and no respondents select it seems inaccurate when sharing of fake news.

Table 4. Association among Online Voter's Education Program and Change of Voting Perception for Key Positions in National Elections, Awareness and checking of fake news, Social media use of fake news, Reading fact-checked information, Viewing fact-checked information

Online Voter's Education	*Point bi-serial (r_{pb})*	*p-value, df*	*Interpretation*
Change of Voting Perception for a Presidential Candidate	0.212***	<.001, df = 444	Positive Weak Correlation
Change of Voting Perception for a Vice-Presidential Candidate	0.154***	<.001, df = 444	Positive Weak Correlation
Change of Voting Perception for a Senatorial Candidate	0.238***	<.001, df = 444	Positive Weak Correlation
	Pearson r (r)	*p-value*	*Interpretation*
Awareness and checking of fake news	0.191***	<.001	Positive Weak Correlation
Social media use of fake news	0.078	0.100	No Correlation
Reading fact-checked information on social media	0.237***	<.001	Positive Weak Correlation

Note: (N = 446), * = $p < .05$, ** = $p < .01$, *** = $p < .001$

Table 4 indicated correlation analysis of online voter's program and change of voting perception of key election post in presidential, vice-presidential or senatorial level, as not significant. It shows that attending online voter's education is not related to changes of voting perception in choosing a presidential, vice-presidential or senatorial candidate. Likewise, correlation analysis of online voter's education program is not significantly related to awareness and checking of fake news (r= .191, p <.001), social media use of fake news (r= .078, p <.001), fact-checking information (r= .237, p <.001).

Table 5. Association of Fact-checking information on social media, Awareness and checking of fake news, Social media use of fake news

	Fact-Checking information on social media		
Factors	*Pearson r*	*p-value*	*Interpretation*
Awareness and checking of fake news	0.524***	<.001	*Positive Moderate Correlation*
Social media use of fake news	0.267***	<.001	*Positive Weak Correlation*

Note: (N = 446), * = $p < .05$, ** = $p < .01$, *** = $p < .001$

Table 5 displays correlation analysis using Pearson's r signified that awareness and checking of fake news and fact-checking information on social media are moderately and positively related with one another (r= .534, p <.001). It displays that awareness and checking of fake news is moderately related with how the respondents read fact-check information on social media. The respondents are aware and check if the news is fake as they read fact-check information on social media. This shows that the more the respondents are aware and check fake news, the more likely they are to spend time in reading and fact-checking it before doing anything with the information. Correlation analysis using Pearson's r signified that social media use of fake news and reading fact-check information on social media are weak and positively related with one another (r= .267, p <.001).

Discussion

The current findings of the study shows that more females than males attended the online voter education program. As early as 1980's, the turnout of women participating in electorate is on the rise (Turpen, 2008). One explanation of higher participation of women in voter education is society's advancement and democratization of women's activity and direct participation in the realm of politics and governance (Azimova, 2016).

In terms of monthly gross income, majority of the registered voters or 28% belongs to those who earn 10 to 20 thousand pesos, belonging to the lower income level bracket. One article has supported our study findings, showing that those in the lowest income category had participated in voting related activities. In fact, during a Presidential election in USA in year 2016, voting participation rate for families in the lowest income category were 48 percent (Akee, 2016).

In this study, where majority of the respondents share fake news seems to be similar to other studies in the U.S. showing that two out of three individuals share fake news story, knowingly or not, on social media (Azzimonti & Fernandez, 2017). Sharing fake news based on the idea that "it provides understanding of a particular event or situation" is in keeping with findings that fake news, when believed can be spread and shared to others (Flynn et al, 2017). In fact, others use social media to generate and spread low-quality information (e.g. fake news) in society (Vo, 2021). In addition, Doing this appears to be aligned or related to people's political beliefs, identities and predispositions (Flynn et al, 2017).

Findings of this study also demonstrate that reading fact checked information also increases awareness and checking fake news. One explanation for this is that those who have attained higher education, like college students in this case, read fact-checked information. This is because they have the skills and knowledge to do so. In this case, fact-checking appears to be effortful evaluation strategy, as this involves the process of determining the accuracy of the information presented through various steps (Brodsky, 2022). The more they fact check information, the more likely they are to find out if the information presented to them is fake news. This in turn helps them fight against misinformation and disinformation. Another explanation for fact-checking which increases awareness and checking of fake news is tied to the need for information. Accordingly, users would put more effort and more strategy in evaluating information if it is important for them (Brodsky et al, 2021). More so, in terms of election, those who engage in fact-checking have high interest and knowledge in politics (Kyriakidou et al, 2022).

Conclusion

This study shows that reading fact-checked information appears to be related with awareness of fake news. Despite such findings, the present study are cited with limitations. First, the respondents in this study are university students, who are 1st time registrants in the last May 2022 National Elections in the Philippines. Their experiences in voting and electoral participation is quite young. Second, our participants came from the university setting and might be more school-culture based. Third, the income level of the participants belong to low to middle income category. The findings do not apply to those belonging to Upper middle class to Higher class level of income. Another limitation of the study is that there were no follow-up activities provided to verify if students have applied the lessons learned in the online voter's education program.

While voter's education programs remain an essential part of the campaign in encouraging young voters to participate in elections, there is a need to revisit its effectivity especially to young audiences who are often exposed to fake news proliferating in social media. Other than providing programs to watch, finding ways to engage students participation through other means can help raise awareness on voting and not being vulnerable to fake news. This emphasizes the importance of increasing college students critical thinking abilities to evaluate the political messages they are confronted with. More so, since fact-checking behavior leads to awareness of fake news, universities should look at increasing this among students. In the future, studies on voter's participation and what kind of messages they are more inclined to expose themselves as well as factors related with it can be studied.

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Exploring the Technology-Writing Connection Through Collaborative Writing in Google Docs

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Abstract
A strong connection between Technology and Writing is seen by many researchers in the field of Foreign Language Learning. They point out the importance of putting the thoughts into words via technology. It provides many tools for students to write online and offline. The aim of this paper is to explore the relationship between writing and technology through collaborative writing in Google Docs. The participants of the case study are 14 students who study in the Bachelor study programme "English Language", in the Faculty of Education and Philology, Department of the Foreign Languages at "Fan S. Noli" University, Korca, Albania. They were divided in two groups: Group A and Group B with 7 members each. The assignments that students had to complete in Google Docs were different. Group A had to write an informal letter and Group B had to write a formal letter. Students had one role within the group: an Initiator, a Topic Facilitator (1 participant), a Content Facilitator (2 participants), an Outlining Facilitator (2 participants) and Reviewing and Editing Facilitators (2 participants). After all the steps of their assignment have been completed, students were allowed to go to Grammarly (https://app.grammarly.com/) to edit the letters that they had written collaboratively. Students seemed to really enjoy taking these opportunities to work in collaboration with their friends. This connection between writing and technology seemed to be very strong and effective.

Keywords: Collaborative Writing, Google Docs, Technology-Writing Connection, Students' Assignments

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1. Introduction

Before online collaborative writing became popular, writing was thought to be an individual activity. Due to the development of new digital technology tools like wikis, Google Docs, and other collaborative writing platforms, this perception has changed recently. According to Ardiasih and Rasyid (2019), online collaborative writing alters perspectives from product-based to process-based writing. The writers can sustain a constant cycle of writing by routinely engaging in a number of process-based writing tasks, such as idea generation, structuring, drafting, reviewing, concentrating on, and evaluating. Additionally, in collaborative writing, students are expected to maximize their writing assignments by turning in numerous drafts and receiving feedback from the instructor, their classmates, or by checking computer programs.

In a view of learning based on collaboration, Bakar and Som (2016) advocate the analysis of participation in social and collaborative activity where participants strive toward academic goals. One of the resources that teachers and professors might utilize to get their students writing is Google Docs. Because of Google Docs' collaborative writing tools, students in one class or at home can actively produce high-quality writing (Alkhataba et al., 2018). This is made possible by Google Docs' capabilities.

Peer collaboration is thought to have a good impact on writing abilities (Buss & Karnowski, 2000; Lundstrom & Baker, 2009).

More specifically, when students participate in peer editing, a collaborative learning process, they are able to communicate with one another and read and evaluate one another's writing (Nagin, 2012; Yu & Lee, 2016). This condition gives the writers the chance to get more constructive criticisms from the other writers, which will assist students, improve the caliber of their work.

Writing in Google Docs in L2 enable the educators to develop online interactive environments for collaborative writing in which students can engage in peer feedback and peer editing of work (Dizon, 2016; Strobl, 2013). This allows L2 students to obtain feedback from the teacher and their peers.

Therefore, as an attempt to shed more light on the potential benefit of using Google Docs on collaborative writing, this study tries to explore the connection between Technology and Writing by using Google Docs for group writing. A critical and analytical assessment is provided for the way that students worked on it.

2. Literature Review

Numerous collaborative web second-generation applications (such as Google Docs, Wiki, etc.) have entered language schools and universities during the past ten years and have changed the dynamics of student interactions. Given that they give them a virtual place to contribute to a text that is changing, these technologies are made to be very dynamic and collaborative (Hadjerrouit, 2011). Or, to put it another way, "The affordances of social digital networks enable people to work together on projects in ways not necessarily possible in the past due to distance, time, age, or language constraints" (Coiro, Knobel, Lankshear, & Leu, 2008, p. 527).

Technology software, which is currently being developed at a rapid rate, offers creative ways to streamline the collaborative writing process, encourage greater sophistication and accuracy in student writing, and facilitate timely, helpful feedback from one member to the other (Liu & Lan, 2016). For instance, university students, who frequently find it difficult to interact face-to-face, can complete their collaborative writing assignments with ease and efficiency using web-based writing tools like Google Docs (Davey, Bozan, Houghton, & Parker, 2016; Seyyedrezaie, Ghonsooly, Shahriari, & Fatemi, 2016).

Numerous studies concentrate on how technologies affect various parts of writing and writing instruction. Suwantarathip and Wichadee (2014), for instance, looked into the nature of student collaboration in Google Docs work groups as well as the potential effects Google Docs may have on student writing in a Thai university. The quantitative study discovered that students who commented and critiqued each other's work through Google Docs developed a deeper comprehension of the writing process overall and outperformed those who had been in face-to-face groups on an individual post-test.

According to this study, Google Docs can be effectively used to improve students' writing skills, and those changes can be observed even on a personal level.

Zhou et al. (2012) conducted a study to determine the efficacy of using Google Docs for L2 learners, and they found that it was successful in enhancing the learners' abilities for collaborative writing and learning. As homework outside of class, the participants completed writing projects in groups of three or four using Google Docs. The course was well-received by the students, who thought Google Docs was a useful tool for completing writing assignments.

In a different study, Bikowski and Vithanage (2016) discovered that while both solitary and collaborative web-based writing were successful at enhancing L2 learners' writing abilities, the latter strategy had a more profound impact. The survey's findings also showed that L2 writers had favorable opinions of the in-class web-based writing training, but they preferred group writing exercises over individual ones. The participants also preferred instructor corrections over peer corrections since they had doubts about their colleagues' editing abilities.

Alharbi (2019) investigated the efficiency of Google Docs in an EFL writing course using a qualitative case study. By giving students the chance to receive feedback from teachers and peers, peer-edit and revise drafts of writing, and give responses to peers, Google Docs was effective in improving writing skills, according to analyses of the teacher's observation and feedback, students' comments and editing via Google Docs, and their follow-up interviews.

Despite the studies discussed above, the widespread use of Google Docs for EFL collaborative writing requires further empirical support and warrants further studies to be carried out.

3. Method

3.1 Participants

The participants of this case study are 14 students, 9 of whom are females, and 5 are males. They range in age from 18 to 21. They study in the Bachelor study programme “English

Language", in the Faculty of Education and Philology, Department of the Foreign Languages at "Fan S. Noli" University, Korca, Albania. They had to write an assignment in Google Docs collaboratively and hand it in after three weeks.

3.2 The Research Design

Students were divided in two groups: ***Group A*** and ***Group B*** with 7 members each. The assignments that students had to complete in Google Docs were different. Group A had to write an informal letter and Group B had to write a formal letter. Students had one role within the group: an Initiator, a Topic Facilitator (1 participant), a Content Facilitator (2 participants), an Outlining Facilitator (2 participants) and Reviewing and Editing Facilitators (2 participants). Students worked for three weeks to hand in the assignment.

In the first week, students had to read the entire assignment carefully and the description of the roles. They had to access the group's collaborative document. The group's Initiator had to create and share the document. Then they had to decide on the purpose of the letter and find and share samples of letters to use as models. Students had to write an outline of the letter from beginning to end. They had to carry out the duties of your individual role. They also must contribute to their group's collaborative writing project.

In the second week, students had to keep working on writing the letters, editing and revising. They had to make sure their collaborative letter met the criteria stated in the rubric. All group members were responsible for reviewing and editing after completing the letter.

In the third week, students had to hand in the finished version of the letter and a reflection letter to explain each one's role and the progress of the assignment completed in Google Docs. They had also to write how this experience was and what they learned. Students were allowed to go to Grammarly (https://app.grammarly.com/) to edit the letters that they had written collaboratively.

3.2.1 Explanation of the Rubric

Students Were Given the Following Rubric:

As a group, you will collaboratively write a formal or informal letter. Your letter should be 200-350 words. You will work online using Google Docs. First, you have to ***decide on the purpose.*** After finishing your collaborative work, you will work individually on a reflection. Please read the instructions carefully before you start.

Instructions:

(1) You have to take a role within the collaborative assignment.
(2) Read the responsibilities of the chosen role and be sure to accomplish them correctly.
(3) Hand the assignment within the deadline.
(4) Write a 200-350-word **reflection letter** on your collaborative writing experience, discussing your role, contributions, and success or failures. Provide information on your role, how the experience was successful or not.

Recommended Timeline for Completion:

This assignment is designed to be completed in three weeks.

1st Week of the Assignment:

Step 1: Read the entire assignment sheet carefully.
Step 2: Understand your role in this collaborative writing activity.
Step 3: Access your group's collaborative document. The group's Initiator should create and share the document.
Step 4: Contribute to your group's collaborative writing assignment:

- Decide on the purpose of the letter.
- Find and share samples of letters to use as models.
- Plan the writing of the letter from beginning to end.
- Carry out the duties of your individual role.

2nd Week of the Assignment:

- Keep working on editing and revising.
- Make sure your collaborative letter meets the criteria stated in the rubric.
- All group members are responsible for reviewing and editing after the letter is complete.
- Remove all comments and notes so the letter is completely clean.

3rd Week of the Assignment

- Hand in the collaborative assignment.
- Hand in the reflection letter.

Suggestion: Once you finish your reflection, we highly recommend that you use www.Grammarly.com to make final revisions to your paper before submitting it.

3.2.2 The Description of Students' Roles

Role 1: Initiator (1 Participant)

As an Initiator, the student has to go to Google Docs and create the document that will be used by all group members in this collaborative writing task and select the option "Anyone on the internet with this link can edit". The document has to be named "Collaborative Letter Writing – Formal or Informal Letter". Then, the student has to share the document link to the group members and course. He has to start this collaborative work by asking all group members to share their opinions about what should be the purpose of the letter and work with all the group members to help them reach a consensus on the purpose of the letter. Later on, he has to ask them to find and share samples of letters to serve as references and contribute by helping keep the group motivated and engaged until this collaborative writing task is finished.

Role 2: Topic Facilitator (1 to 2 Participants)

As a Topic Facilitator, the students has to help the Initiator finalize the group's consensus on the purpose of the letter, encourage brainstorming, share topic suggestions, encourage and track suggestions, and maintain motivation and engagement until the collaborative writing task is completed.

Role 3: Content Facilitator (1 to 3 Participants)

As a Content Facilitator, the students must initiate and share content suggestions with group members, encourage them to share samples of letters as content references, and share their ideas on content, even if not based on samples. They have to keep track of all suggestions and remind them to be related to the chosen purpose of the letter. They also have to provide constructive comments on the relevance of ideas and help connect the group members to the chosen purpose.

Role 4: Outlining Facilitator (1 to 2 Participants)

Outlining Facilitator(s) focus on letter format, including heading, inside address, introduction/salutation, body, closing, and signature.

As an Outlining Facilitator, the student has the responsibility of initiating and sharing outlining suggestions with your group members. He also has to encourage outlining suggestions by sharing samples of letters and ideas on outlining, keeping track of all suggestions, and ensuring they are related to the chosen purpose of the letter. He must work with the group members to reach a consensus on the outline of the letter, and choose one part to draft. He also has to inform all group members and ask them to choose their part, ensuring each member is responsible for drafting it. At the end of the task he has to ask for feedback and contribute by keeping the group motivated and engaged in outlining and drafting until the task is completed.

Role 5: Reviewing and Editing Facilitators

All group members are responsible for this Group Role, in addition to the individual roles each group member chose previously.

As Reviewing & Editing Facilitators, group members have responsibilities to initiate and share suggestions, encourage suggestions, track suggestions, and ensure they are related to the letter's purpose. They should use grading criteria and rubrics to ensure the letter meets the expected criteria and facilitate the group's review and editing. Feedback is essential to keep the group motivated and engaged, and the reviewing and editing process must be completed before the submission deadline. It is crucial to maintain a friendly tone and remind group members that the task must be completed before the deadline to ensure individual reflections are submitted by the due date.

3.2.3 The Evaluation Rubric

The Collaborative Assignment of the Students Was Ggoing to be Evaluated Based on the Following Criteria:

Table 1. The evaluation rubric

Criteria	Ratings		
Integrating knowledge	**6 points** Both the reflection letter and the letter of your group must be full. The individual reflection makes clear and logical connections to the concepts such as the connection between technology and writing, collaboration and writing as a process.	**3 points** The reflection and/or letter indicate partial connection to concepts.	**0 points** The reflection and/or letter fail to connect with the content introduced in them.
Completeness	**5 points** All the required components are included as explained on the assignment sheet. In other words, the individual reflection letter has been written fully.	**3 points** Some, but not all of the required components are included as explained in the assignment sheet.	**0 points** The assignment is substantially or fully incomplete.
Clarity	**4 points** The individual reflection letter provided detailed answers. The first paragraph of the collaborative letter provides a clear statement of the main purpose of the letter. The following paragraphs include details supporting the main purpose of the letter.	**2 points** The reflection and/or the letter are partially unclear.	**0 points** The reflection and/or the letter are substantially unclear.
Delivery	**3 points** The whole submission is visually appealing and well-organized. Both the reflection and the letter are well-formatted and well-organized visually and respect the word count (200-350 words). The Google Docs link to the Collaborative Letter has been shared within the deadline.	**2 points** Visually or organizationally, the reflection and/or the letter leave room for improvement.	**0 points** The reflection and/or the letter are not organized and/or visually appealing.

Mechanics	**2 points** The submission is free of spelling and grammatical errors which obscure meaning. In other words, both the reflection and the letter have been carefully revised; edited and proofread before being submitted and have no grammar or spelling mistakes.	**1 points** The reflection and/or the letter include spelling and grammatical errors which obscure meaning.	**0 points** The reflection and/or the letter include substantial spelling and grammatical errors.
Total points	**20 points**	**11 points**	**0 points**

4. The Result of the Study

After students were introduced with the assignment, they were divided into two groups: Group A had to write the Informal letter and Group B had to write the Formal Letter.

The Result of the Group A

First students suggested some ideas concerning the purpose of the letter:

- Thanking someone
- Inviting a friend
- Apologizing to a friend
- Sending a reminder to someone
- Requesting help or information
- Congratulating a friend.
- Wishing someone a speedy recovery or a happy birthday
- Catching up to a friend
- Travel experiences
- Memories about something
- Family updates
- Future plans or invitations

They decided to choose the purpose: Inviting a friend.

Then the suggested the following outline of the letter:

1. Greeting: Start with a friendly greeting
2. Introduction: Begin by mentioning that you hope your friend is doing well and briefly explain the purpose of your letter
3. Event details: Provide the essential details of the party, including the date, time, and location
4. Express enthusiasm: Share your excitement and let your friend know how much you would love to have them there

5. RSVP: Kindly request your friend to RSVP by a certain date, so you can make necessary arrangements for food, drinks, and other arrangements. Provide your contact information (phone number or email) for them to respond
6. Closing: End the letter with a closing remark

Group A's Informal Letter:

Hey, Angela,

Hope this letter finds you in great spirits! How's everything going with you? I can't believe it's almost time for my birthday, and I couldn't imagine celebrating it without you by my side. So, I wanted to personally invite you to join me in the festivities.

I'm throwing a birthday bash that promises to be loads of fun, laughter, and memories. The event will be held on 23 July at 20:00 at D'Angelo. Trust me, you won't want to miss it!

I've planned some exciting activities and games that I know you'll enjoy. We'll have a DJ playing our favorite tunes, a dance floor for all the crazy moves, and of course, a delicious spread of food and drinks. It's going to be a blast, and it won't be the same without your presence.

Please let me know if you can make it, as I need to finalize the guest list and make necessary arrangements. You can RSVP by 21 July. If you need any help with transportation or directions to the venue, just let me know, and I'll be more than happy to assist.

On a side note, since we've been friends for such a long time, I'd love for you to bring along any photos or memories we've shared together. We can reminisce about the good times and create new memories to cherish.

I really hope you can come and celebrate this special day with me. Your presence would mean a lot to me, and it wouldn't be the same without you there. It's going to be an unforgettable evening, and I can't wait to have you by my side.

Looking forward to your positive response. I hope to see you there!

Take care and see you soon.

Warmest wishes,
Group A

The Result of the Group B

First students gave some ideas concerning the purpose of the letter:

1. Write a Request Letter to the manager for a promotion
2. Write a Letter of Interest (job)
3. Write an Apology Letter to a client for a wrong order
4. Write a Reference Letter for someone who needs to start a job in a company

They all decided to choose option 2: *Letter of interest: Applying for a job*.

They wrote the following outline of the letter:

Dear Sir/Madam,
-*Introduction*
A. Where/when post appeared, reason for writing
-*Main Body*
B. Age, studies/qualifications
C. Work experience
D.Personal characteristics
-*Conclusion*
E. CV attached, when available for interview, closing remarks
-Yours faithfully, + (your full name)

Group B's Formal Letter:

Dear Mr. Johnson,

I am interested in applying for the programmer position which I saw advertised in the May edition of the magazine ESL Jobs.

I am 27 years old and I feel I have the required qualifications. I have a degree in Computer Programming and I also have a Master Degree in Advanced Algorithms .

I have experience in this job because I have been working as programmer for Oracle company for 3 years. Also I have worked as a private tutor offering online programming courses in the last 4 years.

I consider myself to be a highly motivated individual who works well in a team environment. I am a quick learner, detail-oriented, and I am always looking for ways to improve my skills. I am also an excellent communicator, and I am able to explain complex technical concepts in a way that is easy for others to understand.

I would be very grateful if you would consider my application. I have attached a copy of my CV. If you require any additional information regarding my application, please do not hesitate to contact me on 43422255. I am available for an interview at your convenience.

I look forward to hearing from you.

Yours sincerely,
Anna Rossi

1. **The Evaluation Rubric for Group A and Group B**

After each member of the group A and B handed in the reflection letter and collaborative letters, they were evaluated based on the Evaluation Rubric below:

Table 2. Evaluation Rubric of Group A and B

Criteria	Group A Informal Letter	Group B Formal letter
Integrating knowledge	6 points	6 points
Completeness	5 points	5 points
Clarity	4 points	4 points
Delivery	2 points	3 points
Mechanics	0 points	2 points
Total points	**17 points**	**20 points**

Both groups showed responsibility and devotedness in working fir this assignment. They were involved in completing it within the deadline. They all handed the assignment and the reflection letter with the deadline.

Group B gained the maximum of the points: 20 points, which mean that they completed successfully all the criteria.

Whereas Group A gained 17 points in total as their letter had some grammar mistakes:

> *I need to finalize the guest list and **make necessary** arrangements – make the necessary arrangement.*
>
> *On a side note, since we've been friends for **such** a long time, I'd love for you to bring along any photos or memories we've shared **together**. – The word **such** and **together** have to be omitted.*
>
> ***It's going to** be an unforgettable evening, and I can't wait to have you by my side. – Instead **of it is going to be** – it **will be.***
> *Looking forward to your positive response. I hope to see you there! – it must be: Hope to receive a positive reply and see you there!*

2. The Results of the Reflection Letters

Reflection letters were written correctly. They all answered the main points which had to be included in them. Students reflected on the way they had worked on the collaborative assignment and they expressed their thoughts on the main concepts such as working collaboratively online in Google Docs and how they improved their skills in writing and technology.

Some examples of students' reflection letters are given below:

> *My role for this assignment was that of "Content Facilitator." First, I learned to use Google Docs because I had never used that website. Then, I was very precise in completing all my duties as a content facilitator, like sharing samples, encouraging my friends, giving ideas, and providing constructive comments. I tried to be as active as possible and offer my help anytime. I also wrote the first three paragraphs of the formal (job application) letter while following the outline. (Student 1)*

Based on my experience, I learned to use Google Docs, which I now consider a valuable skill. It is an efficient and fun website. Also, I was very focused on the writing process, using suitable structures, vocabulary, and grammar. In the end, I can say that this assignment helped me to improve my writing and collaborative skills. (Student 2)

Conclusion

Collaborative writing in Higher Education is a great way to involve students working together to create a single document or content, used in various settings like business, academia, creative writing, and online content. Advancements in technology and online collaboration tools make it more accessible and efficient. So, technology is reinforcing the connection between collaborative writing and online tool.

In this study, 14 students from the study programme Bachelor in "English Language" at Fan S. Noli" University, Korca, Albania, took part in a collaborative assignment in Google Docs. They were divided in two groups; group A and B. Group A had to write an informal letter and group B had to write a formal letter.

The results of the study showed that working in Google Docs is great way to make writing a process rather that something that is done for a few minutes.

Students learned how to work in Google Docs and they found it to be an efficient tool for real-time collaborative writing, offering features like collaboration and sharing.

Through this assignment students learned that effective communication is crucial in a collaborative writing, and it is essential to define roles, responsibilities, and expectations from the beginning.

They outlined and planned the letters before diving into the writing, assigning specific sections or tasks to each group member based on their choice or interest. They reviewed and editted the document as a group, ensuring consistency in style, tone, and formatting.

They provided constructive feedback to the group members and tired to be open to receiving feedback.

At the end they conducted a final review to ensure the document is polished and error-free, checking for grammar, spelling, and formatting issues. Later on they publish and shared the completed document to the professor. Students wrote a letter of Reflection where they described their own experience.

Working in Google Docs made the students learn and improve after completing a collaborative writing project by reflecting on what worked well and what could be improved for future collaborations.

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Teaching History and Social Sciences in Multicultural Classrooms in Chile

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Abstract
This work is part of the recently defended doctoral thesis. Its objective was to analyse the educational practices of History, Geography and Social Sciences teachers in multicultural classrooms in Chile, to contribute to the improvement of student inclusion. This research was carried out in public schools in Santiago de Chile, characterized by having a great cultural diversity among their students, and its participants were the teachers of History, Geography and Social Sciences of said centres. The methodology was a qualitative approach, through a case study, using in-depth interviews and non-participant observations. The results show that even though teachers generate educational strategies that are close to some principles of the intercultural approach to teaching, many of their practices fail to reach it, and even their practices are carried out in the opposite way to what it should be from an intercultural approach, detecting training needs for multicultural contexts. This coincides with what different authors have reconsidered in recent years in their studies, that teacher training must be carried out from an intercultural approach to generate best teaching practices, and they also recommend strengthening the curricular development skills of schools, to allow contextualizing and adjusting study programs, so that they accommodate the requirements of each of the educational communities. In this way, future accompaniment and continuous training programs should be generated to help improve teaching practices.

Keywords: Cultural Diversity, Inclusion, Intercultural Education, Didactics of Social Sciences, History Teaching

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Introduction

In recent years, Chile has begun to receive many immigrants, due to different elements among them, social stability and mainly the opportunities that are presented in the labour market. The number of immigrants currently represents around 6.6% of the national population (National Institute of Statistics [INE] and Department of Immigration and Migration [DEM], 2019), in turn, the enrolment of immigrant students increased by 99.5% (Silva & Ballesteros, 2017), reaching 3.2% of the national enrolment (Fernández, 2018).

For this reason, the new challenge for Chilean education is how to attend to the cultural particularities of the immigrant student group and to be able to make their existence visible in the classrooms of our educational centres, especially when the "school" and teaching have a relevant function, because in it social relations are generated that cause existing prejudices to increase or decrease in the process of interaction with immigrants who arrive in our country.

In this sense, the new challenge for Chilean education is how to attend to the cultural particularities of the immigrant student group and to be able to make their existence visible in the classrooms of our educational centres, especially when the school and teaching have a relevant function, because in it social relations are generated that cause existing prejudices to increase or decrease in the process of interaction with immigrants who arrive in our country. For this, it is necessary to approach education from an intercultural approach, strengthening educational policies for the benefit of all, especially this migrant group, despite the fact that it is already declared in educational policies and enshrined in Chilean educational legislation (República de Chile, 2009 and 2015), there are still realities that hinder this approach, including racism and discrimination within educational centres (Riedemann & Stefoni, 2015; Tijoux, 2013), absence of pedagogical, theoretical and conceptual orientations, meaning that educational centres do not have the support to know and learn the meaning of education with an intercultural approach.

That is why one of the key elements in the construction of an intercultural school are the teachers, who must face different challenges, among which we can mention; the demand and pressure of having to cover an extensive curriculum in a short time and that offers us a plurality of contents and teaching strategies necessary to attend to cultural diversity in a good way (Poblete & Galaz, 2016), generating that the immigrant student do not make sense of what is taught in school hindering their learning (Joiko & Vásquez, 2016). Even more sensitive in the subject of History and Social Sciences, due to the fact that much of the curriculum content is related to armed conflicts between Chile and neighbouring countries, from which a large number of migrant students come. Therefore, it is necessary adjust the curricular contents, which consider the cultural references of the entire student body, in other words, *to contextualize* the school curriculum, adapting and implementing didactic teaching-learning strategies that incorporate the different particularities of the student body for a good achievement of their process (Poblete & Galaz, 2016).

Even though teachers and educational centres do not receive conceptual or didactic orientations to implement teaching with an intercultural approach, it has been able to put into practice actions that we could associate with some principles and logic of said approach. Developing unconscious responses to these challenges, adapting the curriculum quite a bit, from the selection of historical and cultural elements of the culture of origin of their immigrant students and teaching them together with the mandatory contents of the Chilean curriculum (Joiko & Vásquez, 2016).

This has caused many of their practices to be diffuse, little systematic and incomplete from the point of view of what the expert literature understands and has defined as a teaching process with an intercultural approach.

Next, the theoretical background and the methodology that we follow in this research will be presented. Subsequently, the analysis of the results obtained is presented, organized in the three dimensions with their categories:

In the first, the Formative Trajectory of the teachers of the study will be explained, related to pedagogy, education for diversity, initial and permanent training education. In the second, we explain the Management of Cultural Diversity in the classroom, in terms of curricular planning, objectives, strategies/activities, materials/resources, interactions in the classroom, etc. And in the third we explain the Evaluation of the teaching of History in Cultural Diversity, referring to the opportunities, possibilities, advantages, difficulties.

Subsequently, we present a theoretical discussion with the results obtained. And in the final part some conclusions derived from the analysis carried out are proposed.

Theoretical Background

Next, we will refer to the two main theoretical elements present in this research.

a) Cultural Diversity and Interculturality

We understand interculturality as a dynamic element that allows interaction between individuals in an equal manner, through dialogue and along with it, the enrichment of cultures by learning from the other. In addition to implying "a critical reflection on what is identified as their own cultural forms, which would allow us to understand their relative and historical character" (Stefoni et al., 2016, p. 160). At the same time, it is "a situation, process or project that occurs in the space "between" two different forms of cultural production" (Novaro, 2006, p. 51).

b) The Teaching of History and Social Sciences

Historically, the curricula and the teaching of History and Social Sciences have played a reproductive, homogenizing, and discriminatory role, not recognizing the "other" from an open attitude, but rather making them invisible. For this reason, we believe that we must move from assimilationist models to intercultural and inclusive ones. This means rethinking the didactics of History and Social Sciences that we use in the classroom, allowing teachers to intervene in "teaching and learning situations in a reasoned and reflective way" (Pagés, 2002, p. 261), making possible a democratic practice and the recognition of multiple world views (Sabariego, 2002).

We agree with Pagés (2002), in that it is not enough just to know to teach, a professional must be educated to decide, organize, and put into practice the historical knowledge that must be taught, welcoming the dialogue between different visions of the same topic.

Objectives of the Investigation

- Analyze the educational intervention model in multicultural classrooms where History and Social Sciences are taught in Chile, to contribute to improving student inclusion.
- To characterize the pedagogical practices of History and Social Sciences teachers in multicultural contexts in Chile.
- To understand if the pedagogical practices of History and Social Sciences teachers in Chile include immigrant students.
- Detect training needs for History and Social Sciences teachers in Chile for multicultural contexts.

Methodological Framework

The research was carried out in the commune of Santiago de Chile (Figure 1), which concentrates one of the largest amounts of foreign population, around 212.000 people (INE and DEM, 2019), and which has many immigrant students enrolled in public educational centres, serving almost 93.5% of immigrant students (Joiko & Vásquez, 2016).

Figure 1: Map of Chile, Metropolitan Region, and Commune of Santiago.

a) Selection of the Intervention

To better address the research objectives, we needed a specific profile of the teaching staff to collect more and better information. Therefore, the selection of the population was intentional or opinionated, choosing 3 teachers (2 men and 1 woman), one for each educational centre.

The teaching staff had to belong to the subject of History and Social Sciences, who taught classes at the secondary level and in courses with a high presence of immigrant students. In addition, they had to be graduates of a Public University and with less than 10 years of work.

We consider that they were from secondary school, because they have a greater specialization, which meant that they would have a greater reflective capacity of the content to be delivered and greater didactic resources, this reinforced by the fact that, being young people recently graduated from the University, they could have updates on History content, on attention to diversity, interculturality and the inclusion of immigrant students.

b) Selection and Application of Evaluation Techniques and Results

An exploratory type design was chosen, to approach a phenomenon that had not been investigated until now, using the case study as a research method (Stake, 1998).

The instruments and information collection strategies used were non-participant observation (Flores, 2009) and semi-structured interviews (Hernández et. al., 2014).

The analysis was carried out through the content analysis technique according to (Bardin, 2002) (Figure 2), developing a system of content categories to be analized (Figure 3), in order to understand the teaching practices of the teaching staff of the subject of History and Social Sciences.

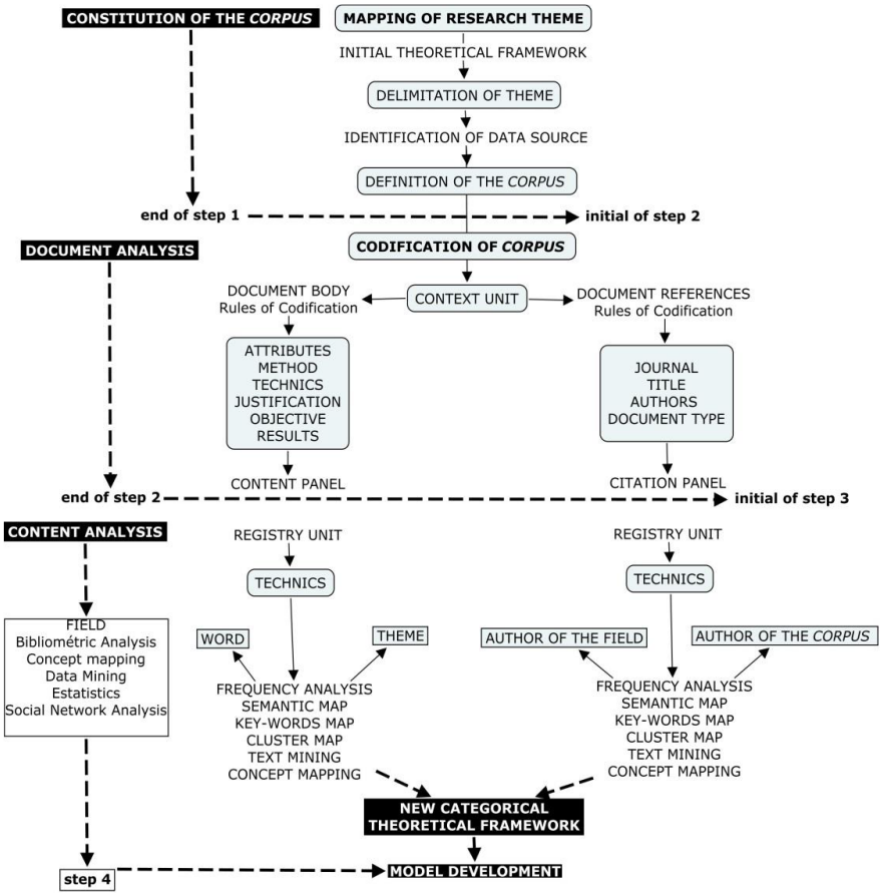

Figure 2: Method for Review and Content Analysis.

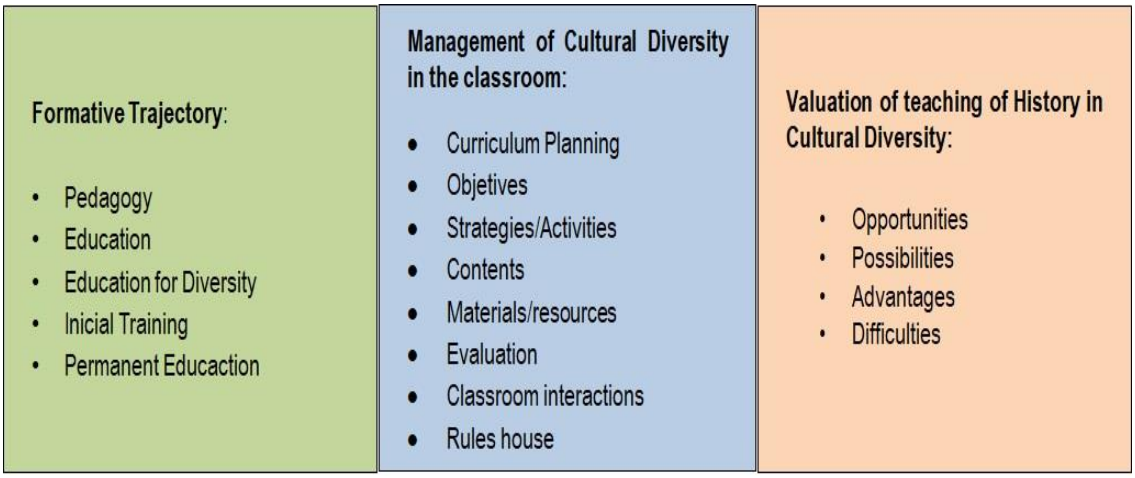

Figure 3: Category System.

c) Application of the Intervention

The interviews carried out were 3 (one per participant) within a calm, trustworthy and confidential environment. The duration was approximately 1 hour, recorded with the authorization of the participants.

The observation sessions of effective classrooms carried out for the investigation were 12, developed in a period of 5 months, not finding any type of difficulty.

Results

Within the investigation, we have been able to analyzed the data obtained, in the different dimensions and categories analyzed.

a) Trajectory Formative

Regarding the formative trajectory of the research faculty, we find similar answers, they state that, in their initial training received, despite being complete in knowledge, they were not prepared to face this type of context and student body, and that the practice has given them some tools. In turn, they recognize that they do not have improvement courses related to multiculturalism and diversity, which is why they are considered academically outdated in these topics. What is a challenge for teaching and a challenge.

In relation to epistemological conceptions, there are similar guidelines among teachers, in terms of their conceptions of education and understanding of the historical discipline, it is stated that teaching…

> Is not only the act that occurs in the classroom. (P01)[1]

And other…

> It is a constant act not only in the classroom. (P03)

[1] The numbering (for example P01) is the way to categorize the responses expressed by the teachers participating in the research.

b) Diversity Management in the classroom

Regarding the didactic strategies, in general, we have shown that despite the fact that multiculturalism is part of the national educational context, and that teachers recognize it, it is only part of the discourse, since it is not manifested in the classroom, nor is it translated into actions that manage to include other cultures, that is, interculturality is not considered by teachers, strategies for the inclusion of the students…

> I do not make changes, not because I am a foreigner must be different. (P04)

It is important to note that despite the fact that the participating teachers are young, they carry out their classes in a traditional way: exhibition, focused on their figure, with traditional materials and tools (Power Point, student's text), and that the small modifications or changes they make, are in "extra programmatic" instances (terrain outputs, fairs, etc.), but they do not make any change of strategy in the daily life of the class…

> I am super traditionalist; I always use the student's book and the blackboard. (P02)

c) Evaluation of the teaching of History and Social Sciences in multicultural contexts.

Within this section we find opinions on the advantages, possibilities, opportunities, or difficulties of having a cultural diversity in the classroom.

All the teachers explained to us that the History and Social Sciences subject is intercultural because the curriculum does include it…

> If it includes foreign students, because there are subjects in that area in the curriculum. (EPC62)

As it also brings advantages…

> It allows you to know other realities, learn to live together and relate to other realities, but not only for one but also for them. (EPA51)

In addition to generating opportunities to be able to treat content in a better way…

> It is an opportunity, because I must be aware of how to deal with them, train myself, be up to date. (EPB42)

Theoretical Discussion

A large part of the teaching practices of the study teachers cannot be carried out from an intercultural approach to reach the diversity that characterizes their students, even many of their practices are carried out in a way that is opposite to what is expected from this intercultural approach. According to Nordgren and Johansson (2015), this further teachers' ability to decentralize and interpret other cultures, in order to connect them with their own.

On the teaching of History and Social Sciences with an intercultural approach, Stefoni et. al. (2016) suggest that it is essential to understand that the process of instances where teachers rethink their discourses and thereby improve their teaching practice to implement a deeper

concept of interculturality in school contexts, in many cases is not spontaneous, so an intercultural policy is needed that seeks to "intervene in the process, guiding it towards communication spaces that would not be generated naturally" (Stefoni et al., 2016, p. 159).

Conclusions

As a conclusion to the results, we can say that these coincide with what different authors re-propose in various studies, I say "re-propose" because this is not new, it is something that has been proposed for decades due to different results of research carried out.

On the one hand, initial teacher training must be carried out from an intercultural approach and continued in permanent training to promote good inclusive teaching practices. And, on the other hand, it is necessary to strengthen the curricular development competencies of the educational centres, thereby allowing the contextualization and adjustment of the study programs to the requirements of each one of these centres.

In this way, it will be possible to develop and/or implement accompaniment and permanent training programs that allow better teaching practices, directing them towards an intercultural and inclusive approach.

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The Experiences of Building Resilience Among Nursing Undergraduates in Macao: A Qualitative Study

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Abstract
Nursing students face many pressures during the undergraduate study. Resilience building is recognized as a valuable coping strategy for nursing students to effectively manage stress in their studies and daily lives. The aims are to understand how nursing students perceive and experience the struggles or stresses during their undergraduate studies and to identify factors that help them build resilience. A qualitative design utilizing one-to-one interview was adopted. A judgment sampling method was employed to select interviewees. Fourteen year-2 to year-4 undergraduate nursing students from one of public universities in Macao participated in the study. Data was collected from March to April 2022. The thematic analysis method was used to perform the data analysis and identify emergent themes. Students reported that the main stressors they encountered during the undergraduate stage were academic performance and relationships. Three themes emerged from the data analysis: (1) challenges from academics; (2) challenges from relationships with others; (3) building resilience over time. Seven sub-themes were identified: unsatisfactory academic performance, language inefficiency issue, uncertainty, loneliness as a freshman, exclusion, external support, and positive coping strategies. Macao nursing students experienced various stresses during the undergraduate stage; besides academic performance, relationship with others was the second top stressor. Though the students can gradually build resilience, it is necessary to offer the special training to undergraduate nursing students for positive coping and resilience-building strategies.

Keywords: Qualitative Study, Nursing Students, Resilience, Macao

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1. Introduction

Globally nursing students were regarded as experiencing more stress than other trainee healthcare disciplines (Tung et al., 2018; Turner & McCarthy, 2017). The most common sources of stress perceived by nursing students were academic-related demands, the high workload in the clinic, and interaction with patients, other health professionals, and teaching staff (Cornine, 2020; Chaabane et al., 2021). In addition, dealing with family demands financial responsibilities, and personal issues cause additional stress (Grant-Smith & de Zwaan, 2019; He et al. 2018). Unrealistic expectations for academic achievement can result in severe consequences such as burnout, dropping out, and attrition of students. Unfortunately, the global nursing student attrition rate is a staggering 30%, which highlights the severity of this issue (Bakker et al., 2018). Pulido-Criollo and associates (2018) further stressed that overwhelmed stress leads to a number of serious physical and psychological health conditions. The ability to effectively cope with challenges and the process of adapting well in the face of adversity, trauma, tragedy, threats or even significant sources of stress is conceptualized as resilience (Stephens, 2013; The American Psychological Association, 2014). Jackson and colleagues further stressed that having good resilience is an essential quality for success in the nursing profession (Jackson et al., 2011).

Two separate studies, one conducted on Spanish nursing students by Rios-Risquez et al. (2018) and the other on Australian nursing students by He et al. (2018), have found a significant and positive correlation between resilience and well-being. In both studies, greater resilience was linked to higher levels of psychological well-being among the students. He et al. (2018) also reported that resilience was the strongest predictor for positive mental health among Australian nursing students, along with support from significant others and family support. A study conducted by Crombie et al. (2013) using an ethnographic case study approach, examined second-year students at a university in London and found that resilience played a significant role in determining course completion rates.

The level of resilience among nursing students varies across countries/regions. Studies have found that resilience was lower among mental health nursing students in the UK (Galvin et al., 2015) and South Africa (Janse van Rensburg et al., 2012). On the other hand, nursing students in Nigeria showed moderate levels of resilience (Aloba et al., 2016), while nursing students in Australia and Spain demonstrated high levels of resilience (Chamberlain et al., 2016; Ríos-Risquez et al., 2016). A study by CHOW et al. (2018) found that the level of resilience among Hong Kong nursing students was lower compared to that of other countries, but the level of resilience among postgraduate nursing students was higher than that of undergraduate students. Previous studies have used quantitative methods to explore the adversity quotient of Macao nursing students, and the results show that they are at a moderate to a low level (Wang et al., 2021).

Researchers have begun to focus on exploring why some nursing students are able to effectively cope with adversity while others cannot, as well as what factors can help nursing students develop or improve their coping abilities and resilience levels. It was discovered that students' resilience was nurtured by the encouragement they received from their parents, significant others, children, grandparents, and in-laws (Carroll, 2011; Crombie et al., 2013). Friendship was also considered important for resilience, particularly supportive peer groups integrated into nursing programs (Carroll, 2011; Crombie et al., 2013). Among these sources of support, mothers were mentioned most frequently and the importance of teacher support

was also highlighted in the interviews, and was considered valuable in enhancing student resilience (Carroll, 2011).

In terms of the effect of time duration on students' resilience is still a controversial research topic. A longitudinal study conducted in England found no significant difference in resilience scores for nursing students after three years compared to first-semester entry (Pitt et al., 2014). On the other hand, a qualitative study by Galvin et al. (2015) highlighted the influence of maturity and experience as important factors in shaping resilience.Findings from another quantitative study showed that important predictors of resilience were emotional exhaustion and academic performance (García-Izquierdo et al., 2018).

Compared to research on stress sources during clinical internships, there was relatively less research on student perceptions of stress sources during on-campus learning and how to deal with them. Although clinical internships were crucial for training nurse students, the difficulties and setbacks encountered during theoretical learning on campus should not be ignored. What's more, despite numerous reports on the resilience of nursing students through both quantitative and qualitative research, there is currently no available qualitative research on the resilience of nursing students in Macao.

Macao is one of the wealthiest regions in the world. Most nursing students in Macao are local high school graduates who grew up, lived in a comfortable community, and received 15 years of free basic education. Due to the low competition pressure, over 95.4% of high school graduates enter universities (Education and Youth Development Bureau of Macao SAR, 2022). Macao is a highly diverse cultural society, and in recent years, with the rapid increase of immigration and tourism, the healthcare service environment has become more challenging (Liu et al., 2015). Considering that nursing students are an important nursing workforce in the future, this study uses a qualitative interview method to explore the process of resilience building by understanding the pressures, setbacks, and coping strategies of undergraduate nursing students in Macao during their 4-year studies in the university. The ultimate goal is to deliberately improve their positive coping strategies, enhance their resilience, and better adapt to future work and social environments.

2. Methods

This was a qualitative design using one-to-one, semi-structured interviews. The study was conducted at one of the local universities in Macao SAR.

2.1. Participants

Fourteen year-2 to year-4 undergraduate nursing students participated in the study. A judgment sampling method was adopted to select interviewees. Inclusion criteria: Study in a Bachelor of Nursing program in the 2022-2023 academic year; have experience in clinical practice; can listen, speak, and read Chinese; voluntarily participate in the study. In addition, the principles for selecting participants also considered participants' expressiveness and maximized variability in demographic characteristics, such as age, gender, grade, and GPA level. Data were collected from March to April 2022 using face-to-face personal interviews.

2.2. Ethical Considerations

The Ethics Committee of Macao Polytechnic University approved the study. The purpose and procedures of the study were explained to all participants, and they were informed that interviews would be recorded and that they had the right to refuse participation or to withdraw from the study at any time. Before the formal study, a written informed consent was obtained from each participant. To ensure that the interviewees had no worries during the interview, they could also ask the interviewers to turn off the recorder when some information they did not want to be recorded. Identities of participants were replaced by numbers and letters and would not be revealed in research reports or publications.

2.3. Data Collection

Three semi-structured interview questions are as follows: 1) What was or were the most difficulties or setbacks you have experienced since enrolling in university? 2) How did you deal with those difficulties or setbacks? 3) Please give examples of setbacks that you think handled well or unwell; and please analyze the reasons why you handled it well or not. Each interview was approximately 30-40 minutes. The interview took place in a quiet laboratory at the university (a familiar setting for the interviewees). For the participant's convenience, an individual appointment was made with each participant prior to the interview. To avoid bias, all interviews were conducted by the same interviewer. In the beginning, the interviewer introduced the purpose and procedures of the study and obtained written informed consent from each participant. The entire interview was audio-recorded and kept strictly confidential. Interview techniques include remaining neutral throughout the interview process, active listening, unconditional active attention, and clarification to ensure the accuracy of information.

2.4. Data Analysis

All interview recordings were transcribed verbatim by two research assistants within 24 hours of the interview. Data analysis was performed concurrently with data collection to determine data saturation. The analysis was performed using the subject content analysis technique (Braun & Clarke, 2006). Consists of three main stages of preparation, organization and reporting (Elo & Kyngäs, 2008). During the preparatory phase, the same script was carefully read separately by two principal researchers, and the tentative themes was selected as the unit of analysis (Elo & Kyngäs, 2008). During the organizational phase, open coding and category creation took place (Elo & Kyngäs, 2008). After generating the initial themes, two research team members discussed and compared their respective research results, and finally reached a consensus on each theme and sub-theme.

Rigor was achieved through this process (Tong et al., 2007): 1) Team members had diverse backgrounds. Each author had extensive experience in nursing education, nursing administration, and qualitative research. Team members contributed their own diverse perspectives and understandings to data analysis and reporting, and diversity within a research team supports a more rigorous interpretation of data. 2) Individual transcripts were emailed back to each participant for confirmation. 3) Researchers continuously compared, discussed and reached a consensus on each topic and subtopic to maximize the credibility of the analysis.

3. Findings

Three major themes, supported by sub-themes, emerged from the analysis: 1) challenges from academics; 2) challenges from relationships with others; 3) building resilience over time.

3.1. Challenges From Academics

For students, the primary task was to study. However, due to the completely different teaching modes and performance assessment methods between the university stage and the high or middle school stages, many college students needed to re-adapt and adjust their coursework preparation methods. Many students had no goals in their studies or had unsatisfactory academic performance, and even delayed their graduation. In this interview, half of the students reported academic-related difficulties.

3.1.1 Unsatisfactory Academic Performance

> *"When I was a freshman, there were too much contents (to learn), and I didn't know what were the key points. (Before the exam) I had to review a lot in one week. I didn't know how to allocate time and the consequence was that I had to retake the exam, which is a big setback. I hadn't experienced it before." (P2)*

> *"I re-studied for the freshman year and re-took Fundamental Nursing. Maybe I just didn't adapt to university. I found the Nursing program very difficult. I couldn't remember many notes during the exam, and I couldn't do the nursing skills well either." (P10)*

> *"After I came to university, I was free, and I became lazy and didn't have the motivation to study. I failed the exam of Fundamental Nursing, and I had to study for an extra year, wasting time..." (P1)*

> *"At first, I didn't care about GPA, thinking it was not very important. Later, I realized its importance until my junior year. I tried to catch up, but now my GPA is only 2.2. I regret that I didn't work so hard in my freshman and sophomore year." (P5)*

3.1.2 Language Inefficiency Issue

> *"I graduated from a Chinese high school. When I entered the university, I thought that half of the classes were in Chinese and half in English. Later, I found out that it wasn't... I have been exposed to Chinese since I was a child. I didn't expect that the PPT and examination papers in the university were all in English. As a result, I failed an important subject, resulting in a one-year delay in graduation, English is too difficult for me." P6*

> *"I think the biggest impact on the grades is English, the English papers. If you speak Chinese with me, I can tell you what I know, but it will not work if you switch to English, because you have to remember some professional terms, but my English is not good. Faced with so many English professional terms, I can't remember them at one time." P13*

"I am not very good at Mandarin, and it is difficult for me to listen to Mandarin. Sometimes if some teachers have an accent, I can't understand what they say at all... " P1

3.1.3 Uncertainty

"When I entered the university, I had a feeling of uncertainty about my abilities. I just didn't know whether my abilities, personality traits, would be suitable for socializing with others, or for being a nurse." P14

"During my practice in school, we were presented with models for training purposes. However, when it came to clinical practice, we had to work with real patients, and I found that the blood vessels of a real person are thinner and less noticeable than those of a model. If I was unable to perform the operation successfully, the teacher may have needed to step in, which was nerve-wracking and impacted my performance. This added pressure caused me to feel nervous, leading to decreased performance. While some of my peers were able to complete the same operation in five minutes, it took me ten minutes." P9

3.2. Challenges From Relationships With Others

University students normally experience various personal relationship challenges. Particularly for nursing students, besides interaction with peers, and faculties, they also engage in other situations, such as dealing with clinical preceptors, patients, families, and other health professionals. Among this group of interviewees, most of them mentioned that they encountered setbacks in interpersonal relationships even more than academic problems.

3.2.1 Loneliness as a Freshman

"When I first entered university, I found it difficult to adapt and open my heart to be friends with others. I would keep a certain distance because I don't like others being so close to me..." P13

"When I was a freshman, I didn't know the people around me very well. My fellow classmate who also attended our middle school has already made new acquaintances, and I felt lonely." P12

3.2.2 Exclusion

"I don't seem to get along very well with my classmates... I don't know if it's my personality or what. Some people don't seem to like me very much and don't want to chat with me. When doing group work, I would not be asked to join in. It was the same during the internship, it was not easy for me to assimilate into the internship group." P1

"I feel excluded by my classmates. For example, if I got high marks in my homework, they would laugh at me. When I got good grades during my internship, they would say that I was flattering to get that, not because of my strength..." P11

3.3. Building Resilience Over Time

This interview found that when students had experienced difficulties or setbacks, and if they could adopt positive coping strategies together with some external supports, such as family members, peers, tutors, etc., resilience could be gradually built.

3.3.1 External Support

"My academic performance was not good since my in primary school. My parents understand me very well. They think that I have already tried my best, and they never put pressure on me." P10

"When I re-take the first grade, my friends were already in the second grade. They lent me a lot of class notes. They hoped that I would pass the exams smoothly, taught me homework and practiced nursing skills with me, making me feel that I am not alone. Sitting in the classroom is lonely sometimes. But usually, at noon they would ask me to have lunch together, and go out to relax after school..." P6

"We were very perfunctory in a group report when we were sophomores, which caused the subject teacher to criticize us severely, saying that we were not serious about our studies. In my junior year, we had a group report assignment again. It happened to be the same teacher. We worked hard on the homework this time, the teacher praised us and said that he saw our progress. I felt that my hard work had received a positive response, and I was very happy." P8

"In my senior year, I was assigned to the XX department, where I had a fantastic clinical teacher who was very encouraging. He would often tell us that it's okay if we didn't know all the theoretical knowledge, and would simply encourage us to try our best to find the answers. Whenever we were able to find the answers, he would commend us with a "good job". These words of encouragement made our internship experience very enjoyable and motivated us to work hard." P7

3.3.2 Positive Coping Strategies

"Whenever I encounter setbacks, I will think of many ways to solve them. For example, if the teacher asks a question and I can't answer it, then I will go home and search for information, and try to answer the teacher later. If the answer is not satisfactory, I will continue to look for the answer, and even ask my senior friends to find a way to solve the problem. Some nursing skills that I didn't do well. I would spend a lot of time to practice and practice. Some students will wonder why I can do so well in the skill test, but they didn't see how much effort I put in behind it." P2

"After failing an exam and having to take a make-up exam, I realized the importance of attention in class and taking notes in class, since then, I have never been absent from classes. I don't look at the key points of the exam handed down by my seniors, I organized the important contents of what we learned and carefully prepared, and then I felt less pressure to face the exams." P9

4. Discussion

The results of this study indicate that the Macao undergraduate nursing students face significant stressors during their academic pursuits, particularly related to poor academic performance and interpersonal relationships. Specifically, poor academic performance was identified as a widely prevalent issue, consistent with previous research findings (Mall et al., 2018; Oner & Ustun, 2013). However, this study also revealed that many of the interviewees cited language barriers as a contributing factor to their academic struggles. This finding is relevant to Macao's unique nursing education context, where the primary languages of instruction are Chinese, English, and Portuguese. English is commonly used as an academic language, as well as in the nursing practice. Moreover, Macao's clinical environment involves daily interactions in three languages (Chinese, Portuguese, and English) and four dialects (Cantonese, Mandarin, Portuguese, and English) (Liu et al., 2015). To meet the language demands of the Macao healthcare system, nursing education institutions in Macao often use multiple languages in classroom instruction and academic communication, such as textbooks, teaching materials, and exam papers primarily in English, with lectures in Cantonese and Mandarin. This approach caters to the diverse needs of students and teachers and helps students better adapt to the language demands of their future work. However, non-native English-speaking Macao students may encounter significant barriers to learning if their English proficiency is poor. A decade ago, researchers (Olson, 2012; Sanner & Wilson, 2008) identified English language deficiencies as a significant obstacle to success for English as a second language (ESL) nursing students. The authors noted that ESL nursing students faced difficulties in reading speed and comprehension due to the need to translate between English and their native language, making reading more complex. Studies also indicate that ESL students encounter challenges in technical vocabulary, grammar, syntax, writing, and nursing documentation. Therefore, the researchers suggest that building language skills for ESL nursing students is crucial for their success, such as providing lecture slides, and copies of class notes, allowing recordings of lectures, extracurricular activities, and workshops for the students (Olson, 2012; Alqahtani, 2022).

In this study, it was found that another main source of stress reported by students is interpersonal relationship issues. Similar findings have been reported in studies of nursing students in Spain (Oner & Ustun, 2013) and the United States (Wolf et al., 2015). It is worth noting that in this study, there were even more students who reported interpersonal relationship issues than academic problems. In the context of undergraduate nursing education, interpersonal relationships can pose significant challenges for students (Bach & Grant, 2015; Ramsbotham, 2019). Specifically, conflicts with classmates and faculty members were identified as common issues, which could lead to increased stress, anxiety, and reduced motivation to learn (Li, et al., 2019). There are several factors that may contribute to interpersonal relationship problems in nursing education, including differences in personality, communication styles, cultural backgrounds, and expectations (Bhana, 2014). For instance, nursing students may come from diverse cultural backgrounds with varying norms and values, which could lead to misunderstandings and conflicts (Almutairi, 2015). To address these issues, nursing education institutions must prioritize the development of communication and interpersonal skills among nursing students. This could involve incorporating relevant coursework and training programs that promote effective communication, conflict resolution, and teamwork (Yoo & Park, 2015). Moreover, creating a supportive learning environment that fosters respectful communication and collaboration among students and faculty members is essential for reducing interpersonal conflicts and promoting positive relationships (Cannity, 2021).

This study found that, although nursing students experienced various stressors and difficulties, they coped with them in different ways. As Richardson (2002) described, resilience is a process of coping with adversity or disruption by strengthening protective factors related to resilience, and resilience is seen as something that can be gradually enhanced and modified through education. The study identified external support as an important factor contributing to nursing students' resilience, which is similar to previous research findings (Carroll, 2011; Crombie et al., 2013). Another factor that was found to contribute to nursing students' resilience in this study was the use of positive coping strategies. Nursing students utilized coping strategies that typically fall into two categories. The first category involves actively addressing and reducing stress, such as seeking emotional support from peers and others, managing workload and organization, sharing experiences with teachers, exercising, and seeking spiritual guidance (Labrague, et al., 2017; Zhao et al., 2015). The second category of coping mechanisms involves avoidance or attempting to alleviate stress through negative means, such as alcohol and drug abuse, binge eating or less eating, social withdrawal, indifference, stubbornness, and dropping out (Gurková & Zeleníková, 2018; Hirsch et al., 2015). Research has found that individuals who adopt positive coping strategies tend to have better mental health outcomes when compared to those who adopt negative coping strategies (Zhao et al., 2015). Students with high levels of psychological resilience are better equipped to understand the importance of positive coping strategies when experiencing adversities and can effectively overcome negative emotions (Li & Hasson, 2020). Furthermore, students with higher resilience are more likely to utilize problem-solving strategies to avoid stressful events and may be helpful for them to effectively deal with various stressors during their educational experiences while maximizing learning (Labrague, 2018).

5. Limitations

While we have followed a rigorous research process, it is important to acknowledge the limitations of this study. Firstly, although we adopted a maximum variation sampling strategy in selecting participants, it is noteworthy that the participants in this study were all from a public university and did not include students from private universities. Therefore, the conclusions drawn from this study may not necessarily be generalizable to all nursing undergraduates in Macao. Secondly, the possibility of recall bias cannot be completely ruled out. Lastly, the current study design involved interviews with students of different grades. In future research, a longitudinal study should be conducted to survey the same students every year to examine the changes in stress, resilience, and coping strategies over time.

6. Conclusions

This study found that nursing undergraduates in Macao encounter various stressors during their undergraduate studies, with interpersonal relationships being the second biggest source of stress, after academic performance. External support is helpful for students to build resilience, including support from parents, peers, and teachers. Internal factors also play an important role in resilience building, such as adopting a positive approach to difficulties and setbacks. While students can gradually develop resilience, it is necessary to provide specialized training on proactive coping and resilience-building strategies for nursing undergraduates.

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Ukrainian Schoolchildren in Europe: Between Preserving National Identity and European Integration

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Abstract
The paper discusses the main problems associated with educating Ukrainian children who were forcibly displaced when the Russian Army invaded Ukraine. The main models of behaviour of Ukrainian parents concerning their children's education, such as enrolment in local schools or (and) continuing education remotely in Ukraine, are highlighted. The risks and difficulties associated with both of these decisions, as well as the ongoing state of uncertainty in the plans of the parents, were analyzed by the author in this paper, and some recommendations were made to eliminate them. The main conclusion that was made was the fact that the Ukrainian education system, despite objective difficulties, managed to survive a year after the outbreak of hostilities. Children, for the most part, have the possibility of continuing their education in one form or another, but the situation requires constant monitoring and flexible decisions.

Keywords: Ukrainian Refugees, Schoolchildren, Education, Welcome Classes

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Introduction

More than a year has passed since Russia's full-scale invasion of Ukraine. About eight million Ukrainians were forced to start their lives from scratch. About 5.5 million have now accepted temporary protection status in European countries (*Situation Ukraine Refugee Situation*, 2023). A year after the start of the war, some of the Ukrainians returned home. However, another significant part of them had already begun to settle in Europe, having experienced the first difficulties of social and psychological adaptation. Many got jobs ("*Intentions to Stay and Employment Prospects of Refugees from Ukraine | Publication | Econpol Europe*", 2022). The significant number of parents has already enrolled their children in local schools. It seems important and necessary to trace the state of educational adaptation of Ukrainian refugee children a year after the outbreak of the war.

Understanding forced migration is a relatively widely discussed topic in modern science. Various aspects related to refugees are considered in detail and closely (e,g. Hahn et al., 2019). The factors of job search, self-selection of refugees, socio-economic profile, education level, and employment prospects are often the subject of research. Ukrainian refugees, in this sense, are no exception (*OECD*, n.d., "*Intentions to Stay and Employment Prospects of Refugees from Ukraine | Publication | Econpol Europe*" 2022, "*Prospects for Integration of Ukrainian Refugees into the German Labor Market: Results of the Ifo Online Survey*," n.d., *Publications* | CESifo, n.d.). An equally important topic that requires constant monitoring is the education of refugees, are Ukrainian children or schoolchildren. According to the UN (OECD, 2022), half of the Ukrainians who have crossed the border since February 24 were children. The second factor that distinguishes the integration of Ukrainian children from other refugees, is possibility to study remotely on Ukraine. This issue makes the education of Ukrainian refugee children attractive for research and is somehow a phenomenon.

There are a lot of papers that consider the state of education of refugees, in various countries of Europe (Crul et al., 2019, Will at al., 2022). They examine in detail the different patterns of adaptation of children to local schools, the timing of enrolment of children in local schools, the quality of this adaptation, and predictors of the quality of adaptation. The main factors influencing adaptation and subsequent integration are (Dryden-Peterson et al., 2019, Montgomery, 1996):

- the speed of granting temporary asylum status,
- the time spent outside school,
- the speed of learning the language of the host country,
- parental involvement in refugee children's education,
- the economic factor, and
- the factor of early selection of children for educational streams

The same factors influence the adaptation of children from Ukraine. Some of them were initially eliminated or mitigated. Ukrainians were immediately given the status of temporary asylum. This status immediately gave them the right to work and the possibility to enrol their children in school (*"The Welcome given to Ukrainian Refugees: Some Challenges and Uncertainties" 2022*). Many countries provide significant financial support by paying for language courses in the host country, providing benefits, and compensating for the cost of renting housing and utilities. So, the economic factors that directly affect the psychological adaptation of parents and their children are significantly mitigated. There are some factors in a student's adaptation that are difficult to avoid, such as a lack of knowledge of the language of the host country, psychological trauma, homesickness, and the breakdown of social ties.

However, there are new factors that have not been observed before. Ukrainian children are as if between two countries - the home country and the host country. For the first time in history, forcibly displaced children have the possibility to continue their education remotely in their own country. The author wants to consider at all the benefits and risks of such a phenomenon.

Research Methods

To conduct the study, the author focused on a vast amount of literature, mainly published on various Internet pages. One year after the start of the war, Ukrainian refugee children are still a topic of discussion in various forums. They're often mentioned in print publications and in various issues. But we do not yet have a real data set for all countries, so our study has some limitations. The author also relies on the results of a survey conducted by the author in October 2022 ("*How Various Adaptation Schemes in the Education Systems of European Countries Affect the Inclusion of Refugee Children from Ukraine in Their Educational System*", 2023). The pilot study included 160 respondents from Poland, Germany and the UK. These countries were chosen because they chose different models for integrating children into their schools (immediate integration into regular classes or prolonged stay in welcome classes) and, accordingly, children had different difficulties in adaptation.

The Ukrainian Education System a Year After the Outbreak of Hostilities

Immediately after the invasion began, the Ukrainian Ministry of Education announced a vacation that lasted about a month. From the end of March, 2022, Ukrainian schools were switched to remote mode, to the best of the abilities that teachers and children had at that time (*Slovo i Dilo*, 2022). Some parts of the Ukrainian territories were under constant shelling, another parts were occupied, and many teachers did not have the technical ability to conduct lessons in synchronous mode, so the assignments were posted on distance learning platforms in an asynchronous format and evaluated by teachers whenever possible ("*Overview of the Current State of Education and Science in Ukraine in Terms of Russian Aggression [as of December 2022]"*, 2022). After one and a half to two months, all children who were forcibly displaced within the country or abroad, could register in any Ukrainian school. So that Ukrainian schoolchildren, wherever they were, could finish the school year, and move to the next class. Schoolchildren who left Ukraine and accepted temporary protection status in the host countries were immediately enrolled in local schools and start studying there. In September 2022, a new academic year began—the first year in full-fledged hostilities. By this time, the Ministry of Education had developed the first reasonably clear criteria for teaching Ukrainian schoolchildren. Some Ukrainian schools began to work in the usual format, and some remotely.

Schools in Eastern Ukraine and, to the extent possible, schools located in the occupied territories operate online. In general, the issue of ensuring the basic security of Ukrainian children in the country was left to the mercy of local self-government systems. During air raids, children were required to go down to specially equipped shelters, lessons were conducted in an asynchronous mode, and other measures were taken to ensure safety, including a flexible transition in the event of a deterioration in the situation from full-time to distance learning. In this case, the question arises of how the rights of children abroad and their access to education should be ensured if parents want to maintain just such a format of education for their children. The Ministry of Education stated that it welcomes family and home forms of education, as well as external studies, for displaced children who are abroad

and in the occupied territories. The variant of the Ukrainian school in the remote mode asynchronously was also kept possible, that is, at the pace and in the time zone in which it is possible for students who are abroad. The parents, in permanent uncertainty, continued to keep the Ukrainian school online for their children, and this situation needed to be resolved. According to our research, two-thirds of parents abroad were still teaching their children in Ukrainian schools eight months after the start of the war. It caused an overload of children, who, in the conditions of adaptation to a new school and new conditions, were also forced to follow the program of the Ukrainian school in the evenings. However, in conditions of permanent uncertainty, it could not be otherwise. Eight months after the start of hostilities, two out of five of the interviewed parents were still determining their plans to return to their homeland or stay in the host country ("*Parental Uncertainty in Plans and Education of Ukrainian Refugee Children in European Countries*", 2023). The rest of the parents hesitated and made their return dependent on the possibility of finding a job, the possibility of a husband arriving, the issue of safety in their hometown, the whole house, and so on. Such parents tried to complete all possible educational strategies for their children, striving to help them learn the host country's language as quickly as possible, and more than other groups of parents worried about continuing their studies remotely in Ukrainian schools. The problem of uncertainty is widely studied in the works of authors dealing with the problems of refugee children (e.g. Karaagac, et al., 2022). However, this problem has not been linked to the possibility of remote education for refugee children in their home country.

A year after the outbreak of hostilities, the Ukrainian government declared that there was no need to overload children with two schools simultaneously (Мірошнікова, 2022).

Thus, for children who are abroad, such a scheme is proposed. If a child attends a local school, their grades will be recalculated upon their return to their home country. If the child does not go to a local school, he is recommended to continue to study remotely in a Ukrainian school, synchronously or asynchronously, including through a family form of education or external study (see "Overview of the Current State of Education and Science in Ukraine in Terms of Russian Aggression [as of December 2022]", 2022).

Despite the objective difficulties, incessant shelling, constant blackouts, and lack of communication, the Ukrainian education system is intact and continues to work. After two years of fighting the coronavirus infection, distance learning platforms and distance courses were created, and it was possible to continue learning Ukrainian children in a remote mode.

Ukrainian Schoolchildren Attend European Schools

The issue of security in Ukrainian cities remains critical, where the possibility of shelling, power outages and lack of electricity is a daily occurrence. The winter of 2022-2023 was harsh due to regular shelling of critical infrastructure, lack of water, heat, electricity, and communications. Those Ukrainians who were forced to leave the country, regardless of their plans or desire to remain in their host countries, continue to live there. Thereby they have taken responsibility for educating their children in local schools. European countries have adopted two vectors for integrating children into education systems. The first is direct enrollment in regular classes. This system is often practiced in countries with Slavic language groups. Poland, Czech Republic, Slovakia, Bulgaria and Montenegro have such a system. The second is "welcome classes," in which children learn only the language of the host country for a few months (or years) and then are gradually integrated into regular classes. Germany, Austria, France, Spain, Belgium, Netherlands, Sweden, Denmark and other

countries have followed this way ("How Different Adaptation Schemes in the Education Systems of European Countries Affect the Inclusion of Refugee Children from Ukraine in Their Education System", 20-23). Let us make one more small remark about integration systems. When we talk about the welcome class system, for example, in Germany, we mean that the welcome class system is quite widespread. However, there is evidence that in some cases Ukrainian children were immediately enrolled in regular classes due to the lack of teachers able to teach the language as a foreign language. This policy depends on the availability of land and the ability to organize welcome classes. In addition, there is evidence that in countries where the policy of immediate integration into mainstream classes is widespread, welcome classes are created where children study the language intensively for several months before moving into mainstream classes. In other words, the system of integration one year after the outbreak of war is not something clearly defined, but a dynamically evolving system with some clear trends.

The German education system, which received a significant number of refugees from Pakistan and Syria between 2010 and 2016, was quite prepared to receive refugees from Ukraine, as was the Swedish education system, for example (Crul, 2019). However, the Ukrainian crisis has become an even greater challenge for all education systems, if only because of the unprecedented number of refugees themselves. According to the latest data, as of January 2023, more than 500,000 Ukrainian children were studying abroad. Most of them are now in Poland - about 200 thousand; in the Czech Republic about 80 thousand Ukrainian children are registered in schools; in Germany - about 200 thousand ("Situation Ukraine Refugee Situation", n.d.).

The issue of adaptation and integration of Ukrainian children in European schools taking into account the socio-psychological portrait of Ukrainian refugees was considered in detail in our previous works ("How different models of adaptation in the educational systems of European countries affect the inclusion of refugee children from Ukraine in their educational system", 20-23). In this paper we want to systematize the results of the ongoing migration processes with school-age children one year after the beginning of hostilities. Thus, during the first year school-age children faced the following problems and difficulties:

- Difficulties in psychological adjustment.
- Breakdown of social ties and search for new friends.
- Ignorance or insufficient knowledge of the local language and related problems in understanding educational material, inability to fully communicate with peers and difficulties in finding new friends.
- Homesickness, homesickness for close relatives, homesickness for familiar things.

Children's psychological adjustment is directly related to their parents' adjustment. In turn, refugee parents usually experience the following adjustment difficulties (Morrice, 2021):

- Factor of uncertain future, inability to make long-term plans in the host country.
- The destruction of social ties.
- Deterioration of the material situation due to the loss of jobs and property as a result of the war.
- Ignorance or poor knowledge of the language of the host country, deterioration of career prospects, need to confirm diplomas or acquire a new profession.
- Feelings of loneliness and yearning, isolation from husbands and relatives. In Ukraine, men under the age of 60 are generally not allowed to leave the country.

All these factors affect the children, the speed and quality of their integration into the new environment ("How Different Adaptation Schemes in the Education Systems of European Countries Affect the Inclusion of Refugee Children from Ukraine in Their Education System", 2023). In addition, one of the most critical factors in this case is the factor of uncertainty in the plans of Ukrainian parents. In a situation where it is unclear how long they will have to stay in the host country - neither the timing of the end of hostilities, nor the possibility of returning home, nor the possibility of staying - people experience the maximum level of anxiety, which inevitably is passed on to their children. It can also slow down the integration process. The question of whether to continue studying in the Ukrainian school at a distance, whether to expel a child, how intensively the language should be studied, is quite a concern for parents ("Parental Uncertainty in the Plans and Education of Ukrainian Refugee Children in European Countries," 2023).

It is difficult to answer what percentage of Ukrainian students are already enrolled in local schools, although statistics on this issue are constantly updated ("Situation Ukraine Refugee Situation," n.d.). However, the answer to this question depends on the host country and the obligation to enroll the child in a local school.

In Germany, Belgium, Switzerland and Hungary, a child with temporary protection status is obliged to attend school. In Poland, the Czech Republic (after the age of 15), Montenegro and Bulgaria, the child's parents can choose how the child is educated. For example, there are about 700,000 school-age children in Poland, but only about 200,000 of them attend Polish schools. In addition, parents can choose to educate their child at a distance in a Ukrainian school or in a Polish school, and are not allowed to combine the two options.

Currently, about 80 thousand Ukrainian refugees study in Czech schools (“The Voice of Ukrainians in the Czech Republic: Experiences and Needs of Children and Parents in Czech Education, 2023). Compared to June 2022, the situation has generally improved: 90% of Ukrainian refugee children attend primary school, compared to 56% in June 2022. Among high school students, only half attend local schools. This is where the uncertainty factor comes into play again: "The problem is that parents don't support their children if education is not important to them or if they don't want to stay in the Czech Republic," says Barbora Krzyzkova-Luženska, principal of Vodnany Primary School. - "Some refugee children are not motivated to get an education in the Czech Republic."

Since the last survey of Ukrainian refugees in June 2022, the intensity of Czech language instruction has decreased. Only about 16% of children aged six and older study Czech at school for at least two hours a day, as recommended by experts. The rest of the children spend less time learning Czech or do not attend school at all. "Teaching Czech has no effect if it lasts only one hour a day. However, it is likely that staff capacity does not allow for more intensive teaching, says Kavanova of PAQ Research. Strangely enough, Ukrainian high school students do best with Czech: 37% can already speak the language in everyday situations. At the same time, however, this is a very heterogeneous group. Half of them attend Czech secondary schools and speak Czech better than all children over the age of three. The other half does not attend secondary school and speaks Czech with incredible difficulty.

In Bulgaria, 127,000 refugees have already been granted temporary protection status, and 92% of the refugees are women and children. However, in Bulgaria, parents are extremely reluctant to enroll their children in local schools; there are currently only 545 students

enrolled in local schools (Not Many Ukrainian Refugees Have Stayed in Bulgaria Since the Start of the Invasion - Novinite.com - Sofia News Agency, n.d.).

Polish authorities express concern that quite a large number of children in Poland do not attend Polish schools - and no one can assess whether they study remotely in Ukraine and what is the situation with their education (Wójcik, K., 2023). According to the situation at the end of May 2023 there are ten thousand less Ukrainian students than at the beginning of the school year. According to the Polish authorities, this situation is due to the fact that Ukrainian children have certain difficulties in mastering the Polish language and are also afraid of final exams, especially exams for the eighth grade and matura. These fears are partially confirmed. In fact, this year Ukrainians are still far behind their Polish peers in the eighth grade exams, although they have improved their results compared to last year. The average score of Ukrainian students is 45% in Polish, 37% in mathematics, and 46% in English. Last year the average result of Ukrainian students in Polish language was 22%, in mathematics - 34%, in English - 44%. However, these results still differ significantly from the average results of Polish students, where the average score in mathematics is 53% and in Polish - 66% (Lvov, O.K., 2023). Since the results of the eighth grade exam are used for competitive selection to Polish lyceums and vocational schools, such low results bring additional risks for Ukrainians not to receive quality education and not to fully realize their natural abilities.

Discussion

The unwillingness to send their children to school may be related to specific problems, such as different ages for compulsory schooling. For example, if a child has already received a certificate of secondary education or is completing the final grade in Ukraine, he/she does not need to enter a lyceum or gymnasium in the host country, that also may be difficult due to the lack of knowledge of the local language. Or, on the contrary, a child is six years old and is a first grader in Ukraine, but in a Polish school at that time he or she would be in the "cerówka", i.e. zero grade. The second problem, following the first one, is the school system, which differs from country to country. Due to the lack of knowledge of the language, it is difficult for Ukrainians to enter Czech or Polish universities. Alternatively, parents are going to return home and therefore do not integrate the child into local schools. On the one hand, this approach seems quite reasonable and meets the long-term plans and, most importantly, the interests of the child. The child continues to master the native program, learns the native language and history, does not miss the school year and does not fall behind in academic disciplines, has the opportunity to ask questions to teachers and studying in a language he or she understands, receives a school-leaving certificate and is not overloaded with parallel education in the school of the host country. After all, children do not have to catch up on missed material when they return home. However, there are inherent risks here.

The stay in the country can be prolonged, and children remain isolated from their peers, do not make new friends, and do not participate in daily school life. There are concerns about time spent in school, the quality of education and individual parental responsibility. Due to regular power and communication failures, education in Ukraine can be asynchronous, grading can be purely formal, and there is no control over its quality, which, in effect, becomes the personal responsibility of parents. If we are talking about months of stay, such a variant of education is possible and acceptable. In a situation where the war has been going on for the second year, the possibility of full integration in such a situation of permanent temporariness seems less realistic. It is necessary to conduct mandatory control over the quality of education.

In any integration strategy, children face different difficulties and, consequently, different risks.

As for children who are abroad but do not attend local schools, since, as the author has already noted, the risk of losing the quality of education exists and, in fact, children's education becomes the responsibility of their parents, it is necessary to establish rather strict control over the quality of such distance education, as well as the time spent by children on the computer. In addition, monitoring of the psychological state of these children is necessary. I assume that the following options for controlling the quality of their education are possible: it is necessary to organize several places where Ukrainian children will attend scheduled classes in a distance format under the supervision of a tutor and spend at least the time established by law. It is necessary to oblige parents to timely provide the program of academic disciplines, information about the number of missed classes, the current level of academic performance of the child. It is also necessary to establish compulsory physical education and sports, to organize constant monitoring of the psychological state of children and parents, and possibly some social activities aimed at psychological stabilization and formation of new social ties. In addition, since the hostilities have not ceased, foreign language lessons should be organized on a permanent basis to facilitate the possible subsequent integration of children into local schools.

In the case of the model where the child is directly and immediately integrated into the educational process (Poland, Czech Republic, etc.), the main and major obstacle to a comfortable and quick integration into the educational process is the lack of knowledge of the local language. In this case, in order to improve the quality of adaptation, the author would recommend to avoid immediate enrollment in regular classes, but to practice the first months of education in welcome classes with intensive study of the language of the host country and immediate inclusion in lessons that do not require language load (sports, music, physical education, English, possibly mathematics). Such a stay should not be prolonged, but should mitigate the difficulties of adaptation. In addition, after suffering psychological trauma, enrolling in regular classes with immediate assessment in a foreign language will not help in accelerating adaptation, only adding stress and strain. In this case, organizing welcome classes may be the best way out.

In the case of a model where the child is expected to spend a long time (a year or more) in a welcome class, there are additional risks associated with being cut off from peers in the host country, as well as the loss of the school year. We need to develop some fairly clear criteria for transfer to regular classes (Heinrich-Böll-Stiftung 2022). We also need to continue to monitor some rather important points. First is the psychological state of refugee children and the impact of the psychological state on children's adaptation in schools. It is still an open question up to what point in the schooling the fact that a child is a refugee and does not yet know the language can be discounted. From what exact month of schooling and under what conditions should he/she be assessed on an equal footing with local students? What is the percentage of children who, after one year, have moved from the "hospitable" classes to regular classes, and what is their level of language proficiency? What we see now is a lack of specific criteria for transition from a welcoming class to a regular class and mechanisms for gradual integration. This issue is left to countries, regions, schools and individual teachers. There is no interaction or any consideration of the fact that children study in Ukrainian online schools. In fact, for the entire first year, no one knows or is interested in what subjects in school were his or her favorite, what strengths or weaknesses he or she has, whether the child

is a humanitarian or inclined to exact sciences. The school year is lost, and it is good if it is only one year. All these questions are still waiting to be answered.

The main point to consider in the current state of affairs is that a large percentage of parents (and children) expect to return home after the end of hostilities. Ukrainian schools continue to work in a distance format, and the government has a strong concern for the quality of education for these children, whether it is in a mixed format or only in local schools. It would be very productive to establish high-quality interaction with the Ukrainian Ministry of Education in order to maximize support for the children and their continuation of distance learning in Ukraine where it is in the best interest of the child.

Conclusions

During any hostilities, children are one of the most vulnerable categories of the population suffering from war. The primary task of the state institutions of Ukraine and the host countries is to ensure the right to education and control the possibilities of its provision. Different host countries have adopted different approaches to realizing the right to education of Ukrainian children, including both compulsory admission to local schools and leaving it to parents' discretion. In those countries where parents are allowed to continue their children's education remotely in Ukrainian schools, state institutions need specific, clear rules and opportunities to control the quality of this education, monitor the psychological state of children, monitor the assimilation of the curriculum, maintain steadfast supervision of parents, and develop mechanisms for integrating children into the host country's community.

In countries where welcome classes are the most common model, segregation of children, the quality of their progress in learning the host country's language, and the actual loss of the school year can also be the biggest problems. The longer the child spends in the welcome class, the fewer chances there are for complete social integration. As a result, they have fewer chances for the maximum realization of their natural talents.

Control, monitoring, and assistance to parents by all social institutions will allow maximum control over the quality of education for Ukrainian children.

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Assessment Horizons: Pre-service Teacher Expectations on Future Education

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Abstract
Socio-technical imaginaries of preservice teachers are an important area of inquiry that warrants exploration, partly because teachers need to be prepared for teaching in a digital society and partly because they will enter schools and influence education in their own right. In this paper, we examine the socio-technical imaginations of pre-service teachers in relation to future assessments in education. Socio-technical imaginaries reflect values and priorities and play a significant role in fostering agency and ownership in meeting and managing the development of future practices, thus contributing to a higher quality of education and professional development. Pre-service teachers (n=21) were instructed to write journal reflections and narratives during a speculative future intervention as part of a teacher training programme. In this study, we sought to explore how pre-service teachers perceive the role of technology in shaping future educational assessment practices. The data was analysed using thematic analysis and discussed through the lens of Information Systems Artefact. The findings indicate both teacher scepticism and robust agency as digital innovations emerge in the learning landscape. This paper will be valuable for stakeholders aiming to promote responsible digitalisation, educators, and educational researchers interested in understanding and adapting to the evolving landscape of technology in education.

Keywords: Socio-Technical Imaginaries, Pre-service Teachers, Chat-GPT, Speculative Futures

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Introduction

Socio-technical imaginaries, a concept coined by Jasanoff (2015), refer to the collective visions of a society's future shaped by technology and its potential impact on social life. These imaginaries are crucial in shaping new technologies' development and integration into society. In this context, assessment refers to evaluating the implications of technological advancements on society regarding their ethical, economic, and environmental consequences. Socio-technical imaginaries refer to individual and collective visions of desirable futures shaped by shared cultural, social, and political values (Jasanoff & Kim, 2009). These imaginaries influence not only the design and use of technologies but also the ways in which societies understand and engage with them. As such, they hold considerable sway over developing and implementing assessment practices, which are integral to educational and professional systems. Technology and its potential and risks are central elements in the societal debate (Kerschner et al., 2018) concerning education. The discussion on the digitalisation of education has hardly changed, even though the technologies in focus have (Kerres, 2022). It has been argued that future teachers must ensure their plans are closer to the students' reality and the use of technology (Becuwe et al., 2022). Following Schelly et al. (2021), this article posits that pre-service teachers' socio-technical imaginaries may offer insights into tomorrow's normative practices and plural ontologies and inform teacher education. Rather than conceptualising future education or planning for protection against emergent fears (Facer & Enright, 2016), this article frames and theorises the nature of pre-service teacher articulation of future education and educational practices. Pre-service teacher socio-technical imaginaries are a relatively new concept, and there is still much that needs to be explored and understood about pre-service teacher anticipation. Exploring respondent narratives allows for raising awareness and could support emerging alternative paths. The study empowers pre-service teachers to verbalise the unknown by sharing their views and positioning themselves and future education in context and with each other (Priyadharshini, 2019). Pre-service teachers entering education are expected to teach for at least a few decades. They need to stay relevant and engage in professional development and educational practices. In addition, school development needs to reflect the digitalisation of society at large to prepare learners for an engaged life in an even more digital society. Previous research has noted that the main difference between less and more experienced teachers lies not in the type of learning activities they undertake but in their attitudes toward learning, learning outcomes, and how their context influences them (Kyndt et al. 2016). Thus, exploring pre-service teachers' attitudes and anticipation of educational futures will likely offer other insights into how they anticipate future schooling. Research at the forefront has already described the potential implications of data-driven and automated assessment (Paiva et al., 2022), learning analytics and artificial intelligence (AI) in the K-12 classrooms (Tedre et al., 2021). However, when pre-service teachers engage in socio-technical imaginaries, they may not be updated with "the latest" in the tech industry. Instead, any extreme may be represented in their expression: i.e., they may include technologies that do not yet exist, report using preferring analogue teaching and learning methods, having a very limited understanding of digitalisation in education, or anything in between. However, "pre-service" implies that they are to become teachers; as such, they will need to rely on their knowledge and experience to prepare for scenarios in the classroom. This article explores the anticipation of assessment in future education through pre-service teacher socio-technical imaginaries. It discusses how these can help to improve the quality of teaching and learning, create better learning experiences for students, provide teachers with the necessary skills and knowledge to be better prepared for future challenges and scenarios and inform further development of pre-service teacher education through the lens of Information Systems

Artefact (ISA) (Lee et al., 2015). In the context of teacher education, Tondeur et al. (2013) addressed how student teachers are being prepared to use and integrate technology into their programs. The aim of this study is to contribute insights into pre-service teachers' socio-technical imaginaries on future assessment in education. Against this background, we raise the following research question: How do pre-service teachers perceive the role of technology in shaping future educational assessment practices?

Background

Assessment in Teacher Education

Assessment in higher education is crucial within all fields of knowledge, not least with regard to future educators. The general idea of assessments in teacher education is that they evaluate knowledge, skills, and competencies across domains like didactics, pedagogy and classroom management - while also modelling assessment practices for pre-service teachers. It is a critical component in preparing teachers for their future professional roles. Both formative assessments (such as classroom observations, lesson planning exercises, and reflective journals) and summative assessments (such as project outcomes and performance-based evaluations) have a place in teacher education as they provide ongoing feedback and support to the students, helping them monitor their progress and identify areas for improvement as well as serving as comprehensive measures of their own overall competence and readiness for the teaching profession (e.g. Kibble, 2017; Pellegrino, 2014; Schildcamp et al., 2020). However, assessment in higher education, particularly in the context of teacher education, is not without challenges and limitations. One issue is the potential mismatch between assessment methods and the complex nature of teaching and learning. There is a debate about assessment in relation to the measurement of learning goals and if the assessment is measuring what it is intended to (Boud, 2018). Traditional assessment practices often prioritise standardised tests and written exams, which may not adequately capture the multifaceted skills required for effective teaching. Nor do such methods prepare teachers to improve their own assessment skills in analogue or digital settings. Assessments focusing solely on knowledge recall may fail to assess candidates' ability to engage students, foster critical thinking, and adapt teaching strategies to diverse learning needs - and in effect - fail to model how they can use assessment effectively as teachers.

Assessment in the Digital School

Preparing future teachers to teach learners using technology suggests a context where infrastructure is sufficiently integrated for widespread access to digital technologies (Starkey, 2020). Teaching others requires introducing digital technologies, integrating existing systems and practices and the infusion across the teacher's work (ibid). There are challenges in observing and assessing students' progress while working at a distance, but advances in networked technologies, particularly when embedded in working practices, offer new solutions (Kukulska-Hulme et al., 2022). They suggest that it is important to continuously consider how the innovations may impact aspects of teaching, learning and assessment and, in this line, if there are any implications for teachers' professional development. Indeed, Pongsakdi et al. (2021) found that even though teachers with low digital confidence showed increased confidence, the staff with high confidence benefited most from the professional development. Yet, with the future in mind, researchers have since long proposed that technology may enhance cognitive processing to improve their intellect and enrich the minds

of humans (Salomon et al., 1991). Such a position also encourages a re-examination of prevailing conceptions of intelligence and ability, what is and what could be.

Socio-Technical Imaginaries

Pre-service teacher socio-technical imaginaries refer to the potential outcomes of students considering a career in teaching. Jasanoff defines socio-technical imaginaries as: "collectively held, institutionally stabilised, and publicly performed visions of desirable futures, animated by shared understandings of forms of social life and social order attainable through, and supportive of, advances in science and technology" (Jasanoff, 2015: 4). Building on Jasanoff, the position here is that we move beyond the language of imagination with socio-technical imaginaries and recognise the diverse pluralistic ontologies of cultures to develop inclusive frameworks for socio-technical system transitions. The introduction of standards-based instruction, the use of technology in the classroom, and the increased emphasis on teacher accountability have significantly impacted the teaching profession. All changes require teachers to be reflective and critical of their practice, necessitating a more in-depth exploration of the different elements that shape the teaching experience. At the same time, the rapidly changing landscape of education has created an increased need for prospective teachers to consider their future as educators. "How a person understands his or her relationship to the world, how that relationship is structured across time and space, and how the person understands possibilities for the future" (Norton, 2000: 45). Teachers will shape the future of learning. Their practices will be relevant for decades. Verbalising how and what pre-teachers believe, hope for, fear, and visualise the future is therefore of interest. Teachers' rights to verbalise priorities, learning studies, and practice development remain relevant to professional development. Visualising the expanded ideas can contribute to better preparation. Previous studies exploring an audience's imaginaries of artificial intelligence (AI) and of the future roles of teachers lifted aspects like "AI taking over" and questions of who would be right: the teacher or the AI system? Hrastinski et al. (2019). Here, we explore the understandings and worldviews of pre-teachers. Acknowledging that individuals often harbour diverse and incommensurable ontologies is essential. We need to accept the reality of pre-service teachers to achieve insights into their anticipation. Their stories can offer valuable insights into teachers' current positions on the role of educational technologies in the future.

Theoretical Lens

Considering the Information Technologies and socio-technical systems for categorising artefacts, Lee et al. (2015) propose a way to conceptualise systems (IS) that they refer to as the Information Systems Artefact (ISA). ISA consists of three sub-artefacts to be understood as interrelated parts of a compound: The technology artefacts with the human-created tools (digital or non-digital; physical or non-physical objects) used to solve a problem, achieve a goal or serve a purpose. The Information artefacts, which include instances of information that occur through human acts, can be used to process data, reduce uncertainty, and establish meaning. Finally, Social artefacts consist of relationships and interactions between individuals that help individuals meet their goals. Stressing that ISA does not necessitate IT (the tools may include digital and non-digital objects) but instead may be adopted as a lens to any societal system, Lee et al. emphasise that ISA "brings the socially excluded segment of the society [...] (thereby resulting in a whole that is greater than the sum of its parts)" (Lee et al. 2015: 18). The technology, social, and information artefacts all support each other's functioning, and it is only, together that they form ISA.

Method

The study was conducted within the teacher program at a Swedish university during November and December 2022. Pre-service teachers (n=21) participated in a synchronous online course on Assessment in digital learning environments, during which times were designated to the socio-technical imaginaries. The students were encouraged to reflect in a logbook and asked to co-author a narrative following intervention scaffolding that supports teacher imaginaries (Ross, 2022). While lesson time was limited, the pre-service teachers were encouraged to continue writing in their logbooks throughout the course. The data comprises 35 text entities: logbook entries (n=30) and narratives (n=5). The log-book entries, recounting individual, and group level reflections are coded with numbers reflecting student(s), log entry, and accumulated entry, for example, “Excerpt 1.2.4”. In exploring narratives of the future and education or educational practices, the actions (interactions and communication) become essential in understanding the critique of the current and the expectations ahead. The discovery becomes central because discovery means learning about one's surroundings, exploring potential goals, and directing intention towards specific affordances (Ross, 2022). As such, these processes reflect how pre-service teachers think about future education and educational practices via the buildings, materials, objects, and characters interacting with them and each other.

The course was designed to introduce digital technologies in education, stimulate creative thinking and exploration, and highlight the risks and potential of AI following the A-C sequence. A) Lecture 1: a three-hour lecture on how the written word has evolved from analogue to digital, including the changed role of the consumer. Lecture 2: looking into “Future education" providing a brief orientation of (non-exclusive) augmented and virtual reality, immersive learning, stations for 3D printing and modelling, telepresence robots in education, green screen and holograms. Adjacent to these lectures, the instruction for reflections 1-2 was communicated. B) Lecture 1-2 was followed by a seminar in which students would present a situation with AI, augmented reality, virtual reality, green screen, telepresence robots, or other digital technologies which they could see themselves using and describe how they engaged learners and executed their summative and formative teaching practices. C) Then, students participated in Lectures 3-4, which included assessment theories, digital examination, diagnostics, technologies to assess live practices, data-driven school development, AI in education and trying Chat-GPT and automated assessment. Then, the students started writing their narratives in groups. The narratives were handed in the following week. The data was analysed using thematic analysis (Braun & Clark, 2012). Notes were gathered in the familiarisation stage. Each logbook entry, representing both individual and group-level reflections, was coded using a system that designated the student(s), log entry number, and cumulative entry identifier (e.g., "Excerpt 1.2.4"). Tentative themes and sub-themes were formulated and grouped. The potential themes were refined by checking them against the coded data and the entire dataset. This step ensured themes were coherent, consistent, and distinctive. Upon discerning a clear and consistent pattern among the themes, each was defined and named, marking the final stage of the analysis process.

Results

We identified three themes: 1. Assessment Design, 2. Implementing assessment, and 3. Critical perspectives on future assessment are presented below:

Theme 1: Assessment Design

Socio-technical imaginaries play a critical role in shaping the design of assessment practices by informing the underlying principles and values upon which they are based. The pre-service teacher narratives suggest a shift in the conception of assessment and learning due to the influences of globalisation, digitisation, and AI.

> *Validating the [internet] source and type of source can be an important element [in assessment]. [As well as] accounting for the process: how to reach a result and not just accept 'a result' in itself can be another point that becomes increasingly important. Assessment is or should be related to the view of knowledge -which today has moved from "knowledge of facts" to "knowledge of using tools to find information and produce facts". Assessment could include how to use tools but not just that; whether it is done in an efficient and/or innovative way; if it adds a new perspective, etc.* (Excerpt 4.2.8)

> *Globalisation and digitisation will create a new view of knowledge, [...]. The teachers will have updated and shared criteria for assessing the students. Digital tools will help the teacher in assessment.* (Excerpt 5.1.10)

> *The choice of working method is affected – [one] may take into account cheating and [...] to what shows a fair assessment.* (Excerpt 15.2.28)

> *It's obvious that AI will create new teaching materials that relieve this burden [from teachers]. The student is connected to a kind of learning station, perhaps a screen, a helmet with a visor or some type of glasses and headphones. Learning takes place subconsciously. The subconsciousness is opened via soft music, and a voice provides learning as a narrative. Images constantly flow in association with the story, and the brain processes all this at its own pace. A night's sleep may be required until the knowledge can be tested via practical assessment, where the student is tested by performing a specific task.* (Excerpt 8.1.16)

In the above excerpts, the pre-service teachers describe that with future technologies, it is important to assess the validity of the online information and adopt some kind of competency-based assessment that focuses on evaluating an individual's ability to perform tasks and meet predefined standards and that this, due to technology, can only be done in the process, and not by accepting the final product. In this future, with AI, the pre-service teachers convey a bond between their view of learning and assessment, in which assessment is designed to assess particular content in a particular context. Thus, what it targets, reflects the values and views of what is important. As is shown in excerpt 4.2.8, there is still a traditional way to view knowledge, which reflects our society's battle with fake news (to validate and identify internet sources). However, some pre-service teachers also moved beyond currently debated issues and highlighted that we are likely to start talking about *what knowledge is.* Finally, with yet unrealised technologies, such as biological implants, one pre-service teacher suggested that learning will be passively transmitted during sleep (see excerpt 8.1.16), and that AI assistants are supporting assessment, impacting the role and essence of what a teacher is. This final example signals that the learning activity and assessment practices are interconnected, where the assessment design is directly linked to the learning activity and what the pre-service teachers expect digital tools to do (i.e., function as assistant teachers, material creators or tutors). While pre-service teachers describe the importance of assessing the validity of online information and adopting competency-based assessments, they also express devoted agency to master the emerging learning environment by actively

redefining knowledge, utilising innovative technologies, and integrating AI in both learning and assessment processes.

Theme 2: Implementing Assessment

In theme 1, pre-service teachers believe that the learning activity and digital technologies will influence the design of the assessment. These, in turn, are results of socio-technical imaginaries which reflect an understanding of the implementation and use phases. The ways in which educators imagine assessments may thus reflect their technological orientation, experiences and understanding.

> *During the day, six lessons will be held, a rather stressful day, but with the help of robot assistants and recordings (for later assessment), it will still be possible to get it done. [...]When the students have gone home for the day, the teacher's second part begins, which focuses on assessment. The teacher listens to the recordings from the robot assistant while at the same time looking at the assessment matrices of the classmates. The assessments are collected digitally to form a judgement. The students do not receive grades, but their various assessments are collected as a digital portfolio to form their merit values for future education. Assessment can take place afterwards. The students peer-assess each other, and the robot listens.* (Excerpt: 1.1.29)

> *Everyone interacts via mobile phone or sees digital screens in the air. We don't have to be in the same [physical] space, but everyone is where they feel like being and through thought, they are transported to 'the immersive' classroom. The teacher's function is a control function; the teaching occurs via a voice and VR [virtual reality] reality where all the usual moments occur via a pretend reality in the student's head. You hand in written tasks, where you don't even have to write, but what you think as a student is created in the form of text that is then shown to the teacher or the robot. AI corrects, provides feedback, and makes judgments, and the teacher just ensures everything flows as it should.* (Excerpt: 14.1.26)

> *Knowledge and performance assessment will certainly change in the future, as it does over time. Today, beautiful handwriting is not judged as was done in the past, just to name a few, but other things will be given a different weight in the future. It can be advantageous to have robots conduct assessments or parts of. More automated assessments can be fairer. I think passing on grades is still left to the teacher to do, but that is unnecessary.* (Excerpt: 4.2.8)

In the above excerpts, the implementation of assessment is focused on how pre-service teachers imagine they will actually be working with assessments in an unknown future. As is shown in excerpt: 1.1.29, there is a strong belief in using robots and AI technology. This means that the teacher's role becomes more of a facilitator. Interestingly, pre-service teachers express that future assessment is implemented in ways where assessment development has developed in parallel but separately from digitalisation. For example, it was described as abandoning grades (see excerpt: 1.1.29) and abandoning the demand for physical presence during assessment (see excerpt: 14.1.26). Pre-service teachers express ideas that align with micro-credentials (e.g., Ahmat et al., 2021), where the know-how is valued rather than knowledge being reduced to grades. While pre-service teachers recognised the evolving nature of assessment and *what will be assessed*, they still thought assessment could be

conducted collaboratively, with peers, AI and teachers having defined and complementing roles, where AI could be a guarantor for fairness. The socio-technical imaginaries can either facilitate or hinder the integration of innovative assessment technologies, such as adaptive testing or e-assessments, into established practices. By recognising the role of sociotechnical imaginaries in shaping assessments, stakeholders can better adapt their practices to accommodate diverse learners and contexts.

Theme 3: Critical Perspectives on Future Assessment

Socio-technical imaginaries were also seen to play a crucial role in interpreting and evaluating conclusions. As seen in themes 1 and 2, they influence the design and implementation. In theme 3, we found that critical voices and interpretations of assessments contribute to the richness of the interpretation, as acknowledging their role can foster more inclusive, diverse, and ethical approaches to assessment.

> *When discussing emerging technologies, it is easy to overlook the purpose of introducing new technology. If the purpose is for students to become good at using technology, it is important to use the technology [at hand]. But, if the aim is for the students to become good in a subject area, it is important to look at whether the technology contributes to increased goal achievement or steals focus and resources from what is really important.* (Excerpt 3.1.5)

> *The teacher's role will change. For me, it boils down to: what was my desire to become a teacher? Do I want to be a teacher if interaction with students decreases? Or is it the case that if I get the help of digital technology to do certain things, the time for interaction will be greater?* (Excerpt: 4.2.8)

> *Assessment in the future is likely to be even more multifaceted because the more we become dependent on the digital world and its tools, the more those parameters must be considered in the assessment. A teacher must also be careful about what is to be assessed so that it is not digital use, such as the ability to find facts that are assessed.* (Excerpt 10.3.22)

> *[It will be] more difficult with assessment and written assignments: "Who has done what?", "How much can the student actually know?"... It is harder to find out what the student can do.* (Excerpt: 15.2.28)

What hinders teachers' technology acceptance may be brought up in themes reflecting critical thinking. In this vein, we can identify scepticisms with regards to the EdTech industry and the real purpose behind the absorption of digital technologies for education and what is perceived as negative changes to the teacher role, with covert statements of quitting their position as a teacher if the role changes not to meet the expectations one had when becoming a teacher (see excerpt: 4.2.8). While scepticism is important, other critical ideas move beyond scepticism and toward what is assessed, where some point out that the sphere focuses on assessment needs to establish that lack of digital skills must not impact how students are assessed (see excerpt 10.3.22), as assessment becomes increasingly digitalised, and others enforce the challenges with discerning individual student contributions and knowledge progression. Thus, respondents present values in which all teachers do not see technology as trustworthy; they recognise their enormous impact and while they expect assistance, new

materials, time-saving assessment, too little control of the learning process, and being reduced to having a control-function trigger different reactions with the pre-service teachers.

Discussion

By acknowledging the influence of socio-technical imaginaries on assessment design, stakeholders can work to create more inclusive and diverse assessment practices that better align with societal goals and values. By understanding the role of sociotechnical imaginaries in interpreting assessment outcomes, stakeholders can work towards more nuanced, equitable, and context-sensitive evaluations. Results reveal that pre-service teachers are contemplating the interplay between the evolving learning environment, the transformation of the teacher's role, and the factors that may hinder technology acceptance. The themes emphasise adapting to the changing educational landscape while remaining grounded in recent and relevant assessment research.

The technology artefact (Lee et al. 2015) focuses on technology's perceived capabilities and constraints. Our findings suggest that pre-service teachers may perceive technology as offering new affordances for assessment practices, such as automated grading, immediate feedback, and adaptive assessment algorithms. They may also consider the limitations and challenges associated with technology, such as concerns about reliability, validity, and equity. The affordances of technology may be shaped by factors such as the availability of resources, the usability of technological tools, and the compatibility between technology and existing assessment practices. In Theme 3 (*Critical perspectives on future assessment*), we explore critical perspectives and identify tech-scepticism. concerns about potential underlying motifs behind integrating digital technologies in education, and apprehension about teacher role change (Ertmer et al., 2012). Beyond scepticism, concerns focus on assessment aspects, emphasising the need to ensure that students' digital skills do not negatively impact their assessment and addressing the challenges in discerning individual student contributions and knowledge progression (Pellegrino et al., 2014).

The information artefact (Lee et al. 2015) focuses on how individuals perceive, and process information technology provides. In this context, pre-service teachers may consider the available information through technological tools such as online assessments, digital learning platforms, and data analytics. They may perceive technology as a means to access a wider range of data about student performance, including real-time feedback, personalised learning recommendations, and progress tracking. Pre-service teachers' perceptions in this regard may be influenced by their understanding of assessment theory and their beliefs about the role of technology in enhancing assessment practices. In Theme 1 (*Assessment design*), pre-service teachers highlight the importance of assessing the validity of online information and adopting competency-based assessments in the context of future technologies (Pellegrino, 2014). They emphasise the connection between their views on learning and assessment, addressing the challenge of fake news and exploring innovative technologies such as AI assistants (Bennett, 2015; Ifenthaler & Yau, 2020). This theme underscores the significance of actively redefining knowledge and integrating AI into learning and assessment processes (Holmes et al., 2019).

The social artefact (Lee et al. 2015) emphasises the influence of social interactions on individuals' perceptions and behaviours regarding technology. Pre-service teachers' perceptions of technology's role in educational assessment may be influenced by their interactions with peers, instructors, and other stakeholders in the education system.

Collaborative learning environments, online communities, and professional development opportunities related to technology use may shape their beliefs about the potential benefits and challenges of incorporating technology into assessment practices. Social norms, cultural factors, and institutional policies can also influence their perceptions of technology's role. Theme 2 (*Implementing assessment)* delves into the transformation of the teacher's role, with pre-service teachers envisioning a future where robots and AI technology influence assessment and transform teaching from a controlling to a more facilitating function (Holmes et al., 2019). This theme aligns with micro-credentials, emphasising the value of actual know-how over grades and fostering collaborative assessment involving peers, AI, and teachers in complementary roles (Ahmat et al., 2021). The role of socio-technical imaginaries in shaping assessment practices highlights the need for stakeholders to adapt to diverse learners and contexts (Jasanoff & Kim, 2009).

Conclusion

Assessment practices must keep pace as teaching methodologies and educational technologies evolve. Ensuring assessments align with contemporary teaching practices and prepare teachers for the realities of modern classrooms requires ongoing evaluation and adaptation of assessment strategies. By examining these themes collectively and incorporating recent and relevant assessment research, educators and researchers can gain valuable insights into pre-service teachers' perspectives on the future of education and the potential barriers and facilitators to adopting new technologies and practices. In summary, the implications emphasize the importance of teacher education in preparing future educators to effectively integrate technology into their teaching practices. Ongoing evaluation of assessment strategies and incorporation of research insights are crucial for aligning assessments with contemporary teaching practices. Recognizing the role of socio-technical imaginaries can foster inclusive and ethical approaches to assessment, ultimately contributing to the creation of equitable educational ecosystems. Socio-technical imaginaries are vital to understanding and shaping assessment practices, as they influence the design, implementation, and interpretation of assessments. Acknowledging their role can foster more inclusive, diverse, and ethical approaches to assessment. By incorporating socio-technical imaginaries into developing and evaluating assessment practices, stakeholders can contribute to creating more equitable, sustainable, and transformative educational ecosystems.

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The Relation Between Mathematics Education Software and Mathematics Thinking Style

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Abstract
In this study the mathematics thinking styles and the need for using mathematics education software for students of the Department of Mathematics and Computer Science and the Department of Business at the Modern College of Business and Science has been identified. The study was conducted among 101 college students during the 2022-2023 academic year. To this end, a questionnaire was used to identify students' preferences when attempting to solve a mathematical problem while the instructor is teaching them. According to the findings, there is a statistically significant difference between students from the two departments in terms of their preference to deal with mathematics concepts. More precisely, the preference of students from the Business department is visual thinking style, and they have a willingness to be taught by use of mathematical education software. Moreover, it is seen that Mathematics Thinking Styles are significantly different according to the students' seniority levels. A statistically significant difference has been observed in the scores of willingness to use mathematics software in favor of the Business department. Finally, the Mathematics Thinking Styles scores do not show any statistically significant differences in terms of the CGPA of students.

Keywords: Mathematics Thinking Styles, Math Education Software, Mathematics Education

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1. Introduction

According to the theory of construction of knowledge which was originally introduced by Bodner (1986), students as individuals have their own mental process in order to form information obtained and interpret lessons. In particular in the field of mathematics education, Ernest (2004) argued that the subjective knowledge is not a passive process but it is actively constructed by cognizing the subject. In this respect, there are different classifications of the ways that students understand and solve mathematics questions. One of the most recent studies which has derived attention of educational researchers is Borromeo Ferri's classification of thinking styles (Borromeo Ferri, 2003, 2004). Accordingly, there are three styles of mathematics thinking, namely visual, analytic and integrated. A student with visual thinking style is characterized by preferences for understanding mathematical notions and relations through "holistic representations, and his/her internal imagination is mainly affected by connection with experimental cases" (Borromeo Ferri, 2003, 2004). A student with analytic thinking style are able to understand mathematical concepts through existing symbolic or verbal representations and prefers to deal with math problems in a sequence of steps, and a student with integrated thinking style has the capability of combination of analytical and visual thinking. Shahbari (2020) studied Mathematics Thinking Styles in the context of modeling process of students and showed that students with visual thinking style have the ability of building a bridge between real world problems and their mathematical knowledge. Risnanosanti (2017) characterized mathematics thinking styles of Mathematics of third year students and showed that students who prefer analytic thinking styles have better achievement than those who have visual styles. In the case of Mathematics Education software, Sevimli (2016) compared students' thinking styles in traditional classes with students in a class with a Computer Algebra System and demonstrated that students in the traditional group give more weight to procedural skills, whereas students in the Computer Algebra System group give more weight to conceptual skills. In another study, Huincahue et al. (2021) implemented a quantitative approach among Chilean students of specific school age and found that students whose preference in solving mathematics problems is compatible with analytical thinking style are more superior in school. In addition to school level, the Mathematics Thinking Styles have been investigated among university level students too. For instance, Nadrah et al. (2019) studied Mathematics Thinking Styles of engineering students in one of universities in Malaysia focusing on their Algebraic knowledge, and showed that the actual behaviour of students when dealing with algebraic problems is more visual rather than analytical style. In another study, Moutsios-Rentzos et al. (2010) investigated both undergraduate and postgraduate students' thinking styles and showed that senior level students prefer flexibility in thinking.

As a matter of fact, a precise knowledge on Mathematics Thinking Styles of students will help instructors to design and implement relevant learning activities and proper approaches such as geometric, algebraic and numerical techniques that beneficial to students, and due to existence of daily interactions in the educational processes, therefore, the more of knowledge of learners' thinking styles, the more improvement in learning process. Indeed, a comprehensive knowledge on thinking styles develops instructors' ability to identify various techniques beyond their own preferences with respect to their students' preferences. Having considered the above-mentioned facts along with the important role of digital educational technologies in the 21st Century, this research aims to highlight the importance of Mathematical Thinking Styles focusing on different majors of studies along with the relationship with the willingness of using mathematics education software.

2. Objectives

The main purpose of this research was to identify students' mathematics thinking styles and preferences and to find potential relationship between thinking styles and use of mathematics education software.

3. Methodology

The study's participants were undergraduate students from two different departments, namely, Mathematics and Computer Science Department and Business Department at the Modern College of Business and Science in Muscat, Sultanate of Oman.

The study sample consists of 101 (69 female, 32 male) students enrolled in 2022-2023 academic year.

Gender	Female - Male
C.GPA	(Free numerical answer in scale of 4)
Major of Study	Business Department Mathematics and Computer Science Department

Table 1: General question

The data was collected through the convenient sampling method, from students registered in Calculus, Linear algebra, and Discrete Mathematics courses. It is worth pointing out that students from Business Department have two mathematics courses, namely, Basic Calculus and Basic Statistics and Probability, and these two courses are provided as Freshman level courses, but various mathematics courses are provided at different levels of seniority in Mathematics Computer Science Department. The Mathematics Thinking Styles Scale (MTS), the usage of Mathematics Education Software and a personal information form created by the researchers were used for the data collection process of the study. The original form of the Mathematics Thinking Styles was constructed by Borromeo Ferri (2003, 2004, 2015). It is worth recalling that the term "Style" is not translated as an ability, but rather, it is defined as a preferred way of using the abilities one has. This means that thinking styles can be changed during the time and based on other environmental factors. Borromeo Ferri (2015). The original form of the thinking style contains 3 main items and 6 subdimensions. Scores to be obtained from each item of the scale range from one to four. Higher points refer to higher levels of presence for the relevant thinking style. The thinking style with the highest score is described as the most frequent thinking style adopted by an individual.

The MTS was updated as to have 3 items with 12 subdimensions by researchers. Moreover, one item regarding willingness to use Mathematics Education software was added to the form. The scales were scored from 1 to 4 where 1 means "Not at all like me", 2 means "Not like me", 3 means "Fairly like me", 4 means "Very like me".

There were 36 students (35.6%) out of the total number of students were from the Business Department and 65 students (64.4%) were from Mathematics and Computer Science Department. A total of 39.2% of the students were Freshman, 28.4 % were Sophomore, 19.6% of students were Junior level and 12.7% were Senior level students.

Freshman	39.2%
Sophomore	28.4%
Junior	19.6%
Senior	12.7%

Table 2: Seniority Level of students

The collected data were statistically analyzed through SPSS. Results of the analyses conducted on the original forms of the scales were explained under the respective titles.

4. Results

According to results in table 1, there are statistically significant differences (at 1% level of significance) in the measures of group work and willingness to use of educational software between students in the Business department and Mathematics and Computer Science department. In both the two measures, students from the Business department have relatively higher levels compared to students from Mathematics and Computer Science department. As for the remaining measures including those of analytic, visual, and procedural, no statistically significant differences have been indicated between students belonging to the two departments as far as these measures are concerned.

5. Conclusion

As the first objective, the authors identified students' Mathematics Thinking Styles (MTS) and their preferences when dealing with mathematics concepts and problems. Also, the researchers investigated students' willingness to use mathematics education software and examined the relationship between MTS and the use of educational software. The results revealed that the thinking style of students of Business Department is the Visual Thinking Style, and they prefer to use mathematics education software in their mathematics courses, whereas in Mathematics and Computer Science Department students prefer the integrated MTS, and therefore they have flexibility in terms of learning mathematical concepts. It can be concluded that instructions based on graphical and geometric approaches could mostly benefit students with Business-based majors, according to their Visual Thinking Styles. In this respect, the rapid growth of educational software in the field of mathematics education benefits instructors to consider that as an essential part of mathematics education. In particular, Latifi et al., (2021) showed the efficiency of GeoGebra software in teaching Differential Equation for students with Integrated Thinking Style. For non-mathematics majors, Marchisio et al., (2022) conducted a mathematics education project focusing on students participated the first year of a biotechnology program and identified the role of software in problem-solving approaches. In addition to the above-mentioned results, the authors found evidence that students from the Business Department prefer to solve mathematics problems in groups. Future studies could investigate the Mathematics Thinking Styles in relation with Rational and Experiential Thinking Styles, as investigated by Coşkun (2018). As for limitations of this study the research questionnaire employed may have limited the resulting outcomes and as such it is suggested that future studies in this line consider using other scales.

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Smart Service Design Demands in the Fourth Industrial Revolution From a Sociotechnical Perspective

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Abstract
Recent technological changes have transformed the knowledge production process, opened previously unimaginable new possibilities, and developed unique values as knowledge creators for the future. These have involved the advent of *digital* or *smart services*, which naturally led to 'smart service design' in adjacent fields, especially those situated at the intersection of technology and service experiences, and require adaptation of design practices to cope with the new challenges and opportunities and deliver services of tomorrow. However, whether technology could subsume service delivery to such an extent that concepts of empathy, aesthetics, and design, not to mention the human touch, will fall by the wayside is controversial. Thus, this qualitative study was based on selected focus groups for a systemised understanding of service design practices from the perspective of sociotechnical transformation to explore a series of questions: How does the Service 4.0 concept impact the responsibilities of the service designer? 2) What new skills, tools, and methods should be made available when designing smart services? 3) How should current forms of service design education evolve to meet the demands of the future society?

Keywords: Service 4.0, Service Design, Smart Service Design Demand, Technology and Service Experience, Service Design Education

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Introduction

Service 4.0 is a relatively new concept, mainly concerned with the incorporation of pioneering technologies, including, but not limited to, artificial intelligence (AI), the Internet of Things (IoT), blockchain, machine learning, big data, the metaverse, and robotics. These once abstract concepts now have practical applications embedded in commonplace services (Paschou, 2018), thereby causing a significant transformation in the pattern of service delivery and extending additional benefits to customers.

Previous studies have predicted that in future society, digital-physical connected service systems will be extensively networked and that more services will be connected with other services in its ecosystem (Caruana, 2023; Schwab, 2017). This rapid progression of sophisticated technologies has led to a paradigm shift in traditional service delivery. Moreover, knowledge production has been transformed, unimaginable new possibilities have emerged, and unique value has been created as a knowledge creator for the future. Service providers are becoming more technology reliant in delivering their services with efficiency and scale, which has led to a complete transformation in service delivery that embodies these innovative technological features. Increasingly, advanced technology is becoming instrumental in serving customers, which is observable in situations such as automated health applications using biometric signals in smart devices (Bohr & Memarzadeh, 2020) or algorithms on over-the-top platforms that suggest user-specific digital content stemming from their interaction choices (Pajkovic, 2021). In addition, these technologies have been adapted from previous interactions by amending subsequent ones and constructing customer profiles for enhanced service delivery and increased sales opportunities. All of these components contribute to a comprehensive process of intelligent learning.

This transformative shift in technology applications has led to the creation of the service designer's roles and responsibilities to meet the new demands and effectively cater to the requirements of the changing landscape. The natural corollary to the advent of digitally enhanced services is the concept of ‘digitalisation’ of ‘smart service’, which naturally leads to ‘smart service design’ in adjacent fields that appear at the intersection of technology and service experiences and call for an adaptation of the established practices to accommodate the ensuing challenges and prospects.

The migration towards Service 4.0 has prompted the need to rethink the roles and responsibilities of service designers to subsume service delivery to such a degree that concepts such as empathy, aesthetics, creativity, and design, not to mention human touch, will become obsolete. However, others consider this as an opportunity to upskill and redeploy workers or alter their labour force. These challenges have raised various questions: 1) How does the Service 4.0 concept impact the responsibilities of the service designer? 2) What new skills, tools, and methods should be made available when designing smart services? 3) How should current forms of service design education cater to the requirements of an increasingly digital society?

The aim of this study was to provide understanding of the current status of service designers and identify the potential opportunities and challenges faced by service designers to discern the educational and technical skills that are critical from a sociotechnical viewpoint. It examined the new opportunities involved in service designers' capacities by:

- reviewing literature in service design, service systems, and networks in the context of emerging technological development;

- reviewing recent forms of service design education; and
- conducting a qualitative study based on selected focus groups for a systemised understanding of service design practices and how the recent development of technologies has influenced the way service designers work from the sociotechnical transformation.

To deepen the understanding of these issues, this paper is divided into three main sections. The first section introduces the Service 4.0 concept and its potential implications for the field of service design. The second section provides an overview of the current status of service designers, including their roles, responsibilities, and the challenges they faced (due to emerging technologies). The third section presents a review of the recent developments in service design education, including the incorporation of emerging technologies in curricula, the changes in teaching methods, and the shift towards a more practical approach. This section also includes recommendations for improving service design education, based on the findings from the review. The final section of this paper presents a qualitative study based on the selected focus groups.

In addition, the aim of this study was to uncover the practical implications of technological developments on service design practices and how service designers have adapted their work to these changes. Insights from this study would provide a deeper understanding of the current and future needs of service designers and help inform the development of relevant educational programmes and training initiatives.

By conducting a multi-faceted exploration of the service design field, this paper hopes to contribute valuable insights for both service designers and educators that would help them navigate the rapidly evolving landscape of Service 4.0. It also aims to stimulate further research and discussion on this topic to stimulate the field of service design to continue to evolve in a manner that is responsive to technological advances and societal changes, and to continue to play a vital role in the provision of valuable services in the future society.

The Concept and Potential Implications of Service 4.0 in the Field of Service Design

The service economy represents a paradigm shift in the modality of economic activity, where the central value lies in the provision of intangible services rather than tangible goods (Gallouj & Savona, 2009). These services embrace various sectors such as health care, financial services, education, hospitality, professional services, and information technology (Parrinello, 2004).

The transition from an agrarian economy characterised by physical labour and manufacturing to a service economy typically aligns with a progression towards industrialisation and urbanisation (Ramirez, 1999). As this transition unfolds, the economy changes from labour-intensive activities to more knowledge-intensive pursuits, which means a shift from manufacturing to service-oriented industries instead of manual labour, as value creation hinges more on intellectual abilities and knowledge application.

The rise of the service economy correlates with technological advancements, especially in the sphere of information communication technology (Schwab, 2017). Technologies such as the internet, e-commerce, digital communication tools, and apps have enabled services across international borders and fostered service-led economic growth.

Unique features distinguish the service economy. One such characteristic is that services are produced and consumed simultaneously. Consider, for example, an experience of dining at a restaurant, where service is rendered. The services of food preparation and serving are rendered concurrently with its consumption. This contrasts with the conventional production-consumption process for physical goods. Another distinctive aspect is the emphasis on relationship building and customer service. In the service economy, value is collectively created through interactions between service providers and customers, and these relationships often extend beyond a single transaction (Lusch et al., 2008; Vargo & Lusch, 2004).

Moreover, human capital becomes the key resource in a service economy, shifting the focus from physical assets to dynamic resources such as human knowledge and skills (Heskett et al., 2016; Lusch et al., 2008). Hence, opportunities for continued education and skills training are paramount in the service sector. However, while the service economy presents many opportunities, it also brings challenges such as income inequality, wage disparity, and the predilection for highly skilled workforces (Autor & Dorn, 2013).

Moving forward, the service economy is likely to witness more technological disruptions with emerging paradigms such as Service 4.0 (Paschou et al., 2018), which focuses on harnessing emerging technologies such as IoT and AI to refine service delivery. These latter developments underscore the pressing need for research to investigate the implications of these transformations for the future of the service sector and society. Indeed, the service economy sector presents plentiful opportunities for design-centric thinking to drive innovation. Sectors such as hospitality and tourism, health care, finance, education, communication, and retail have already witnessed this impact.

In a world increasingly embedded with countless services, the ascendancy of the service economy requires designers to develop cross-disciplinary abilities and capacities. These provide pathways for design-driven change across multiple sectors. Simultaneously, it involves the design of both digital and physical spaces where services occur, integrating aspects of user experience, communication, product, and interaction designs. The ultimate aim is to support evolving service structures and provide a seamless, positive experience to end-users.

Simultaneously, service design has emerged as a key discipline that orchestrates these advanced technologies into the service sector (Stickdorn et al., 2018). The synergy between Service 4.0 and service design holds strategic relevance in this technology-driven economy. Service design is an interdisciplinary approach that shapes how services are delivered and experienced (Meroni & Sangiorgi, 2011). In the context of Service 4.0, service designers play a pivotal role in integrating advanced technologies into services, adapting them to customer needs, and simultaneously enhancing the service experience (Barile et al., 2019).

Service Design in the Service 4.0

Service design in the Service 4.0 context helps organisations move towards more customer-centric services (Clatworthy, 2011). Service designers leverage technology to create touchpoints that personalise and enhance customer interactions. For instance, AI and big data analytics help in thoroughly understanding customer behaviours, preferences, and needs. Using these data, service designers can then develop tailored service offerings and experiences (Barile et al., 2019).

Designers also need to address the orchestration of multiple interconnected smart devices and platforms under Service 4.0 to provide a seamless user experience across different touchpoints (Sangiorgi et al., 2017). Therefore, the user-centred approach of service design is critical to managing the complexity of Service 4.0. Despite offering a host of opportunities, Service 4.0 also poses challenges to service design. One key challenge is ethical considerations related to data privacy and security, given the extensive use of personal customer data (Morelli et al., 2017). Thus, designing trustworthy service systems is a critical aspect of service design in Service 4.0.

Service 4.0 represents the technological transformation of services, and service design is vital to harnessing the potentials of these technologies efficiently and ethically. Service designers play a paramount role in shaping the future of service delivery by ensuring that innovative technologies translate into meaningful and superior service experiences.

The interaction commonly used when using services now requires rethinking the new ways of interaction and enables design to include fewer material aspects in its field of action. In the fields of service design and the nascent Service 4.0 paradigm, one intriguing aspect is the increasingly immaterial or less materialised aspect of design and interaction. The shift from tangible, product-based economic models to service-based models and now to digital platform-based models has accentuated the importance of elements that are less physical and more experiential, cognitive, and relational (Stickdorn et al., 2018). The conventional design has been tied closely to the material and tangible world, with a focus on the aesthetics, functionality, and ergonomics of physical artefacts. However, service design shifts this lens to designing processes and experiences involving a complex amalgamation of people, props, and platforms, making its outputs less materialised than traditional product design (Mager, 2009).

The intangible elements of service design are epitomised in the blueprint technique, a prevalent tool that helps visualise and organise complex service processes (Shostack, 2014). Unlike the tangible results in product design, the outputs of service design are abstract, such as customer journeys, personas, or strategy maps that guide the creation and delivery of service experiences (Zomerdijk & Voss, 2009). Interaction in service design underscores this immaterial aspect even more significantly. The essence of service lies in the interactions between service providers and customers, which are, by nature, immaterial, dynamic, and experientially rich (Holmlid & Evenson, 2008). The quality of these interactions heavily influences the quality of the service, shaping customer perceptions, and satisfaction.

Less Materials Aspect of Design in Service 4.0

As Service 4.0 emerges, characterised by the incorporation of emerging technologies such as AI, IoT, and blockchain, the less materialised aspects of service design and interaction are taking on new dimensions (Paschou et al., 2018). For instance, service interactions are increasingly mediated by digital platforms and AI, making them less physical and more virtual. Moreover, in the context of Service 4.0, the design of services extends to the design of algorithms, big data analytics, and automated decision-making systems. Indeed, design thinking is shifting from designing tangible interactions to crafting complex adaptive systems, entailing a nuanced understanding of technological capabilities, data-driven insights, and human-machine interactions.

Simultaneously, the physical presence of user interfaces in Service 4.0 has diminished, making them more immaterial and permeating different aspects of daily life, from smartphones and wearables to ambient voice assistants and augmented reality/virtual reality. This shift also calls for a new understanding of interaction design that acknowledges the increasing invisibility and ubiquity of digital interfaces (Giaccardi & Karana, 2015). However, even as services become less materialised, the human element remains crucial. In a digitalised world of service interactions, designing meaningful, human-centred experiences becomes even more pertinent. Human needs, emotions, and socio-cultural contexts continue to present themselves as key aspects for consideration. Thus, the roles of empathy and a deep understanding of user behaviour have become increasingly prominent.

Therefore, the field of service design, specifically within the framework of Service 4.0, is venturing deeper into the less materialised aspects of design and interaction. This ongoing transition presents a fascinating research trajectory, potentially challenging established principles and practices in design and necessitating new competencies, methodologies, and mindsets.

Research Methods

This research study employed qualitative methods to examine present-day service design education programmes. It also evaluated service design practices on the basis of qualitative data harvested from comprehensive interviews with professionals in the domain of service design and associated service sectors.

The research procedure was categorised into two stages to maintain a systematic approach. The initial phase was dedicated to gathering information about various service studies and closely examining the existing educational offerings of service design and corresponding programmes on a global scale. By utilising QS World University Rankings, a comprehensive list of renowned global universities was created, with a pivotal focus on the top five universities globally. In the context of Hong Kong, the study conducted an in-depth analysis and interpretation of the various emerging service design programmes available.

In the subsequent phase of this research, the focus was shifted to conducting detailed interviews with selected practitioners operating in different service sectors. This method was aimed at attaining a comprehensive understanding of the evolution of these practices within organisations over time. This would pave the way towards an advanced understanding of newly emerging service design practices, potential pathways, and identifying challenges associated with evolving technologies.

The sample pool for these interviews consisted of 15 professionals and 23 current students. The choice of respondents was intended to reflect the respondents' aspirations regarding their future career prospects and recount their professional journeys. By doing so, the study aimed to shed light on the future implications of service design for both educational platforms and the requirements emerging from the advent of Service 4.0.

Data were collected using methods such as semi-structured interviews that encouraged comprehensive and elaborate responses from the participants. Observations were also found to discern the service design competency and roles of designers within an institution's inner workings and respective projects. This multifaceted approach is designed to ensure a well-rounded exploration of service design practices and education.

Result and Discussion

The Landscape of Service Design Programme Offering

Service Design programmes worldwide play a crucial role in developing service design as a profession as well as a discipline. Each programme is at the master's level and emphasises the most common areas of service design—tools/methods, designing service, service innovation and business innovation.

Institutes	RCA (Royal College of Art)	UAL (University of the Arts London)	Politecnico di Milano	Glasgow School of Art	PolyU
QS World Ranking	No. 1	No. 2	No. 5	No. 8	No. 20
Country	UK	UK	Italy	UK	Hong Kong
Level	Master	Master	Master	Master	Master
Programme	MA Service Design	MA Service Design	MA Product Service System Design	MDes Design Innovation & Service Design	MDes Smart Service Design
Format	2 years (Full-time)	1 Year 3 months (Full-time)	1 year (Full-time)	1 year (Full-time)	1 year (Full-time)
Subjects	Service Design Foundation Programme (20 credits); Design Entrepreneurship (20 credits); Design Research and Advanced Methods (20 credits); Design Management and Platform Design (20 credits); Social Innovation and Future Services (20 credits); Implementing and deploying Services at scale (20 credits).	User-Centred Project (40 credits); Ways of Working (20 credits); Design Futures (20 credits); Collaborative Unit (20 credits); Proposal Development (20 credits); Major Project (60 credits).	Business Innovation (6 credits); Design Methods (6 credits); UX Design (6 credits); Innovation Studio (12 credits); Visualization & Prototyping (6 credits); Service Design & Innovation (6 credits); Product Service System Design Studio - Service Design (12 credits); Design Seminar (6 credits); Final Synthesis Design Studio (18 credits); Internship+Final Interview (15 credits).	Core Research Methods: Working Towards the Preferable (20credits); Parallel Project (40 credits); PG Elective (20 credits); Design Innovation Studio 2-Service Design (40 credits); Master's Research Project (60credits)	Designing Services (3 credits); Service Design Principle: systemic perspective (3 credits); Advanced Service Design Methodologies (3 credits); Research and Analysis for Design (3 credits); Smart Service Design Specialism Studio 1 (3 credits); Socio-Technical Service Ecosystem (3 credits); Systemic Innovation and Design for Future (3 credits); Smart Service Design Lab: Data driven Service Design (3 credits); Smart Service Design Studio 2 (3 credits); Design for Service Experience (3 credits); Research and Academic Writing (3 credits); Capstone Project (6 credits)
Credits	120 Credits	180 Credits	120 Credits	180 Credits	36 Credits

Table 1. Top five MA in Service Design programmes worldwide (as of 2022)

Amongst the international institutes in art and design, the RCA's MA in Service Design programme is uniquely positioned by historical influence over design communities and the industry and has held the No. 1 QS world university ranking since 2013. The programme was introduced in 2012 with the aims of developing research, disseminating new practices, tools and design processes towards solutions to current issues in design and carrying out projects to enhance innovation in both the private and the public sectors in an international context. Within this two-year postgraduate programme, the RCA fully embraces design, technology and business and industry partners. They nurture 120 students (2020), which is the world's largest postgraduate class dedicated to service design.

Likewise, the UAL in the UK offers a four-term model, which comprises 15 months of full-time study. The UAL's MA in Service Design programme, which was newly reformatted from MA in Service Experience Design in 2020, is offered by the London College of Communication at the UAL and teaches design disciplines that will broaden students' understanding of design innovation as a collaborative and interdisciplinary process. The programme develops and serves a range of societal challenges through live design projects with industry partners at both the strategic and systems levels. Students' backgrounds range from social science and business to other related fields, including those with industry and non-traditional design backgrounds.

Regarding the Mdes Service Design in Innovation School at the Glasgow School of Art in the UK, their MA in Service Design programme comprises six specialist pathways. Their

programme allows students to direct their studies towards their own professional goals and explore a specific context of practice. The service design speciality is taught as an approach to design processes to solve complex social problems and focuses on social value as well as economic impact, which is about addressing problems that affect people and society.

The MA in Product Service System Design programme at Politecnico di Milano aims to explore a combination of products, services, spaces, people, communication and digital artefacts for which sustainable design solutions are needed. Their programme is T-shaped with a vertical axis. The first level focuses on a specific design area (product, communication, fashion, etc.) and integrates with a horizontal axis relating to the acquisition and use of cultural tools and matrices from other disciplinary and cultural spheres in a manner similar to that of PolyU's programme. In particular, Politecnico di Milano offers knowledge of service design methods and tools, analysis of user behaviour, and social and technological innovation phenomena to define design opportunities and thereby enhance students' entrepreneurial skills.

Service Design Education in the Context of Hong Kong

By contrast, Hong Kong Polytechnic University (PolyU)'s Smart Service Design (SSD) programme emphasises advanced service design methodology and lab/studio work collaborating with service industry partners. Considering the global top-tier postgraduate service design programmes, it is expected that the content of PolyU's curricula and its service design involvement in wider communities should contribute to service design, which exclusively implies the nature of the demand for service design professions and an understanding of the current state of the service economy in Hong Kong. PolyU Hong Kong is proposing an emphasis on inter- or trans-disciplinarily approaches backed by technologies. Potential graduates of the SSD programme would enter the field of professionals with everything from strategic to systemic and integrated skills, which will allow them to develop new products and arm them with the service experience and complex communication skills needed in wide service sectors.

Although Hong Kong University's School of Professional and Continuing Education (HKU-Space) and the University of Warwick VTC both offer broad-based service design programmes for both a Postgraduate Diploma in Product Innovation and Service Design and an MSc in Service Management and Design, no Master of Service Design programme was introduced in Hong Kong until 2021. Based on the service economy needs and PolyU's unique proposition in the North East Asian context, this comparison presents a significant, although neglected, new proposal of how service design should be benchmarked against high-level international programmes that run postgraduate programmes in service design.

Service Design Demands and Expectations From the Chinese and Hong Kong Context

In the wake of progressive digital technologies, the service sector's landscape is undergoing a significant transformation. Hong Kong possesses a unique position within this shift to a digitally oriented service economy, making notable contributions of about 90% to the city's economy and even more to the Guangdong–Hong Kong–Macau Greater Bay Area (Statistical Digest of Services Sector, 2020). Hong Kong's economic model has been gradually transitioning from a manufacturing-based milieu to one dominated by service-oriented activities, making it a significant hub for international trade, finance and tourism. This economic metamorphosis has been instigated by government policies of minimal interference

and preferential taxation that have inadvertently attracted myriad overseas corporations specialising in various segments of the service industry to base their operations in the city (Lee, 2019).

Over the past few years, the Hong Kong government has implemented several strategies aimed at transforming Hong Kong into a global technology innovation hub (Wong et al., 2020). The Greater Bay Area initiative is one such significant undertaking, backed by a financial allocation of HKD 50 billion to stimulate innovation and technological development. To catalyse this colossal shift towards a digital economy, the government has fostered collaborations with numerous universities and tech enterprises both within the country and abroad (Cheung & Fong, 2020).

The need for services and technology in the economy is undeniably crucial. However, there is a growing awareness that the realisation of innovation lies not only in technology but also in value-added product, service and system design (Zhang & Song, 2021). Numerous examples can be observed in both the private and public sectors, encompassing diverse industries such as technology, consumer electronics, healthcare, tourism, hospitality, telecommunications, insurance, finance and government services. Respected global consultancies (e.g. IDEO, Livework, Engine, Fjord and EY) currently serve an extensive client base from both these sectors. The requirement here is an integrated approach to designing service experiences and systems that involves a fusion of multiple design disciplines into a systems-based solution. A comprehensive understanding of the technological, commercial and organisational context is also vital for creating and implementing innovative services.

Nevertheless, despite escalated attempts to foster the growth of service design as a professional discipline, there exists a substantial gap between demand and supply due to a significant deficit in the necessary skills in the Hong Kong technology and service sectors. Moreover, the capability for and value of service design are not sufficiently acknowledged (Yang & Sang, 2020). Therefore, reforms are warranted in the prevalent education design that attend to emerging industry needs and potential market demands. Additional measures, such as the establishment of the Service Design Network (SDN) and the SDN Hong Kong Chapter, would be instrumental for curating a professional platform conducive for local and international interdisciplinary collaborations and knowledge exchanges.

Service Designer's Expected Career Pathway and Roles in the Service Sector

According to a thorough analysis of interviews with service industry professionals, including those who pursued postgraduate studies to finesse their skill set, two career path models have been identified. Despite the lack of formal recognition of their designation as service designers and professional designations diverging from 'service designer', their roles align closely with service design job responsibilities. Given the inadequate dissemination and recognition of service design capabilities in the current service industry, many professionals are functioning as service designers under a variety of job titles. (i.e., UX designers, design researchers and design managers).

Such roles are diverse, and their job categories are contingent on the level of recognition and knowledge the organisation has for service design's relevance and capabilities. For instance, organisations that focus on digital products for the service experience employ a slew of professionals with titles such as 'UI/UX designers', 'service researchers' and 'product design managers' to conduct the researching, mapping, visualising and materialising of customer

and stakeholder experiences and journeys. Furthermore, they work closely with teams across the organisation, including the research team, UX team, back-end engineering team and the product owner. Additionally, in organisations closer to digital service management- or consulting-based firms, service designers (or designers in service delivery teams) tend to collaborate closely with stakeholders closer to management, such as service consultants, project managers and service quality managers.

In other words, both tracks require a collaborative mindset, the ability to understand research data and leadership that is more strategic and understands the whole rather than a single product/service. Ultimately, the design of a service encompasses more than the sum of its parts and necessitates a comprehensive, strategic understanding of the whole rather than a narrow focus on individual products or services. It requires a collaborative mindset, a comprehensive understanding of research data and strategic leadership that is not limited to a single product/service. Actuating service design as a profession at the organisational level could help bridge these gaps, meeting the escalating demand intrinsic to a digitally transformed service sector.

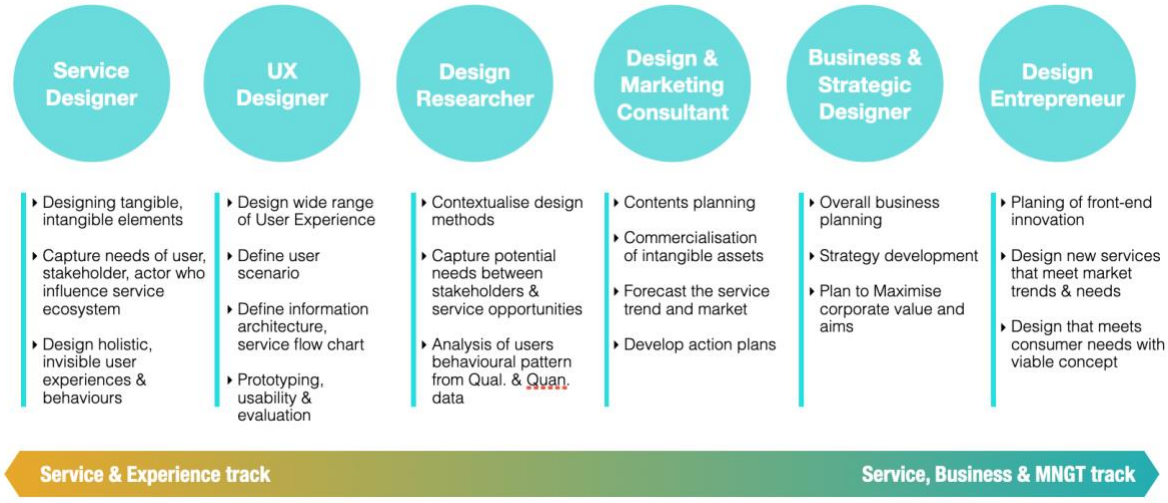

Figure 1. Career pathway and roles in the service sector

Role of Service Design Profession and Relationship Within Service Sector

As professionals gain experience and redefine the boundaries of predefined roles, their initial understanding of service design evolves. This development entails a comprehensive interpretation of service design and its role within an organisation. Correspondingly, service design has now extended to the implementation stages, thereby fostering both organisational and technological advancements.

In the current era of digital innovation within the service sector, this progression necessitates an amplified focus on technical competencies amalgamated with strengthened project management and stakeholder administration skills (Kimbell, 2011). As companies recognise the need to adapt to a rapidly evolving digital landscape, service design's role as a transformative agent is being understood and valued (Segelström, 2013). The dynamic organisational structures and transformations call for the establishment of a new norm deviating from the traditional 'business as usual'. Service design plays a pivotal role in this deviation by promoting collaborative practices that are essential for integrated design processes.

Service design professionals perceive their role not only as designers but also as strategic contributors to the organisation, as demonstrated by Figure 2. Thus, the service designer's role transitions from focusing on individual projects to undertaking broader strategic management responsibilities, expanding the horizon of service innovation through practices such as scenario building and foresight-based planning.

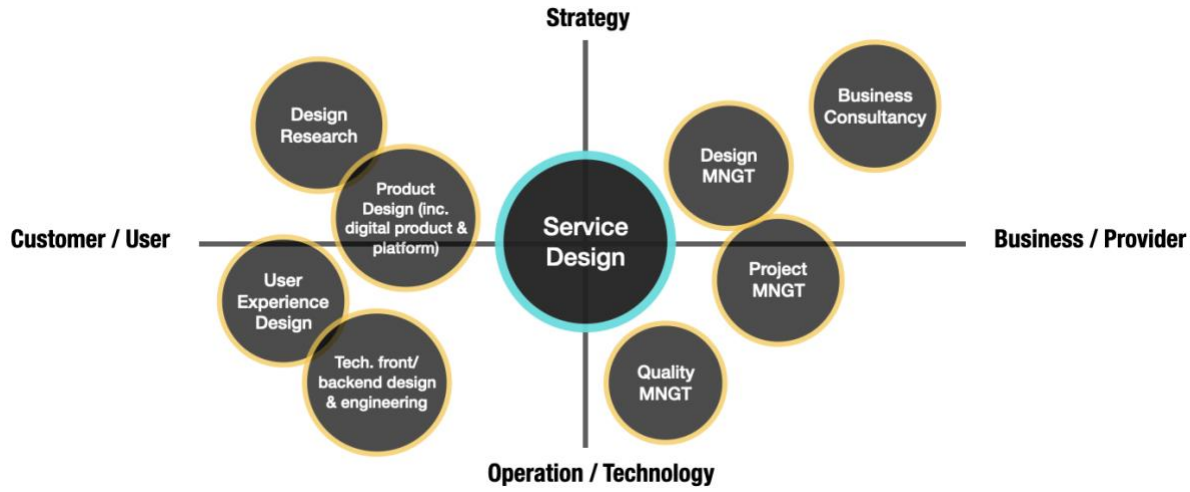

Figure 2. Service design position and relationship within the organisation in the service sector (Author)

However, an issue of contention is that such higher roles are predominantly occupied by senior designers, leaving junior or newly hired designers feeling left out. The rising predominance of automated visualisation and UX tools can substitute for or quicken the operational design tasks of junior designers.

Presumably, then, it might not be as essential for junior designers or those new to service design to learn about service design to become design managers. Instead, it might be more relevant to enhance cooperative and collaborative attitudes towards work, synthesise insights, refine one's interpersonal skills, and broaden one's perspectives to scrutinise issues from various angles.

This evolution validates the growing significance of service design in stimulating organisational transformation and technological advancement, surpassing its traditional boundaries. Hence, service design educators should acknowledge these shifts and develop pedagogies that equip future designers for the versatile roles they may assume in an organisation. Moreover, this recognition will encourage organisations to exploit the expansive capabilities of service design to accommodate the mounting expectations of a digitally advanced service sector. It will also arm service design professionals with the skills necessary to keep pace with swift digital advancements and evolving industry demands.

Conclusion

This paper has identified three key areas of potential implications for service design in Service 4.0 within the unique Hong Kong context.

First, the study has refined the understanding of service design's role in sectors such as UX, user research, project management, and digital service delivery, highlighting its considerable influence. This influence is largely determined by the characteristics of specific organisations and their service offerings, indicating the importance of context in interpreting and applying service design best practices.

Second, the paper addresses the challenges posed by the growing integration of automation and digital technologies in service design. While these technologies oblige design professionals in the service sector to evolve, they provide opportunities for growth and competency development within the profession.

Third, considering that changes can occur in multiple directions, this study ventures into forecasting roles and structures of the service design profession. It proposes potential scenarios for innovative service design education that reflect the changing landscape of the discipline.

Underscoring the multidisciplinary nature of service design across sectors and domains, this study seeks to pinpoint new opportunities for future professional directions. It also attempts to fathom the unparalleled value that service design confers in an era marked by a rapid technological revolution. As service design transcends traditional boundaries and stakes its significance in driving organisational transformation, its potential contribution to the realm of the digital service sector seems limitless. While challenges are inevitable, the evolution of service design presents monumental prospects for both practitioners and the industrial landscape at large.

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The Effect of Group Poster Competition on Student Motivation in a Rural Primary School in Southwest China

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Abstract
Motivation has always played an essential role in determining students' academic performance. The intent on boosting student motivation has led to different pedagogies. This study focuses on how group poster competition designed for 27 sixth grade students in a rural elementary school in China may affect students' levels of motivation in English classes. The group poster competition took place for six consecutive weeks from May to June 2023. The students were divided into 9 groups. Each group drew a poster weekly and presented their posters to the class to review the learning points in it. All students rated the presentations based on a rubric. The winning group received creative certificates of merit at the end of the semester. Although their final exam scores in Spring 2023 term did not show great improvements from the last one, a majority of them reported increased interest in learning English and improved classroom learning behavior during its implementation. My observation during the intervention period corroborated their reflections, as they completed homework more often, concentrated in English class more often and got higher scores in mock exams. I would recommend other teachers to incorporate group poster competition as a means of teaching into classes with students from different socioeconomic backgrounds and of different age groups to explore whether it fits in such contexts. Overall, implementing group poster competition may help students show more positive learning behaviors and perform better in tests, but it only shows a correlation and not a causal relationship.

Keywords: Motivation, Primary School Education, Classroom Learning Activity

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Introduction

Motivation always plays a crucial role in determining students' academic achievement. Before facilitating further discussion, I will first clarify the definition of motivation. According to Schunk et al. (2014), "motivation is the process whereby goal-directed activities are instigated and sustained" (p. 5). In my sixth grade English class, I observed that 55% of all students in the class, or roughly 15 students, who did poor in English tests did not lack the intelligence or ability to learn English well. What they did lack was the motivation to learn English, as demonstrated in their inadequate homework completion, lack of concentration in class and low test scores. The reason may be that for most students in my school, English is a foreign language which they may never use after leaving school.

Their lack of motivation led me to think of a way to engage them through interesting, interactive teaching. I also wanted to increase their peer collaboration through group work, as individual participation could spark their interest in active learning and make them work harder. Also, as Harada & Yoshina (2004, p. 22) noted, cooperative learning among students could increase students' creativity and add to the richness of in-class activities. Group poster competition was my solution to change them from passive knowledge receivers to active language learners.

Group poster competition worked in this way: The 27 students were divided into 9 groups. Each group drew a poster weekly and presented their hand-painted posters to the class to review the learning points in it. All students rated the presentations based on their content and clarity. The winning group received creative, hand-written certificates of merit and reward at the end of the semester. I was curious to learn how group poster competition as a means of teaching may affect students' level of motivation.

Teaching Context

The targeted population of this study consisted of 27 students in sixth grade in a rural primary school in Guangxi, China. Among them, 11 were females and 16 were males, mostly from low socioeconomic background. 22 students were left-behind children whose parents left their hometown and became migrant workers in nearby cities. Among the parents of the 27 students, 10% cared about their child's English grades in school, and 2 of them gave support to their child's English learning activities through homework assistance or finding paid after-school tutoring.

There were four English classes for grade 6 every week. Each English class lasted 40 minutes. The textbook used was PEP Primary School English published by People's Education Press. The components of each English class included presentation through lecturing, practice through teacher-student interaction and summary and homework. The goal of sixth grade English class was to let students master the form, pronunciation and meaning of certain key words and sentence patterns. Daily teaching activities aimed at helping them become fluent English speakers and efficient language users. The classroom learning activities were generally goal-oriented and test-oriented, as sixth-grade students took the Middle-School Entrance Examination in early July. There were two county-wide standardized exams each semester, which served as the main measurements of students' academic achievements.

Research Question

Whether group poster competition in sixth grade English class has an effect on improving student learning and motivation and how?

Research Method

Overview

Before implementing the project, I presented the average scores and passing rate in the students' last final exam in Fall 2022 term in a table. At the end, all students took the final exam in Spring 2023 term, the result of which was compared with that of Fall 2022 term. Due to the limitations of the test statistics gathered in the Spring 2023 final exam, I could only give a quantitative description of students' test score statistics. The result was supposed to demonstrate how group poster competition affected student motivation to learn English in a rural primary school. The conclusion was based on the students' test scores and qualitative data gathered from random student interviews throughout the intervention and a final motivation survey.

Duration of the Intervention Program

The group poster competition took place for six consecutive weeks from May to June 2023.

Method for Assessing the Levels of Student Motivation

In this study, the assessment of students' level of motivation included both a quantitative component and a qualitative one.

The quantitative assessment of students' level of motivation included comparing the average score and passing rate in the students' most recent standardized final exam for Spring 2023 term, with respect to their final exam results in Fall 2022 term.

The qualitative part of the assessment consisted of a formative assessment in the form of student interview questions (Appendix A) asked and answered during the intervention period and a summative assessment in the form of a motivation survey (Appendix B) given and collected at the end of the sixth week after implementing the program.

During the intervention period, I interviewed 6 students on their motivation level in learning English. At the end of the sixth competition, I carried out a survey asking all 27 students to assess their current level of motivation. I asked them to read each statement, tick the choice that best represented their current state and write down their feedback on their current level of motivation in relation to the group poster competition at the end of the survey.

Findings

Analysis of Test Statistics

Below were aforementioned score statistics of the 27 students from the final exam in Fall 2022 term.

Variables	Average Score	Median Score	Highest Score	Lowest Score	Passing Rate
Statistics	51	44.5	94	25	33.3%

Table 1. Students' test statistics in the final exam of Fall 2022

The average score of the class was 51 and the median score was 44.5. The highest score was 94 and the lowest score was 25. The passing rate (percentage of students scoring 60 or higher) was 33.3%.

Below were the score statistics of the 27 students from the most recent final exam in Spring 2023 term.

Variables	Average Score	Median Score	Highest Score	Lowest Score	Passing Rate
Statistics	53	45	87	27	37.0%

Table 2. Students' test statistics in the final exam of Spring 2023

The average score of the class was 53 and the median score was 45. The highest score was 87 and the lowest score was 27. The passing rate was 37.0%. For this study, we focused on the average score and the passing rate of the class.

The average score increased from 51 to 53, and the passing rate increased from 33.3% to 37.0%. However, we couldn't say whether the increase was statistically significant or not because we couldn't say between the two tests whether there were other factors affecting students' scores. So we could only give a qualitative description of students' test performance.

Student Interview Questions and Answers

I interviewed 6 students during the proceeding of group poster competition. As for Question 1, 5 of them said they enjoyed the activity, and 1 said it was OK. The reasons given for enjoying it were the interactive form of the competition and their autonomy in designing the posters. The reason given for the OK answer was that the competition helped in reviewing the knowledge, and the interviewee didn't have a particular interest in the competition. For Question 3, all 6 interviewees expressed increased enthusiasm in learning English during the competition.

Results of the Motivation Survey

All 27 students completed the survey. For the statement "I enjoy group poster competition." 19 selected "Strongly agree", 6 selected "Agree" and 2 selected "Disagree".

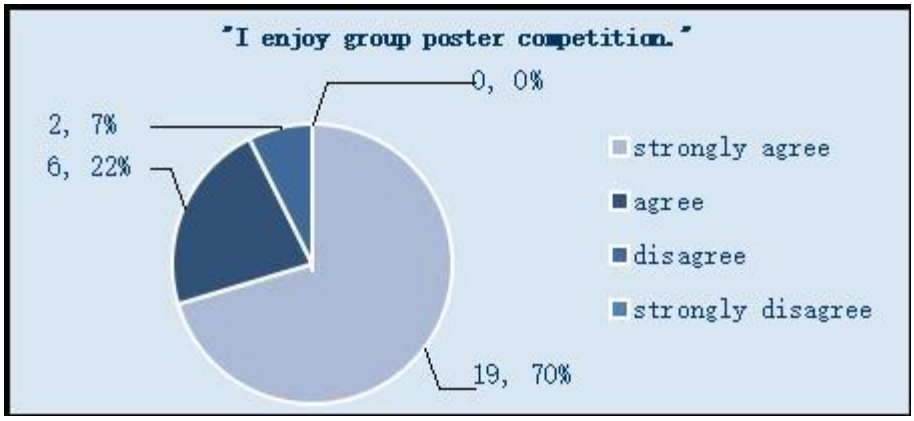

Figure 1: I enjoy group poster competition. (n=27)

For the statement "Group poster competition increases my interest in English language learning.", 18 chose "Strongly agree", 4 chose "Agree" and 5 chose "Disagree".

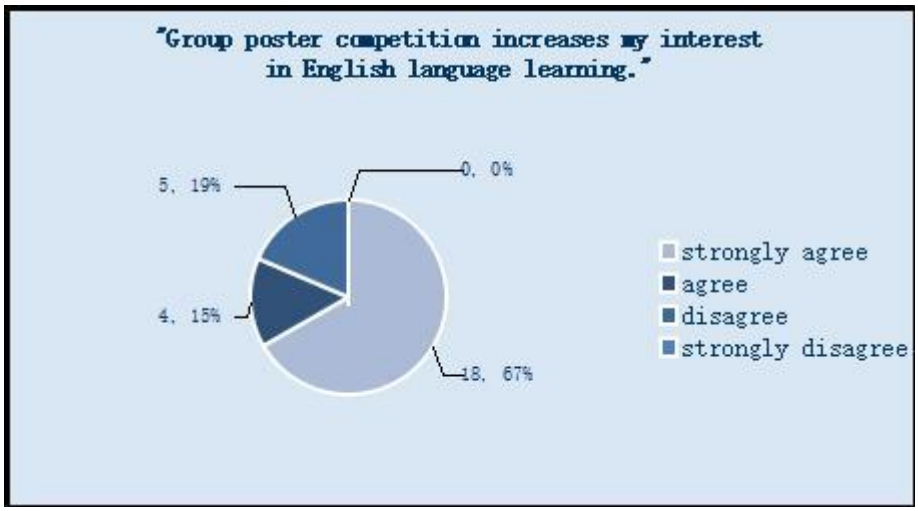

Figure 2: Group poster competition increases my interest in English language learning. (n=27)

For the statement "Group poster competition helps me learn English. ", 16 selected "Strongly agree", 7 selected "Agree" and 4 selected "Disagree".

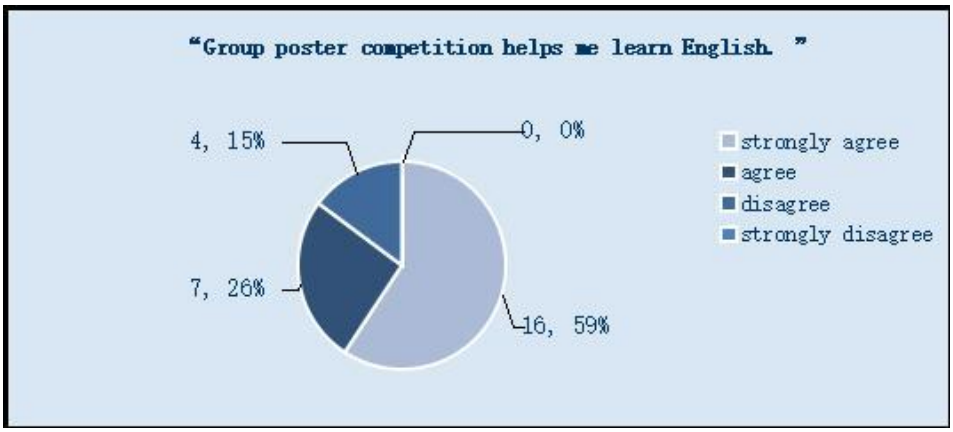

Figure 3: Group poster competition helps me learn English. (n=27)

For the statement "During the group poster competition, I complete my homework more often", 14 chose "Strongly agree", 7 chose "Agree" and 6 chose "Disagree".

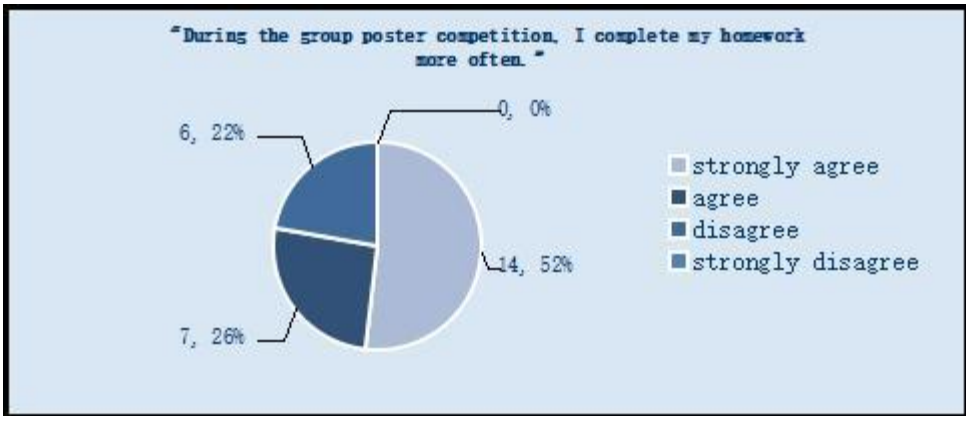

Figure 4: During the group poster competition, I complete my homework more often. (n=27)

For the statement "During the group poster competition, I concentrate in English class more often.", 15 selected "Strongly agree", 4 selected "Agree" and 8 selected "Disagree".

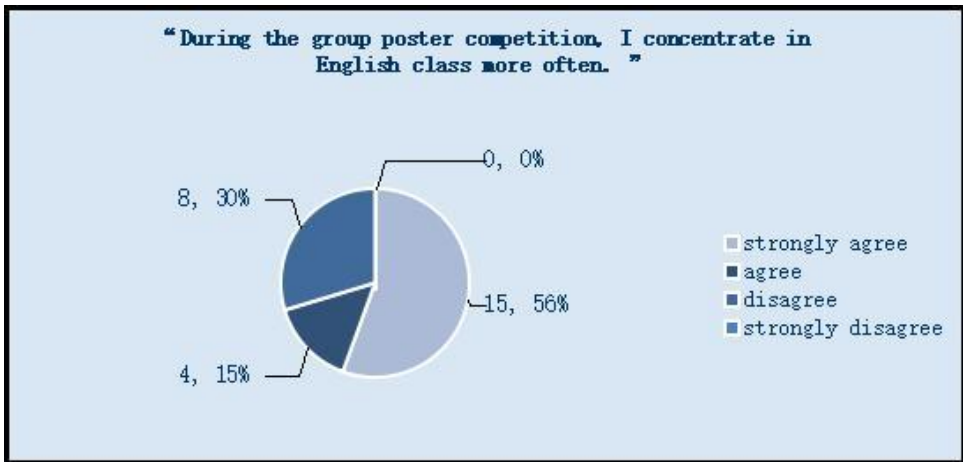

Figure 5: During the group poster competition, I concentrate in English class more often. (n=27)

For students' written feedback on the program, most students wrote that the competition did spark their interest in learning English. They self-reported that during the intervention period, they felt more involved in classroom through peer collaboration and they loved to participate more in English class to get a sense of achievement after reviewing materials in their posters before the entire class. All these interactions empowered them and increased their self-efficacy in learning English. After all, as Black (2004, p.40) found, making students feel engaged in classroom learning sparked their intellectual curiosity and promoted effective ingestion of knowledge.

Conclusion

From my observation in the intervention period, students showed improved classroom learning behavior and better performance in tests. Specifically, they completed their homework more often, concentrated in English class more often and got higher test scores in mock exams. Besides, my students really enjoyed the interactive learning environment and

increased participation in class, as they raised hands more frequently in classroom interactions with me and shared their opinions more actively in group discussions. Their most remarkable improvement was their change from showing visible stage fright in the first competition to becoming comfortable and confident about public speaking in the end.

As we can see in the data and figures, most students show a positive attitude towards group poster competition. A majority of them report increased interest and improved learning behavior during its implementation. There is a tendency in the motivation survey that as the statements on students' English learning behavior become more specific, the number of students disagreeing with the statements steadily increases. Perhaps as students get more reflective of their actual performance in English class, they come up with more details that contrast with the statements. Overall, I would recommend other teachers to incorporate group poster competition as a means of teaching into classes with students from different socioeconomic backgrounds and of different age groups to explore whether it fits in such contexts.

Discussion

This research only focuses on small-size, rural primary school class, so its applicability in larger classrooms and different school settings is still unclear and opens for further research. Meanwhile, developing different dimensions of assessing changes in student motivation levels is another possible area of exploration.

Furthermore, some researchers have proposed ways of motivating students that may be used in combination with group poster competition to see their effects in the future. For example, Kobus et al. (2008) demonstrate through their study that "creative engagement, student self-assessment and positive reinforcement" contribute to students' better academic performance, improved learning behavior and increased self-efficacy. For another instance, Biehler and Snowman (2015, pp. 398-402) suggest that means of motivating students specifically through positive reinforcement include offering effective praise, establishing a series of short-term learning goals for students to reach step by step, encouraging collaboration in classroom discussions through active contribution of opinions, etc. All these are valuable motivating strategies to be further studied in combination with group poster competition.

Appendix A

Student Interview Questions
学生面试问题

1. What do you think of the group poster competition so far?
1. 到目前为止，你觉得小组海报竞赛怎么样？

A. I enjoy it! B. It is OK. C. I don't like it.
A. 我觉得不错！ B. 一般般啦。 C. 我不喜欢。

2. Why do you give such answer in question 1?
2. 为什么会给出问题 1 里的答案呢？

3. Do you think group poster competition increases your enthusiasm in learning English?
3. 你认为小组海报竞赛是否提升了你学习英语的兴趣？

A. Yes! B. Not really.
A. 是的！ B. 没有。

Appendix B

Motivation Survey
学习动力调查

Read the following statements. Please tick under the choice that applies.
阅读下列陈述。请在你认同的选项下面打√。

No. 序号	Statement 陈述	Strongly Agree 非常同意	Agree 同意	Disagree 不同意	Strongly Disagree 非常不同意
1.	I enjoy group poster competition. 我享受小组海报竞赛这个活动形式。				
2.	Group poster competition increases my interest in English language learning. 小组海报竞赛让英语学习更有趣了。				
3.	Group poster competition helps me learn English. 小组海报竞赛让我学到了英语知识。				

4.	During the group poster competition, I complete my homework more often. 小组海报竞赛开始后，我完成英语作业更主动了。				
5.	During the group poster competition, I concentrate in English class more often. 小组海报竞赛开始后，我上课听讲更专注了。				

6. Please provide a detailed description of your current level of motivation in learning English after the group poster competition, as compared to your level of motivation before it. Please also write down any feedback you would like to let me know for group poster competition.

请详细描述一下在小组海报竞赛开展之后，你现在英语学习的动力与小组海报竞赛开展之前相比，有什么变化？ 也请写下你对于小组海报竞赛的任何想写的反馈。

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Ergonomic Aspect in Home-Office Teaching

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Abstract
The objective of the study is to present the comfort conditions in a domestic space from an analysis of ergonomic aspects aimed at carrying out activities at home office. The emergence of the Covid-19 virus spread around the world and led many countries to enact a lockdown, with consequences for the educational and economic system, among others. Therefore, the educational teaching space that was at school became home with the Covid -19 pandemic. The activities developed by the teachers that were in person became remote. In this way, the need arose to study the space and the health impacts of these professionals, who were not adequate to meet the emergency demand and meet the teaching and learning performance of students. The methodology used comprises a quantitative, bibliographic evaluation for an ergonomic analysis of the space built and adapted to the new reality of the work of the teacher who will carry out his classes remotely in a domestic space. The conclusion of the analysis carried out on the data collected and analyzed from the factors indicated in the research regarding lighting, temperature, and noise, are not satisfactory in terms of comfort in these spaces. It was evident that this space is not suitable for carrying out such activity, these factors interfere in teaching and learning, as well as in the health of the teacher.

Keywords: Teaching Space, Teaching Methods, Comfort of the Teaching Environment

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Introduction

This work is a case study carried out with the aim of raising the space conditions and conditions of comfort and health in the work activities of the teachers of a technical course of Work Safety and Nursing Technician of the Instituto Federal de Pernambuco IFPE (Federal Institute of Pernambuco), Campus Abreu e Lima, in Brazil, that resulted in damage to the health of teachers. The objective is to present the conditions of the environment for the home office in times of the Covid-19 pandemic, which focuses on fundamental aspects of comfort situations in terms of lighting, temperature, noise, furniture, and equipment present in these workspaces.

Ergonomics seeks to improve working conditions and improve workers' lives. In addition, it integrates different fields of knowledge, such as Psychology and Physiology, studying each in a real work situation experienced by human, identifying critical elements regarding their health and safety and based on this, preparing recommendations related to the improvement of physical conditions in certain areas and workspaces (Gomes, 2010).

As a result of the Coronavirus pandemic that emerged in 2019, the educational system has been facing challenges in disseminating remote teaching, reorganizing its school calendar, and adapting face-to-face classroom activities to home office (Nota Técnica GVIMS/GGTES/ANVISA nº 04, 2020). The disease was identified as a SARS-CoV-2 virus that causes a severe acute respiratory syndrome, which can affect organs other than the lungs. Scientific research has identified that transmission of the virus is very high among people (MEC, 2020).

In view of this aspect, the educational system used the advancement and democratization of digital information and communication technologies (TDIC) that caused radical behavioral changes in society and made these changes possible in teaching, and reflected on contemporary educational trends, among them hybrid teaching (Froese et al., 2001; Reisslein et al., 2005; Magalhaes & Lima, 2012, Luthon & Larroque, 2015). The new workspace presented to professors in emergency in the context of the pandemic caused sudden changes and demands from the institution and contemporary students. Therefore, "the teacher suddenly had to change the 'button' to change tune and start teaching and learning in other ways" (Behar, 2020). To carry out this investigation, it was used the methodological design based on understanding a quantitative and bibliographical evaluation to carry out an ergonomic analysis of the space built and adapted to the new reality of the work of the teacher who will perform his classes remotely in a domestic space.

Transition From Face-to-Face Teaching to Remote Teaching in the COVID-19 Pandemic

The reorganization of the educational system in Brazil was modified in time of the Covid-19 pandemic. The Ministry of Education and the Ministry of Health sought to develop transition measures for the academic activities of the school year and pointed out other measures that have already been presented by UNESCO (Brasil, 2020). One of these measures was “the Expansion of technological resources for Distance Learning (DL) in universities and federal institutes” (Parecer CNE/CP Nº 5/2020, 2020, p. 2).

Through Ordinance No. 376, which provides for classes in technical professional education courses at the mid-level while the COVID-19 pandemic situation lasts. Exceptionally, the

Ordinance authorizes the institutions that are part of the federal education system regarding technical professional education courses at the secondary level in progress, to suspend face-to-face classes or replace them with non-face-to-face activities (Parecer CNE/CP Nº 5/2020, p. 2).

Such changes brought to light a socioeconomic and vulnerability problem for students and a new reality for teachers who do not have technological knowledge, conditions to subsidize and develop remote teaching in their homes. According to Dias and Pinto (2020, p. 546), many students “do not have access to computers, cell phones or the Internet and knowledge of platforms and applications". Another aspect is that "a considerable number of teachers needed to learn to use the digital platforms, inserting online activities, evaluating students at a distance and producing and inserting materials on platforms that help students understand the contents, in addition to the usual recorded and online classes” (Dias & Pinto, 2020, p. 546).

Historically, technologies are responsible for influenced sociocultural changes, especially by Digital Information and Communication Technologies (TDIC) that are increasingly present in almost all layers of society, allowing teachers and students to connect and communicate even though they are in different parts of the world, countries, cities, communities, and neighborhoods. Society around the world can connect and interact in real time, with its multiple ideas in an intense, rich, and uninterrupted exchange of information (Moran, 2015).

According to Fardo (2013) spaces must be studied, analyzed, and modified to expand so that communication is achieved and causes changes in the way we receive and access information. In this sense, the school needs to change to receive and integrate these new students who are “multitasking”, being able to at the same time: use the cell phone, attend classes, chat on the Internet and share news in groups through social networks. (Maravalhas & Abreu; 2015). However, what is perceived in the face of such changes is that the school is still rooted in the traditional teaching model, prioritizing the same method of communication that is face-to-face, in which the teacher occupies the position of main protagonist, holder and transmitter. information (Valente, 2014). In addition, the school still maintains the same physical structure, the organization of spaces, curricular activities, and the same didactic resources: blackboard and brush.

Faced with these changes in society, the predominant model of traditional education has faced enormous challenges. Among them, the reorganization of the curriculum, teaching methodologies, time and spaces intended for learning (Moran, 2015).

> The standardized school, which teaches and evaluates everyone equally and requires predictable results, ignores that the knowledge society is based on cognitive, personal, and social skills, which are not acquired in the conventional way, and which require proactivity, collaboration, personalization, and entrepreneurial vision. Traditional methods, which favor the transmission of information by teachers, made sense when access to information was difficult. (Moran, 2015, p. 16)

According to Christensen, Horn and Staker (2013), hybrid teaching emerges as an alternative to improve traditional teaching, but without breaking with it. That is, hybrid teaching allows students to learn both in the physical classroom space and in the online environment, complementing traditional teaching that enables the interaction of the physical space and the elements it comprises, such as the virtual ones that enable another form of learning. interaction and learning. It is worth mentioning that the hybrid teaching model allows the

student to learn inside and outside the formal teaching space, in a more flexible and continuous way, combining the physical spaces of the classroom with the multiple spaces of everyday life, including digital ones (Moran, 2015).

The use of technologies is already part of the daily life of most students, however, it is perceived the need for school learning to approach this routine, to know and take ownership of these omnipresent spaces, whether at school or outside, as well as the benefits provided by technologies to advance its mission (Silva et al., 2015).

The transition from face-to-face to remote modality implies a tacit change in the teacher's work environment, from a classroom in the school environment to a home environment that was not designed for such a function. It is important that this home office space offers a comfortable, healthy, safe, and stimulating environment. In this situation, the quality of the spaces must be considered in the family building, that is, the set of physical conditions capable of providing comfort, well-being, and health to its users, so that they promote the improvement of the quality of life in these spaces. According to Alves et al. (2000), ergonomic evaluations and applications have contributed significantly to the improvement of human working conditions, health, increase in quality of life, which is an essential condition for good productive and cognitive performance.

Therefore, the available spaces and conditions deserve to be adapted, reinvented, and elaborated to meet the quality of teaching, that is, one must consider the teaching concept and the curricular perspective adopted by the teacher, alternative spaces and obstacles that can transform resources to enable creativity, innovation, and the construction of diversified practices. Regarding these observations, Lima (1998) points out that every space produced by man interferes in the educational process in a positive or negative way. Space conditions our daily gestures, accustoms our vision, stimulates symbolic elements, establishes points of reference. If the school space or the space destined to the home office destined to develop the teaching activity must be treated with care considering the comfort, safety, equipment, internet access, furniture, and pleasant environment for the senses, allowing the stimulated to develop healthy teaching relationships and encourage learning. Thus, the environment intended for work activities (home office) and its facilities must consider environmental conditions, such as acoustics, temperature, and luminosity, as they can be decisive in the performance of teachers.

In these environments, the beneficial action and softness of light awakens curiosity in the individual and stimulates intelligence and imagination. For several ancient civilizations, light originated and guaranteed security in well-being and quality of life, having therefore been considered a supernatural gift (Czeresnia et al., 2013). Light is essential for carrying out numerous tasks in our daily lives. In home life, at work and at school, light is crucial to our safety and comfort. According to Regulatory Norm NR 17, they recommend that lighting in “all workplaces and work situations must have lighting, natural or artificial, general, or supplementary, appropriate to the nature of the activity. In addition, “lighting must be designed and installed in such a way as to avoid glare, annoying reflections, shadows and excessive contrasts” (Ministério do Trabalho e Previdência, 2021). Corroborating Millanvoye (2007), portrays that lighting is presented as a risk factor for workers when they are inadequately performing their activities in the workplace. As the classroom and the home office are a workspace for the teacher, as well as a place where teachers are inserted, consequently these spaces are subject to the same risk.

In teaching and learning spaces that have technological devices, such as computers, projectors, among others, which are generally present in school environments, whose teachers try to adapt to the physical conditions that are limited during the class period (Corgati et al., 2009; Souza et al., 2021). In view of this, it is important to analyze the existing conditions of these new workspaces, understand the adaptation needs and look for alternatives in the search for acceptable environments for the necessary basic conditions of teaching and learning (Souza et al., 2021). In these environments there is a predominance of poor air circulation, not providing direct contact with solar radiation. The environmental conditions of these spaces can cause psychological and, mainly, physiological damage to the occupants of these environments. Regarding this issue, Conceição and Lúcio (2011) report that the thermal quality of environments can significantly influence health and human comfort in these spaces.

According to the Brazilian Regulatory Standard 17 (NR 17) (Brasil, 2021), which deals with comfort in the work environment, the temperature must be maintained so that the worker does not suffer any physical damage and:

> the organization must adopt temperature, air velocity and humidity control measures to provide thermal comfort in work situations, observing the air temperature range parameter between 18º and 25°C for air-conditioned environments. Environmental ventilation control measures must be adopted to minimize the occurrence of air currents applied directly to workers. (Ministério do Trabalho e Previdência, 2021, p. 8)

Adapting the space to the climate benefits human beings in several ways, providing them with thermal comfort, health, and better performance of daily activities (Kowaltoski, 2011). The human body works like a thermal machine: consumption of energy to generate heat, in balance with losses and gains of heat to the environment. The thermoregulatory system also acts on the sweat glands, increasing or decreasing the production of sweat through perspiration (Ruas, 1999).

Spaces where the presence of noise is uncomfortable, memory can be affected, ambient noise interferes with the retention of information and consequently with learning, according to Moreira (2015). The importance of cognitive psychology especially in the field of memory, consisting of short or long term. Corroborating NR 17 demonstrates that:

> in workplaces in indoor environments where activities are carried out that require maintenance of intellectual request and constant attention, measures of acoustic comfort and thermal comfort must be adopted. In addition, having control in indoor environments to provide acoustic comfort in work situations. (Ministério do Trabalho e Previdência, 2021, p. 8)

One of the memory concepts is directly related to learning, responsible for retaining information and retrieving it in the future. For Conceicao and Lucio (2011) when information is apprehended, it needs to be organized and stored.

The absence of acoustic comfort strongly affects our health and the teaching-learning process, as it facilitates distraction, hinders the level of attention and cognition, and hinders the audibility and understanding of the teacher's voice. The human ear presents a favorable response to sounds that are not too excessive, but exceeding certain limits, which NR 17

establishes “the acceptable background noise level for the effect of acoustic comfort will be up to 65 dB (A), pressure level continuous sound” that has been presented as a major risk factor for the health of the human being is liable to feel pain, which can lead to irreversible damage. Dreossi and Momenshon-Santos (2004) through the auditory ability, the subject can extract the essential characteristics of the sounds, separating them from the non-distinctive ones (selective attention), promotes the analysis of the information, registers, understands and elaborates the answer (Santos & Spinelli, 2007).

The application of resources to obtain a healthy environment, in which the human being is inserted in each space, must provide sensory comfort conditions relevant to the function performed and provide the desired well-being (Guterres, 2016).

Materials and Method

To respond to the objective of this study on the ergonomic aspects of home office teaching spaces, the health and comfort factors of doctoral students (teachers) of a teaching institution in Portugal, who carried out their activities remotely during the period, were analyzed. of the Covid-19 pandemic in the residential environment. Doctoral students who are also professors who carried out activities remotely during the Covid-19 pandemic. For analysis, we used a questionnaire that was developed on the Google Forms platform and sent to teachers (Severino, 2017). As the analysis of space in a residential environment is relevant in teaching and learning activities in the virtual environment, the method for carrying out this analysis was limited to the use of a quantitative approach in line with the ergonomic analysis of the built environment and comfort (Marconi & Lakatos, 2017). The research is characterized by the development of the facts addressed by the questionnaires that allowed the collection and tabulation of quantitative data that were compared, analyzed, and confronted with the theoretical framework (Gil, 2019).

The questionnaire was formulated with questions raised in which the subjects developed their work activities in which environmental factors, furniture, equipment, and the allocation of spaces for classes remotely. Aspects of natural and artificial lighting, natural and artificial ventilation, and the presence of noise in the environment, another factor that was studied in terms of furniture and equipment that consisted of computer, cell phone, tablet, and the internet (Pinto, 2013; Rocha et al., 2003).

Corroborating Mont'Alvão and Villarouco (2011), are elements that make up and should be considered ergonomically to develop environmental comfort (light, thermal and acoustic), environmental perception (cognitive aspects), adequacy of materials (coatings and finishes, colors, and textures), accessibility, anthropometric measurements (layout, dimensioning), and sustainability. Furthermore, Silva et al. (2015) states that to evaluate an environment, systematic procedures with a holistic ergonomic view are essential. The analysis was based on a group that carried out home office work activities established by educational institutions, which adopted emergency measures remotely, following the protocols suggested by the World Health Organization (WHO), as a result, the community spread of Covid-19 which reached all continents. To contain the disease, the WHO recommended basic isolation and treatment actions for identified cases, massive tests, and social distancing (Parecer CNE/CP Nº 5/2020, 2020). Therefore, in the meantime, institutions began to develop learning strategies with pedagogical management (Alves & Cabral, 2020).

In Brazil, the Ministry of Health declared a state of emergency in public health of a national nature due to the human infection of the new Coronavirus, through Ordinance No. February 04, 2020. In view of Ordinance No. 188 of the Ministry of Health, states and municipalities began to develop public policies to combat Covid-19, thus suspending classes in schools, as well as public and private universities (Ordinance No. 188, 2020).

The study was carried out during classes in the remote modality, since the face-to-face form was suspended on the recommendation of the Ministry of Education and measures adopted by the university to preserve the health of all teachers and students (Palú et al., 2020).

Results

The results of the teachers' perception are presented according to the order of the questions contained in the questionnaire (Marconi & Lakatos, 2017). Thus, like the questionnaire, it allowed us to obtain a sample that enabled the indicators of the characterization of the teachers' perception and factors that indicate harmful aspects to health, well-being and, consequently, may affect teaching and learning.

In the next items of the questionnaire, comfort conditions regarding lighting, noise and temperature are presented, as well as the elements present in the space where teaching and learning activities are carried out. Figure 1 will provide us with aspects related to lighting and temperature in the spaces where the activities were developed.

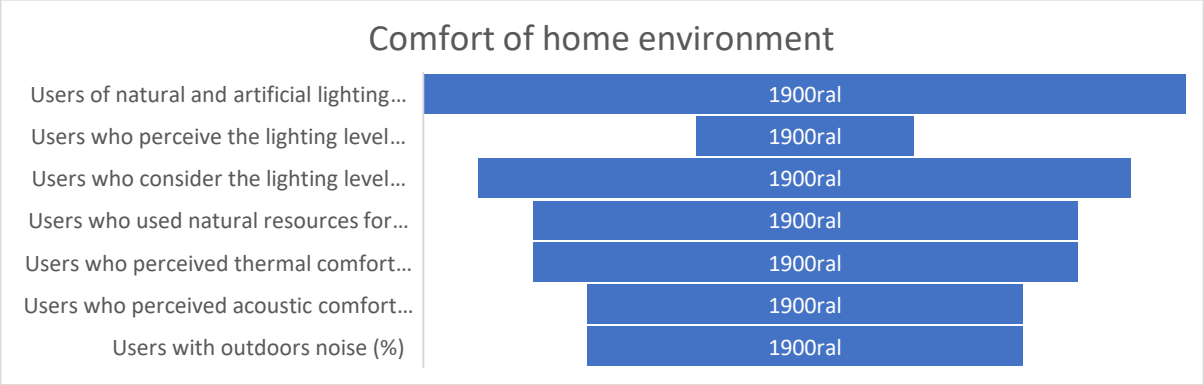

Figure 1 – Discomfort of the environment in the domestic space
By the authors (2022)

Also in Figure 1, attention is paid to comfort in relation to external and internal noise. The home environment is influenced by noise and in the research the subjects did not use any resources to minimize this effect. The open or closed environment suffers from the noise that causes discomfort for the subjects. By making use of natural ventilation, it allows an improvement in the quality of life, however, on the other hand, it suffers the action of external noise that is usually related to traffic and commercial activities, thus causing noise pollution, a very common example is the “car selling eggs” that announce the sale through cars with loudspeakers near the residences. Noise can cause interruption of classes, interference and lack of concentration and irritation due to noise for teachers in remote activities.

Another fact considered is the use of fans that can cause allergic processes due to the spreading of dust, as well as causing internal noise in the environment in use. As for thermal comfort, 62.5% use fans and only 25% use air conditioning and 62.5% considered the

comfort in the home environment pleasant. In this perception, the environment must be suitable for thermal comfort, healthy and better performance of activities. When the human body is in an environment with irregular temperatures, it undergoes changes in the body, causing visual discomfort, sweating, physical and mental exhaustion, which was presented by the research subjects (Buriol et al., 2015).

The percentage of home lighting resource used was 87.5% natural and artificial. For teachers in remote activities, lighting was considered 25% fair and 75% good and great. However, this evaluation compared with problems presented during the activity and after the activity demonstrated a significant visual discomfort and headache. Direct or indirect lighting can cause glare, as well as the time spent in front of the computer. In addition, incorrect posture in front of the computer screen at a different angle can cause eye fatigue (Kroemer & Grandjean, 2005).

The authors Kroemer and Grandjean (2005), describe that environmental factors interfere in the individual's health. According to Pinho et al. (2021) in their research, it was detected that the “home environment and equipment had a low level of suitability for remote work.” The factors found were identified by the research in the “physical space, furniture and noise level” that strengthened the terrible conditions in the home space.

The pandemic has reshaped the environment and the way of exercising the teaching profession and bringing it to reflection by authors who make arguments on the subject. It can be seen in the research by Pinto et al. (2013, p. 1) that the environment interferes in the activities of teachers, in the quality of life and that,

> the quality of the indoor environment significantly depends on the parameters and criteria used in its assessment (e.g., temperature, noise, ventilation, and lighting), as well as on the design and functioning of the building (including the systems) and on the behaviour of individuals. On the other hand, the indoor environment affects the health, comfort, and productivity of occupants.

The Figure 2 indicates the teacher's situation during the working day and after the working day.

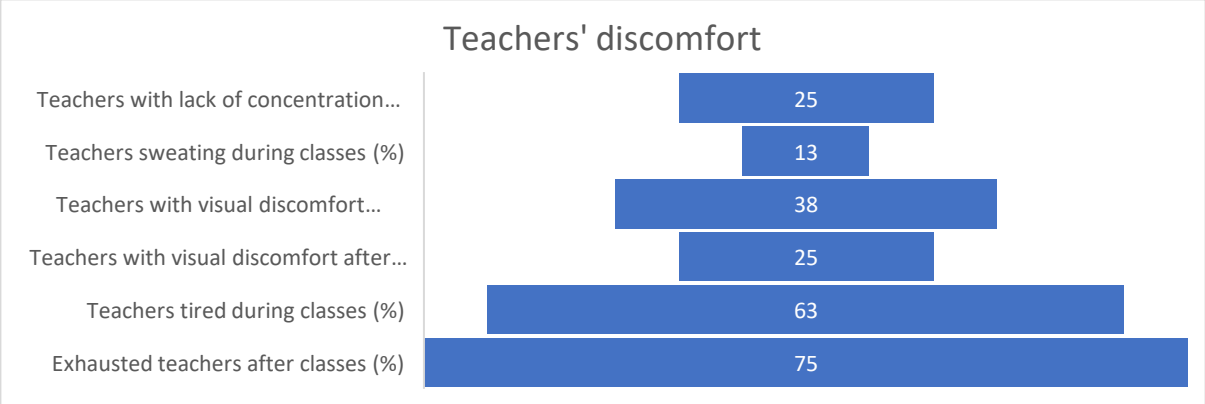

Figure 2 - Assessment during and after the shift
By the Authors

Some aspects raised about physical discomfort, teachers felt tired during the working day in 62.5% and after the day 75% of respondents felt exhausted, due to intellectual activity.

Therefore, it was identified consequences of stress in the work environment in remote activity of teachers, which drew attention, was physical and mental exhaustion. Another factor analyzed was related to remote class time, furniture, temperature, and lighting. Visual discomfort due to lighting presented 37.5%, which needs to be further investigated for indications that the lighting is insufficient, positioning of light fixtures and windows, type of lighting, computer screen, long workday, and no adequate break for rest.

In this regard, Valle (2011) reports that the environment must have planning and organization for the workplace and furniture are aspects of comfort, as well as noise, lighting, and temperature, if the environment does not provide these ergonomic demands, professionals will suffer human limitations at work. Figure 3 demonstrates the elements that are used to minimize the discomfort of the environment.

In Figure 3 it can be founded some factors that can aggravate the discomfort and health problem.

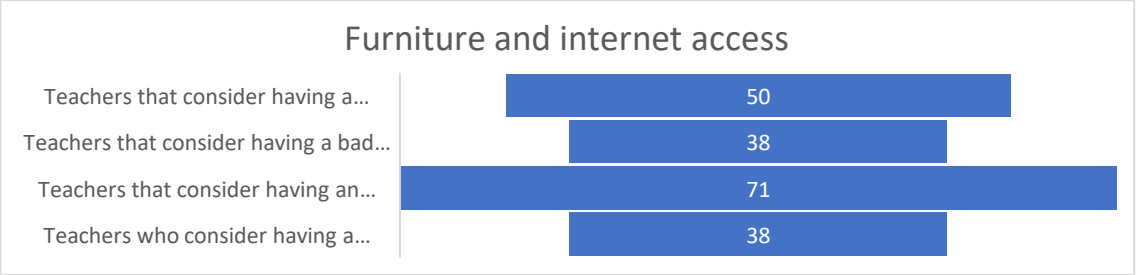

Figure 3 – Evaluation of Furniture and internet access
Source: The authors

As for the furniture, it was verified that 37.5% of the interviewees consider it bad, this factor interferes a lot in terms of postures and accidents, and may be related to the physical arrangement, organization of space, type of table and chair that was not suitable for the function. As for internet access, 37.5% think it is bad. In this regard, the internet, the tools for developing the preparation and transmission of classes via computers and the internet, did not satisfactorily meet the objective of teaching and learning. in addition, an overload of work due to the activities carried out by teachers along with domestic activities. In Related to health, teachers showed more debilitation and among the symptoms were anxiety attacks, bad mood, and insomnia.

However, for blended learning to be effective and to contribute to meeting contemporary educational demands, it needs to be well planned. Furthermore, it was found that the implementation of digital technologies could enhance the application of educational trends (Pine, 2021).

Final Considerations

The object of this study was to show the scope of the importance of studying spaces for carrying out activities remotely, paying attention to the comfort conditions of these spaces that affect the quality of teaching, health of teachers and, consequently, student learning. In this way, it is understood the relevance of initiating this reflection and promoting the area of education and those involved in the construction and modifications of spaces intended for teaching and learning.

It was verified how the space and all the factors that are present in them can interfere in a positive or negative way when it is not considered. Thus, the prominence of the teaching space remotely or in person is undeniable because it configures a place of significant relevance in the cultural, social, economic scenario, mainly in developing countries, in the case of Brazil, where there are still great inequality social and economic dimensions of continental dimensions. In this way, it is important that spaces for the development of new hybrid teaching methodologies also make it possible to consider the quality of health and well-being of teachers. Who can carry out the quality teaching developed in these home environments that was studied and that allows a better scope of remote teaching with greater responsibility for those who participate and contribute to education.

However, just making use of these technologies is not enough to change crystallized educational paradigms, and therefore, it is necessary to take ownership of active methodologies. In this sense, active learning methodologies are positive in the face of the emergency of the Covid-19 pandemic, as face-to-face teaching modalities were suspended to adhere to social distancing. The form of remote activity has become an alternative to proceed with pedagogical training instructions with the aim of academic completion. However, this teaching modality and the environment in which the activities were developed remotely showed fragility due to space, furniture, comfort aspect, difficulties of teachers, students in mastering the tools, in addition, access to the internet for not meeting the requirements. the desired capacity and financial resources to acquire it and access learning platforms. Finally, it is hoped that this article can contribute to the future with theoretical and empirical research that intends to implement the hybrid teaching model and considering the non-formal teaching spaces, as these interfere in the teaching and learning of the student and the teacher in a way positively and negatively for who uses them.

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Breaking Free From the Medical Model Approach in Special Education: A Roadmap to Biopsychosocial Model – Latvian Experience

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Abstract
Disability models are crucial in understanding and addressing disability related issues and supporting people with special needs. The medical model, which views disability as a medical condition that can be treated or solved, is the oldest and most widely used disability model in most European countries, including Latvia. Health is considered the norm or ideal to strive for. The Latvian special education system still partly operates with a medical model approach, although significant steps have been taken towards a biopsychosocial model approach, which views disability as a combination between the health state of an individual and society. The author of this research conducted a historical literature review of the Latvian inclusive education system and pedagogical-medical commissions, which decide whether a special education program is needed for a child, to classify their approach and identify necessary first actions for a shift to the social model approach. This article can be significant for other countries that are currently transitioning towards a more inclusive education system as it provides valuable insights for policy makers in other countries and helps raise awareness about the benefits of the biopsychosocial model of pedagogy.

Keywords: Pedagogical-Medical Commissions, Medical Model, Biopsychosocial Model

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Introduction

My research topic is related to the practical need to modernize outdated systems in Latvia according to the concept of inclusive education, recognizing that we are diverse and that this diversity is beneficial to society as a whole.

In 2019, with the action of the Latvian government - specifically Cabinet of Ministers regulations, the operation of the Republic of Latvia's Cross-Sectoral Coordination Center (CSCC) was supported to develop solutions for enhancing inter-sectoral collaboration and support systems to reduce the risk of child development, behavior, and mental disorder formation. In 2020, the CSCC, together with the Latvian Association of Local Governments, the Latvian Child Welfare Network, the Children's Clinical University Hospital, and other partners, initiated work on establishing a previously unprecedented preventive support system in Latvia. The aim was to ensure the availability of necessary prevention, early intervention, and support services for children with developmental difficulties or at risk of their formation throughout the territory of Latvia. Currently, the development of assessment tools for early childhood development is underway, and the process of approving this tool has been initiated. It is planned that the utilization of this tool, along with handbooks, action algorithms, and early interventions for children, will be introduced in 2024 (CSCC, 2022).

Until now, such a validated, standardized, and comprehensive set of methodological tools for early childhood development assessment in a digital environment has not existed. Therefore, the operation of this assessment tool is also not regulated by the legislative acts of the Republic of Latvia. It is unequivocally clear that to perform the mentioned assessment of early childhood development and any intervention activities, a complex, inter-institutional (education, health, and welfare sectors) solution is necessary, performing several functions. As an example, such actions could include: facilitating mutual communication among the parties involved in the coordinated screening of early childhood assessment, providing coordinating system management to ensure that children identified with specific needs through screening receive support in their daily learning process.

So far, the only existing institution in Latvia that could perform similar functions is the Pedagogical-Medical Commission (PMC), as it is the only state and municipal institution capable of conducting assessments for preschool-age children and determining educational support measures (Cabinet Regulation No. 709, 2012).

Due to the existing issues with the current operation of the PMC, which are later discussed in this article, and considering their outdated ideological framework and new tasks regarding early childhood assessment, it is necessary to establish a new model in place of the mentioned PMC. There are also ongoing discussions on whether a Child Development Support Center should be established in Latvia to facilitate collaboration between the education, health, and welfare sectors and oversee various sectors involved in inclusive education.

Additionally, a working group has been established by the Ministry of Education, which will start the work on modernization of the outdated PMC in Latvia.

Therefore, the objective of my research is the historical analysis of the PMC, aligning their approach with the disability model, and identifying the most relevant problems associated with the work of these commissions.

Within the scope of the study, by examining periodicals, legislative acts, and relevant literature, research tasks were formulated. Namely – the task is to review briefly the three main disability models - medical, social, and biopsychosocial; to examine the historical development of PMC in Latvia and the persisting issues they face.

By analyzing the findings from previous research on the models in Italy and Portugal (Rektina, 2022), suggestions are provided for improving the Latvian system to align it with a contemporary understanding of inclusive education.

Three Disability Models as a Framework

First, I would like to provide a brief outline of three disability models mentioned earlier, so that Latvia can define the principles it wants to pursue in the context of inclusive education while developing a new support system.

Medical Model Approach

In the medical model, disability is considered a medical condition, and, therefore, doctors are specialists who treat and alleviate both symptoms and diseases to improve an individual's condition (McTigue, 2015). Health is a norm or an ideal to strive for; falling ill is considered an incorrect action, and illnesses are the results of erroneous processes (Hirschberg, Kobsell, 2017). The primary concern of the medical model is to identify deviations and then treat them in an appropriate form: "Essentially, the medical issue is to diagnose bodily or intellectual 'abnormalities' and recommend corresponding treatments." (Barnes, Mercer, Schakespeare, 1999).

Disabled individuals are seen as "sick people" who are excluded from any social obligations and responsibilities that others consider "normal." (McTigue, 2015). This model emphasizes shortcomings rather than potential, and a person's life is determined by specific diagnoses and predictions about their abilities.

"The medical model has led to a focus on diagnosis, highlighting individual problems, emphasizing weaknesses, labeling, and stigmatization. The primary focus is on addressing the problem rather than the process of teaching and learning" (Befring, 1997).

It is precisely from the medical approach that a contemporary approach has developed in Latvia, which involves grouping and classifying children according to specific signs of illness, treating them, and consequently correcting the disorder. Education is tailored to the unique parameters' characteristic of each group of illnesses, with the hope of improving the overall functional state of the child. Through the medical model, this led to a narrow specialization in pedagogy, essentially segregating children into separate groups based on their problems, such as children with visual impairments or hearing impairments. Following this principle, special schools were organized for each such specialized or classified group. For instance, schools for visually impaired, blind children, and so on. Similarly, educators were "prepared" and continue to be "prepared" according to the problems of each group of children. (Nimante, 2008).

Social Model Approach

The social model identifies society's negative attitudes and exclusion as the main factors contributing to the disadvantaged status of disabled individuals. The social model of disability explains that discriminatory societal policies and inadequate infrastructure hinder the full participation of persons with disabilities in society (Petasis, 2019). Society sees disabled individuals as different from others due to their impairments, and they are therefore considered weak, dependent, and incapable (Shinohara, Wobbrock, 2011).

The principles of the social model of disability have supported the development of disability legislation, such as the adoption of the United Nations Convention on the Rights of Persons with Disabilities in 2006.

The social and economic utility approach was not foreign to the educators of the first Latvian Republic either. It was precisely according to this principle that the assessment and consideration were made as to which children were suitable for special schools and which education could not help. (Fan, 1937) Those who were useful workers were educated, later respected, while those who could not work did not deserve education. Nevertheless, 58 at least deserved compassion (Nimante, 2008).

Biopsychosocial Model Approach

Biopsychosocial approach - This model views disability as a combination of an individual's health status and the surrounding social environment. The biopsychosocial model forms a more integrated and comprehensive concept of disability, incorporating elements from both the social and medical models. Thus, this model suggests that disability is caused by physical or biological problems that need to be treated by medical experts. Additionally, society needs to find ways to include disabled individuals in social, economic, and political activities by supporting them and ensuring equal opportunities (Petasis, 2019).

Since the degree of "normality" depends directly on society, in order to address this issue, there needs to be a change in society's attitude towards people with special needs and, more broadly, towards diversity in general. (Nimante, 2008).

In the social model, unlike the medical model, the child is perceived as a value where both the child's strengths and weaknesses are defined. In pedagogical activities, a results-oriented education program is developed, necessary services and resources are provided to ensure the required support. Concurrently, parents and professionals are educated, promoting the child's development and relationships. Thus, not only the child but also society itself evolves. (Oliver, 1990; Mason, Reiser, 2000).

Inclusive education is believed to be based on a biopsychosocial approach, and the Latvian Saeima (Parliament) in its Research Final Report in 2020 has recognized that inclusive education system in Latvia is in its early developmental phase. Purposeful and systematic actions in this direction have been initiated relatively recently, and several solutions are still more sporadic than systemic (Saeima Final Report, 2020).

A Brief Historical Overview of the Development of Inclusive Education in Latvia

Already in 1928, in the Latvian-language periodical "Strādnieku Avīze" (Workers' Newspaper), it was indicated that the reason why some children were not attending school was due to factors such as being deaf, mute, mentally impaired, and the like. It was deemed unacceptable for them to attend regular schools, while specialized schools were still too few and sometimes located far from the children's residences (Strādnieku Avīze, Issue No. 250, November 3, 1928).

In the 1951 "Skolotāju Avīze" (Teachers' Newspaper), it was noted that around the 1930s, a separate children's home for children with mental and physical disabilities was established in Jurmala. Children from orphanages were also placed there, including those who were living with sick and degenerate individuals. This institution was referred to as a "defective children's home." The article emphasized that children with intellectual development could not be educated in regular schools. Moreover, if a child falsely diagnosed with intellectual disabilities was sent to this educational institution, their intellectual development would be hindered, as they would be grouped with children with severe intellectual disabilities (Skolotāju Avīze, Issue No. 25, June 22, 1951). A similar article with the same content can be found in the 1950 edition of "Skolotāja Avīze," where an order was issued that local authorities should draft documents about defective children living in the school district and ensure their placement in special schools (Skolotāju Avīze, Issue No. 11, March 17, 1950). A particularly relevant article is the 33rd issue of "Skolotāju Avīze" from 1955 (Skolotāju Avīze, Issue No. 33, August 18, 1955), in which it is mentioned that in mainstream schools, children with special nervousness are observed and should be placed in special schools for children with nervousness. During the Soviet era in Latvia, until the restoration of Latvia's independence in 1991, the situation with comprehensive and auxiliary schools is accurately described in bulletin "Padomju Daugava" (Soviet Daugava) in article from 1981:

> There are children who, for various reasons such as childhood illnesses, inherent disabilities (weak vision, hearing, mental retardation), and other disorders, cannot follow the curriculum of mainstream schools. These schools only admit students upon the recommendation of a special medical-pedagogical commission. Children who have attended preparatory groups or the first grade are sent for evaluation by the educational commission. (Padomju Daugava [Jēkabpils] Issue No. 44, April 11, 1981.)

The first attempts at inclusive education in Latvia began in 1994, when private educational institutions in Riga and Jurmala started admitting children with functional and mental disorders. Thus, the first attempts at inclusion in Latvia occurred approximately 24 years later than in other parts of Europe.

A significant development in the progress of inclusive education occurred in the year 2000, with the enforcement of the Latvian Education Law, which establishes that special education is a specific form of general education (Education Law, 1998). This law defines what special education is and outlines the opportunities it provides for students with special needs and their parents to choose any educational institution suitable for their health condition, abilities, and developmental level to receive appropriate education. The obligation of educational institutions is to ensure pedagogical, psychological, and medical correction for the student, as well as prepare them for work and life in society. Any educational institution has the right to license special education programs in accordance with the procedures set forth in the General

Education Law if there is appropriate environment and qualified personnel to ensure quality education for students with special needs. The integration of students with special needs into general education institutions is stipulated by the General Education Law. Furthermore, parents of students with developmental disorders now have a lawful basis to choose an educational institution for their child according to their own preferences (General Education Law, 1999).

By 2004, a legislative framework for the inclusion of students with developmental disorders in general education institutions had been established. Gradually, a positive societal awareness was being formed. Practical inclusion of students with special needs in general education institutions and preschools had been initiated. Teacher training programs at higher education institutions included lecture courses on special education for subjects within general education. Courses and projects were organized, which educated teachers from general education institutions. A significant number of projects funded by both special and general education institutions, as well as EU funds, were realized. The parents of students with special needs became more active, forming support groups in Latvian regions (Domniece, Eglava, 2004).

In 2008, the UNESCO International Education Conference was hosted in Latvia, the largest international forum on education policy matters. This event played a pivotal role in emphasizing inclusive education as a fundamental principle and strategy for achieving accessibility and quality in education. The transition from special education to inclusive education is considered a significant paradigm shift, requiring teachers to become versatile leaders, educators, motivators, moderators, and specialists in education and assessment of diverse student groups (Hofzess, 2008; UNESCO, 2008/b; Vasilevskis, 2008).

Starting from September 1, 2020, the Cabinet of Ministers Regulation No. 556 "Requirements for General Education Institutions to Enroll Students with Special Needs in their Implemented Education Programs" comes into effect. This regulation outlines the support that an educational institution must provide to students with special needs in order to include them in the mainstream school's educational process. These regulations still distinguish between regular general education schools and special education classes and schools, indicating that in Latvia, integration is still ongoing and segregation is being practiced (Cabinet Regulation No. 556, 2019).

In 2006, Professor D. Nīmante of the University of Latvia conducted a study on how the concept of inclusive education is understood in Latvia. In Latvia, the understanding of inclusive education is associated with three approaches:

1) inclusive education as special education;
2) inclusive education as integration;
3) the inclusive education approach where any child is the subject, any educational institution is the object, and the indicators of inclusive education are accessibility, alignment of education with each child's individual needs, and involvement (Nimante's Study, 2006).

This study also demonstrates that in Latvia, although the term "inclusion" is used, it is often synonymous with integration. In Latvia, educators mostly do not distinguish between the terms "integration" and "inclusion," which hinders the country's progress toward an inclusive education model.

According to data from the Latvian State Education and Content Centre for the year 2022, there are 42 special education institutions in Latvia, where approximately 4432 children with special needs are studying. Moreover, when comparing the data from 2017 onwards, there is an observed trend where the percentage of students with special needs in mainstream schools has been increasing[1].

The Historical Development of Pedagogical Medical Commissions (PMC) From Their Establishment to the Present Day

The origins of PMCs can be traced back to 1961 when the Ministry of Education issued an order "On Improving the Work of Republic's Special Schools and Classes," which established medical-pedagogical commissions. These commissions were responsible for assessing mentally disabled children in several state districts, and from 1970 onward, in all state districts. Commissions typically consisted of doctors, defectologists, speech therapists, and teachers. The decisive factor was usually the medical diagnosis, which determined whether a child would be referred to a special school for education. In addition to regional and city-level medical-pedagogical commissions, there was also a republican medical-pedagogical commission responsible for evaluating children with visual and hearing impairments, as well as children with cerebral palsy. The work of these commissions was not always systematic and comprehensive; they usually operated only once a year - in the spring before the end of the school year.

In Latvian periodicals, which are essential sources that can testify to the society's understanding of a specific historical period, the following is indicated:

> From May 31st to June 14th of this year, the School and Children's Institution Management of the Latvian SSR Ministry of Education, together with the Department of Pediatric Preventive Medical Institutions of the Ministry of Health Protection, is organizing medical-pedagogical assessment commissions for mentally disabled, nervous children, and children with speech disorders. (Skolotāju Avīze, Issue No. 20, May 17, 1967)

From the further excerpt, it can be inferred that children are referred to the pedagogical medical commissions by the school.

> [...] mentally disabled and nervous children, as well as children with significant language defects, must be brought to the assessment commissions. [...] Mentally disabled students who have been unsuccessful for several years in the mass schools of grades I-III and are unable to master the curriculum should be sent to the commission. [...] Upon arriving at the commission, mentally disabled students should have the following documents: a) an extract from the school's pedagogical council meeting minutes regarding the student's inability to master the curriculum of the respective grade in the mass school and a decision on the necessity of placing him in a special school; b) a comprehensive student profile indicating how long the student has been studying in the mass school (grade), analyzing his achievements and behavior, as well as indicating the measures taken to achieve the student's success (individual assistance, medical treatment, etc.). The profile must be signed by the class teacher and the school principal; c) certificates of academic achievements for the entire

[1] Data of Latvian State Education and Content Centre, 01.09.2022.

> school year and a few notebooks with written assignments, drawings; d) birth certificate; e) the student's individual record with all medical records [...] It is advisable for one of the parents and the class teacher, who can provide information about the child's development, past illnesses, etc., to accompany the children to the commission. (Skolotāju Avīze, No. 20, May 25, 1968)

Meanwhile, in this newspaper article, a significant harm caused by parents to their children by allowing them to attend mainstream schools is highlighted:

> Currently, in school collectives and families, alongside concerns for successfully completing the academic year, there is another concern for ensuring that all children attend schools appropriate for their health in the next academic year. Therefore, every year in June, the pedagogical medical commission operates. Many parents are aware of how important it is to send children to the medical commission to timely direct them to schools appropriate for their abilities and health. However, there are parents, who hesitate or even categorically forbid teachers from doing so, not realizing that by having a child to study in a school unsuitable for their health, they do great harm. The child becomes even more stressed, their health deteriorates, and their interest in studies and life around them completely fades. The Soviet state allocates significant resources and does everything possible to facilitate education for sick children. Special schools are open for nervous, visually impaired and blind, hard of hearing and deaf children, as well as children who have had polio and have impaired nervous systems. In these schools, they are fully provided for by the state, parents do not need to worry about their nutrition, clothing, or study materials. (Padomju Karogs, Talsi, No. 66, June 3, 1969)

And finally:

> In our republic, there are 43 special schools where serious educational and upbringing work is carried out, as well as care for the improvement of students' health. The recently adopted decision of the Latvian SSR Supreme Council envisages further expansion of the network of special schools. Children are referred to special schools by republican or district pedagogical medical commissions. (Skolotāju Avīze, No. 20, May 20, 1970)

After regaining independence, the General Education Law changed the naming of the commissions, emphasizing the order of words to highlight the pedagogical assessment of children.

In 1999, the General Education Law (General Education Law, 1999) was adopted, which regulated the activities of PMC with the same approach – to direct children to special educational institutions based on the opinion of the PMC. A child with a commission opinion for a special program cannot start education in a general education school. This law provided that special education creates opportunities and conditions for students with special needs to receive education in any educational institution that corresponds to their health condition, abilities, and development level, while also ensuring pedagogical, psychological, and medical correction, as well as preparedness for work and life in society. Article 50 of the law stated that special education programs are implemented according to the type of developmental disorder, abilities, and health condition of students as determined by the pedagogical medical commission. The functions are similar to those mentioned in the current version of the law.

The law also discusses the integration of children with special needs into general education institutions. Specifically, in general basic education and secondary education institutions with appropriate facilities, based on the opinion of the state or municipal pedagogical medical commission, students with special needs can be integrated. The Cabinet of Ministers determines the provision of these schools according to special needs.

If students do not master the 1st-grade curriculum, the school's pedagogical council, in which the school doctor will participate, will decide whether to have them repeat the year. If, after repeating the material, the student still hasn't mastered the required course, the decision about their further education will be made by the pedagogical medical commission (Progress, Limbaži, No.16., 07.02.1987).

In 2012, separate Cabinet of Ministers regulations (Cabinet Regulation No. 709, 2012) on the competence of State and municipal pedagogical medical commissions were adopted, and they continue to operate to this day.

Currently, there are 56 municipal and State PMC operating in Latvia. Only two municipal PMCs operate on a permanent basis, with qualified specialists, appropriate facilities, and equipment. Other municipal commissions operate according to their capabilities – some commissions hold regular meetings once or twice a month, while others convene only once or twice a year.

According to data from the Unified Information System of PMCs, during the year 2018, both state and municipal commissions collectively issued 6907 recommendations (assuming that each child receives one recommendation per year) regarding the most suitable educational programs for students. However, often parents do not inform educational institutions about the PMC's recommendation for their child to pursue a specialized education program, resulting in the support for these children not being provided. Furthermore, PMCs do not monitor whether the children recommended for specialized education programs are actually pursuing them.

Municipal PMCs, considering the variations in the number of children across different municipalities, possess diverse experiences and knowledge in assessing children's developmental disorders and needs. Moreover, the professional preparedness of specialists involved in the commission's work also varies significantly. Consequently, as indicated by education sector specialists, there is no uniform practice for evaluating the same cases between different municipal PMCs. Analyzing available statistics, it is evident that municipal commissions operate in highly diverse ways (Research Group, 2019).

The research conducted by the University of Latvia emphasizes that PMCs operate in irregular structures, where individuals with insufficient experience sometimes carry out responsibilities, and there is a lack of continuous accountability (Research Group, 2019).

Current Shortcomings of Pedagogical Medical Commissions and Possible Solutions

As mentioned previously, while describing disability models, inclusive education in Latvia is still in its early stages of development and several remnants of the medical model are evident in the functioning of PMC. Pedagogical-medical commissions provide a decision on the child, assigning them an educational code consisting of two digits. These codes grant access to special education. The basis of the pedagogical-medical commission's opinion is the child's

medical diagnosis, which allows the child to be assigned to the appropriate educational program code. However, medical diagnosis does not determine educational needs, and health impairments are not always linked to special educational needs.

The Latvian CSCC (CSCC, 2023) has identified the main deficiencies in the existing support system and PMC, which require a review of their operations. This review will be carried out by a working group established by the Latvian Ministry of Education in 2023 and 2024. The identified deficiencies are as follows:

- Fragmented Support and Services: The currently offered support and available services are fragmented and not well coordinated.
- Lack of Integrated Information Platform: There is a lack of a unified integrated information platform for accumulating and exchanging information.
- Identified Deficiencies in Inclusive and Special Education Systems: Weaknesses have been identified in the systems of inclusive and special education.
- Behavioral Disorders and Social Factors: Behavioral disorders rooted in social environment factors are often not critically assessed and are directed towards the healthcare system for resolution.
- Insufficient Involvement of Family Doctors' Teams: Family doctor teams are not adequately involved in the assessment of children's mental health.
- Ineffective Juvenile Offense Prevention System: The existing juvenile offense prevention system is not effective; it reacts to offenses only from the age of 11 when more corrective measures can be applied, but by that age, the opportunity to correct the child's behavior is decreasing. There is a need for swift reaction to antisocial behavior regardless of the child's age.
- Inconsistent Approach in Municipality PMC: There is a significantly differing and unsystematic approach to assessing children's educational needs in various municipal PMC. This lack of consistency does not promote proper assessment of children's educational needs or a positive attitude from parents.

In another study (Regulation Project, 2021), the following additional deficiencies are highlighted:

- Delayed Response to Crisis Situations: The response to crisis situations is often delayed, rather than being timely and proactive.
- Episodic Early Prevention Services: Early prevention services are observed only sporadically and episodically.
- Imbalance in Resource Planning, Funding, and Evaluation of Investments' Effectiveness: There is an imbalance in planning resources, funding, and evaluating the effectiveness of investments.
- Fragmented Sectoral Approach: The prevailing fragmented sectoral approach divides and disrupts the holistic implementation of a child's developmental trajectory. As a result, the comprehensive value of a child's developmental needs is not institutionalized on a national level.
- Regional Disparities in Service Quality and Availability: There are significant regional disparities in the quality and availability of services.
- Lack of Unified Practical Collaboration Mechanism: There is no unified mechanism for practical collaboration in client and case management.
- Lack of Regulation for Inter-Institutional Collaboration Authority, Rights, and Responsibilities: There is a lack of regulation defining the authority, rights, and responsibilities for inter-institutional collaboration.

- Although there have been significant improvements in the operation of PMK compared to before the year 2000, there are still significant shortcomings, such as:
- Commission's opinions are not accessible to schools, and parents may choose not to present them to educational institutions.
- There is no tracking of opinions to ensure that the child actually receives the necessary support on a daily basis.
- By assigning a code, the child is stigmatized.
- Long queues are formed to obtain commission opinions, and assistance is delayed.
- Behavioral disorders, which are influenced by social and environmental factors, are often not critically evaluated and are directed to be addressed within the healthcare system.
- Support for the learner is disrupted if they do not have the opinion of the pedagogical-medical commission (Research Group, 2019).

Conclusion

In order for Latvia to move towards the biopsychosocial model approach and establish a new and improved system for providing support to children in the education sector, in the frame of doctoral thesis the experiences of Italy and Portugal were studied (Rektina, 2022).

Italy and Portugal were selected as the countries to be studied in the context of early childhood intervention systems, as they have fully implemented inclusive education at all levels of education (from pre-school to university) and have the relevant legislation in place. This fact has been confirmed in the educational literature for more than 10 years (Marsili et.al., 2021, Ianes & Dell'Anna, 2020, Begney & Martens, 2007) and in various reports and data (UNESCO 2020 Global Education Monitoring). The research has led to a number of valuable insights, system characteristics and architectures, which the Latvian working group will take into account when designing Latvian early intervention and support systems, of course bearing in mind the historical and cultural differences between countries. However, the examples and experiences from abroad give Latvia a broader insight into the possibilities that can be developed in the design of the new early development assessment and support system. In both countries, the biopsychosocial approach is recognized and can be observed in the functions of the support system. There is close cooperation between the Ministries of Health, Education, Labor, and Social Policy in both countries. For the child, an immediately established dynamically functional plan is created, which includes clear action steps for the family and specific support measures. Additionally, an individual educational plan is developed with the involvement of a wide range of specialists, which is regularly evaluated and modified if necessary. The main approach is not to impose a specific program on the child but to develop their maximum potential by assessing their strengths and weaknesses (Rektina, 2022).

As a result of all the research tasks, the following proposals can be put forward for further actions to improve Latvia's progress towards a contemporary understanding of inclusive education:

- By 2024, the introduction of an early preventive support system for Latvian children in grades 1 to 6 should be planned, with regular assessments.

- Latvia should establish a framework for cooperation between the Ministries of Education, Welfare, and Health.

- Continued political discussions should focus on the creation of a new structure, the Child Development Support Center (CDSC), which would oversee the work of existing inclusive education support centers and the operations of pedagogical-medical commissions.

- Existing pedagogical-medical commissions should be transformed into multi-professional intervention teams that:
    i) Coordinate in-depth research for children who show increased risk factors during screening.
    ii) Develop individual child development and learning plans in collaboration with doctor-specialists, families, educational institutions, and other specialists.
    iii) Determine the necessary support measures.
    iv) Provide family support and monitoring measures to ensure that the child receives daily necessary support.
    v) Offer professional development in line with contemporary disability theories.

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The Use of Grade-Level Readers in the Foundation Phase

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Abstract
Grade-Level Readers in the form of Reading Anthologies are provided in South African Foundation Phase classrooms (Grades 1-3) for home language learners in order to promote their reading interest and make teaching reading easier. However, evidence shows that teachers lack an understanding of teaching reading in line with methodologies prescribed in the curriculum. This study aimed to examine the effectiveness of Grade-Level Reading Anthologies in impacting reading instruction and promoting reading in the Foundation Phase classroom. A qualitative case study underpinned by Tomlinson's theory of differentiation was used to collect data in six quintile 1 and 2 (five categories of schools from the poorest to the least poor) primary schools. Grade 3 reading lessons (with grade-level readers used as the main resource during Group Guided Reading activities) were observed. Data from the lesson observations were analysed manually by using thematic analysis. Classroom observations revealed the teachers' lack of knowledge in teaching reading and their inability to cater for differences and diversity in the Foundation Phase classroom. In view of these findings, it is recommended that teachers should be provided support through coaching from relevant stakeholders such as Non-Profit Organisations, education district officials and academic experts in teaching reading so that they can be able to teach reading cognisant of the differences existing in their classrooms.

Keywords: Grade-Level Readers, Foundation Phase, Reading Anthologies

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Introduction

To cater for diversity and multilingualism in the South African context, Grade-Level Reading Anthologies have been developed in all 11 official languages taught in the South African Foundation Phase (Grades 1-3) classroom. However, the outcomes of the Progress in International Reading Literacy Study (PIRLS) between 2006 and 2021 show the percentage of Grade 4 learners who cannot read for meaning in any language declined from 87% (2006) to 82% (2011) and down to 78% (2016) but increased back to 81% (2021) (Department of Basic Education, 2023). Although there was an outbreak of COVID-19 which disrupted the entire education system worldwide, the history of a 5% and 4% decline in the previous years suggests that even if the pandemic had not disrupted the normal teaching and learning process, percentage of learners who cannot read for meaning would not have dropped below 70%. There are several reasons contributing to the current literacy crisis in South Africa, and this includes inter alia the teachers' lack of knowledge in implementing differentiated instruction (a strategy for accommodating various learning needs) in the classroom (Jager, 2016; Onyishi & Sefotho, 2020). For this reason, the Department of Basic Education is calling for more advanced training of teachers to improve reading literacy in schools.

This study looked at the use of home language Grade-Level Reading Anthologies in the South African Foundation Phase classroom. Unlike single readers, Reading Anthologies are collections of different stories compiled at the appropriate level of learners. Very little research (if any) has been done in terms of examining the use of Reading Anthologies in the Foundation Phase. Studies conducted to date focus on single readers (Prior, Fenwick, Saunders, Quellette, O'quinn & Harvey (2011; Kontovourki, 2012; Seals, 2013). This study was an intervention which occurred in the form of providing isiZulu home language Reading Anthologies in the Foundation Phase to a randomised sample of 100 Quintile 1 – 3 schools in the King Cetshwayo District in KwaZulu-Natal and teacher guidelines which were intended to help teachers use the anthologies effectively in their classrooms. In order to establish whether the provision of Reading Anthologies had implications for reading practices and whether they promoted reading in the classroom, an in-depth qualitative case study design was used to gather data in six quintile 1 and 2 schools. Hence, Grade 3 reading lessons (with the RAs used as the main resource during Group Guided Reading activities) were observed in the sampled schools.

For the purpose of this study, the following research questions were posed: *What is the impact of Grade-Level Reading Anthologies on reading instruction? How effective are Grade-Level Reading Anthologies in promoting reading in the FP classroom?* To answer these questions, the article first discusses the literature related to this topic and unpacks Tomlinson's differentiated model as the theory situating this study. This is followed by describing the method used to collect data. Finally, the main findings, implications and conclusion are presented.

Literature Review

Relevant sources in terms of looking at the use of Grade-Level Reading Anthologies were outsourced using academic databases such as JSTOR, EBSCOhost, and ERIC. The literature reviewed is conceptualised according to the following themes: Grade-Level Reading Anthologies, the role of Grade-Level Reading Anthologies in the Foundation Phase classroom and using Grade-Level Reading Anthologies according to the Foundation Phase curriculum.

Grade-Level Reading Anthologies

As already mentioned, Grade-Level Reading Anthologies are collections of different stories compiled at the appropriate level of learners in each grade. Each learner is given their own Reading Anthology for use in the South African Foundation Phase classroom and to take home for practice. The anthologies are categorised according to various grades (Grades 1-3) and reading development or colours (blue representing level 1 for struggling readers, green representing level 2 for averaged readers, and red representing level 3 for advanced readers). Anthologies, according to their levels, provide learners with opportunities to access a wide range of stories written in their home language. They contain colourful pictures; however, they are paperbound (softcover) books which makes it challenging to sustain them, given their fragility. An alternative to using softcover texts which are unsustainable, is to opt for eBooks. However, although eBooks are sustainable and useful in developing children's literacy skills better than print books (López-Escribano, Valverde-Montesino, García-Ortega, 2021) – accessing eBook reading material may be a challenge for under-resourced schools in particular, historically disadvantaged ones. In this case, it is recommended, as per the Teacher's Guide that teachers should teach learners to take good care of the anthologies for the purpose of sustaining them. *Biblionef* (the programme theory of donor organisation) also assert that access to books which are looked after and age-appropriate is beneficial in several ways, which include inter alia, improving literacy skills and promoting confidence and improvement in learning (Nassimbeni & Desmond, 2011).

The Role of Grade-Level Reading Anthologies in the Foundation Phase

Grade-Level Reading Anthologies provide learners with opportunities to develop their home language, given that they have been compiled in all the South African official languages which are used as the languages of learning and teaching in the Foundation Phase. Text conventions (e.g., illustrations and pictures) characterising these anthologies help learners comprehend the text better (AL_Hinaai, 2021). This is also supported in a study that examined the effect of pictures on reading comprehension for learners with reading impairment. Findings in this study showed that texts with pictures could help to improve reading comprehension (Razalli, Thomas, Mamat & Yusuf, 2018). A similar study which looked at the role of illustrations and pictures in reading comprehension revealed that accurate illustrations and pictures have positive effects on reading comprehension (Parks, 2020).

Another significant role of Grade-Level Reading Anthologies is the fact that they enable teachers to conduct various reading activities, such as Group Guided Reading, paired and independent reading with learners. Moreover, teachers can use the anthologies according to their learners' reading abilities - this, according to Kuhn et al. (2006), helps to promote reading development in young learners.

Using Anthologies According to the Foundation Phase Teacher's Guide

Reading anthologies, according to the Teacher's Guide, are graded readers which are used for various reading activities, such as Group Guided Reading, Paired and/or Independent Reading (Department of Basic Education, 2020).

Group Guide Reading: At the beginning of the year, the teacher conducts baseline assessments (short assessments to establish the learner's reading level) to place learners in their relevant ability groups.

In terms of using the Grade-Level Reading Anthologies according to what is stipulated in the guide, teachers are expected to allow and encourage learners to take the anthologies home, where they will read with the support of their parents or caregivers. Learners are expected to return the books to school for reading in class and the teacher is supposed to make a reading record page for each learner to monitor their reading progress and to know when it is time to move them to a different group. Given the fragility of the texts, teachers are expected to teach learners to look after the books.

For reading every day during Group Guided Reading Activities, the teacher sees two small groups of 6 to 10 learners (each for 15 minutes) where he/she uses the Reading Anthology, which is at the learners' reading level. The teacher is expected to read with each group once or twice a week. During Group Guided Reading lessons, the teacher should give learners opportunities to read aloud from the anthology while he/she listens carefully and helps them if they struggle. Given that learners are not gifted the same – some would easily catch up with reading; hence, they should be moved to more advanced levels, while others would need more support before moving to the next level.

Paired Reading: Paired Reading provides opportunities for the teacher to read aloud with a learner who struggles to read by him/herself or learners taking turns to quietly read to each other. This activity normally happens when the teacher is busy with a small group.

Independent Reading: Independent reading gives learners opportunities to read the anthology alone in class or at home. Like Paired Reading, Independent Reading also occurs in class when the teacher is working with his/her small group of learners during Group Guided Reading activities.

Tomlison's Differentiation Model

Tomlinson's (2003) model of differentiation was found to be compatible with examining the use of Grade-Level Reading Anthologies in this study. Tomlinson describes differentiation as factoring students' individual learning needs before designing a lesson plan. This model provides teachers with opportunities to tailor instruction to accommodate differences and diversity in their classrooms. It enables teachers to modify their classroom organisation, curriculum, instructional methods, and assessment procedures to address the individual learning needs of their students (Tomlinson, 1999). The diagram (Figure 1) below shows the model which FP teachers can use to differentiate classroom elements (content, assessment, teaching methodology, and learning environment) according to the learners' characteristics (readiness, interests, and learner profile) and through a range of instructional and management strategies. This model is meant to assist teachers in ensuring that all learners, despite their differences, benefit from the entire learning process.

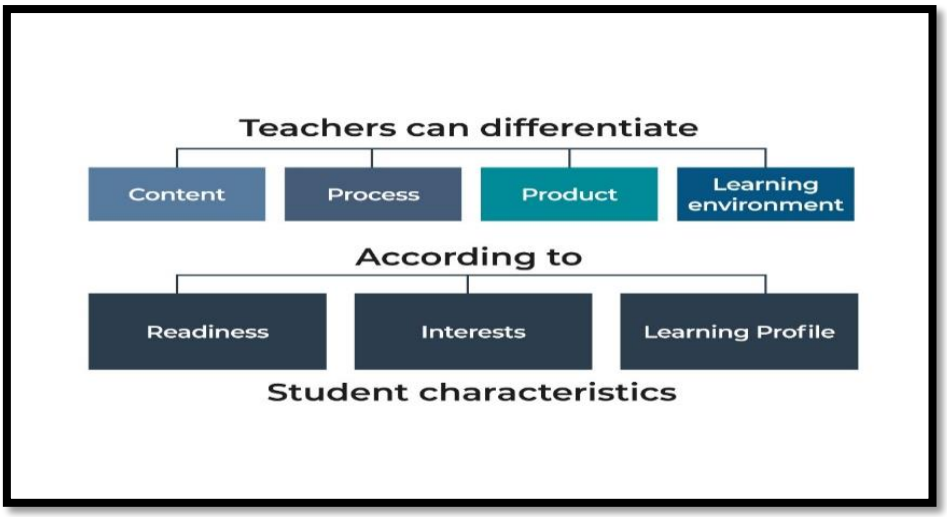

Figure 1: Model of Differentiation in Language Learning
(Department of Basic Education, 2017, p. 38)

Evidence has also shown the effectiveness of differentiated instruction on both struggling and apt learners (Hamman, 2014; Magableh & Abdullah, 2020). For example, in a study that examined the effectiveness of differentiated instruction strategies between the control group (n=59) and experimental group (n=29) of Grades 4 and 5 English Foreign Language learners in Jordan, findings revealed that employing differentiated instruction enabled the experimental group to perform better than the control group in reading comprehension (Magableh & Abdullah, 2020).

Inclusion in Differentiated Classroom

Inclusion in education, according to Kirschner (2015, p. 2), refers to "the inclusion of persons with physical and mental impairments such as sensory or mobility limitations, intellectual disabilities, learning disabilities, language disorders, behavioural disorders, and autism spectrum disorders." An inclusive classroom environment requires teachers to effectively implement a differentiated approach which enables them to meet the diverse and heterogeneous needs of all learners in the classroom (Webster, 2014). With South African teachers having to deal for long with many differences at varying levels in their classrooms (Singh, 2004), the Curriculum and Assessment Policy Statement emphasises the role of inclusion in organising, planning, and teaching (Department of Basic Education, 2011). An inclusive classroom environment makes learners feel safe, valued and respected (Garibay, 2015). However, research has shown that most teachers still do not know how to plan instruction that accommodates diversity in their classrooms (Mahlo, 2017; Adewumi & Mosito, 2019. Omodan & Ige, 2021). For example, a study that examined challenges associated with management of diversities in South African High schools found that language, cultural and personal relativism, learning impairment and comprehensibility were the dominant challenges faced in diversity management in all the schools visited (Omodan & Ige, 2021).

Research Methodology

This study was conducted in six quintile 1 and 2 schools (4 Primary and 2 Combined Schools) selected from a randomised sample of 100 quintile 1-3 schools in the King Cetshwayo District of KwaZulu-Natal. A qualitative case study design was used to observe

one Grade 3 isiZulu home language lesson in each of the six schools. The Grade 3 class in each school was selected randomly and automatically included teachers of the targeted classes. Notes were taken throughout the research gathering process to supplement data captured through video and audio recordings during observations. A lesson observation instrument reflecting the realities and demands of the FP curriculum (Curriculum Assessment and Policy Statement) and prepared by Zenlit Intervention (2016), a video recorder and notes to supplement data were used to gather information about six HL reading lessons in the Grade 3 classrooms. The lesson observation instrument was adapted to suit the focus of this study, and it is divided into two sections. **Section A** covers details of school visits. **Section B** comprises lesson observations, which looked at the following aspects: classroom teaching and learning environment, the use of Reading Anthologies in the classroom, Group Guided Reading Activities and opportunities afforded to learners to read in isiZulu home language. Only one Grade 3 classroom was observed per school, and all the teachers in each of the six schools volunteered to participate in the study. Observations in each classroom lasted approximately 10 to 30 minutes.

For the purpose of this study, the qualitative data from the observations were analysed manually by using thematic analysis, following Braun and Clarke's (2006) six-phase framework for doing qualitative thematic analysis. The first phase involved transcriptions and translations of lesson observations from isiZulu to English, ensuring familiarity with the data and identifying patterns in meaning across the data. The second phase involved generating initial codes from the data, moving back and forth. The third step involved sorting all potentially relevant coded data extracts into themes which were guided by the research questions posed for the study. In the fourth step, the coded data extracts for each theme were reviewed to check whether they formed a coherent pattern. The fifth step involved determining what aspects of the data were captured by each theme. The final sixth step involved the writing up of the report.

Ethical principles were considered in this study. The study was led by the Department of Basic Education in partnership with Wits Consortium and entailed evaluating one of its programmes in public schools. Consent was obtained from all participants in the evaluation. Pseudonyms are used to protect the identity of the participants and schools (e.g., Grades 3 teachers are referred to as TA to TF, and schools as School A to School F).

Conclusion

Findings

The findings from classroom observations are presented according to the following themes: classroom teaching and learning environments, the use of Grade-Level Reading Anthologies in the Foundation Phase classroom, Group Guided Reading activities, Teacher's Guide and opportunities for reading in the home language.

Classroom Teaching and Learning Environments

Most classes observed were not creative print-rich environments. Some classrooms had dull walls which did not display colourful learning charts or posters, as shown in Figure 1. Although all the six Grade 3 classrooms in the schools sampled had a classroom library corner, the classroom of the School B teacher was the only one where the Grade-Level Reading Anthologies were displayed on the library bookshelves. The visibility of single

readers in the classroom of Schools A and E suggested that teachers and learners were not effectively using the anthologies provided to promote reading. Thus, although teachers received the Reading Anthologies, it seemed as if some used them superficially, suggesting that they preferred the single readers to the Reading Anthologies provided. In the classroom of School C, there was no evidence that TC used the anthologies with learners in her classroom. All the Reading Anthologies in the classrooms observed did not seem to have been covered to sustain their use, suggesting that they were not taken care of. Three classrooms (Schools A, B and E) had a library corner, but the classroom in School B seemed to be the only one with an organised library corner, and the anthologies displayed on the bookshelves in School B were still in good condition compared to other classes. Each learner received a copy of the reading anthology in the classroom of Schools A, B and D, whereas in the classroom of Schools E and F, learners either shared the book in pairs or in groups. In the classroom of School C, there was no sign showing that the teacher and her learners used the reading anthologies.

The Use of Grade-Level Reading Anthologies in the Classroom

Grade-Level Reading Anthologies in all the classes observed were used for Group Guided Reading, reading aloud, or choral reading in groups or as the whole class. Paired/Independent Reading was only done in the classroom of TA. Children in her class were called up to read to the whole class during the Group Guided Reading slot while the other learners listened. Only TB used the anthologies according to the learners' level of reading development (as shown in Figure 2), given that the books catered for the developments/grades. For example, in her classroom, TB gave learners in one group whose reading was accurate and fluent Reading Anthology3 (for Grade 3) while the struggling readers in the second group were given Reading Anthology1 (the Grade 1 book), suggesting that although the second group was in Grade 3, they could only read Grade 1 level readers - which might have been sourced from Grade 1/2 teachers because Grade 3 classes did not receive Grade 1 level readers. The Grade 3 teachers in the five other schools visited used the same Reading Anthology3 text with all the learners, suggesting that they might not be aware of their individual learners' reading development.

Figure 2: Grade 3 Group Guided Reading activities in School B classroom

Group Guided Reading Activities

Group Guided Reading lesson activities where teachers used the anthologies were observed in all six Grade 3 classrooms in each school. According to the South African National curriculum, teachers should see two small groups daily (each for 15 minutes). From what was observed, two Grade 3 teachers in Schools A and B were the only ones who managed to see two groups for about 15 minutes each as per the recommendations in the curriculum. However, Schools C, D, E and F spent less than 12 minutes with a small group or the whole class. All the teachers focused their engagement time on choral reading (reading aloud with the whole class or groups). This defeats the purpose of Group Guided Reading, which is intended for differentiated teaching, where teachers get to listen to learners reading individually in each group. Although research has shown that choral reading, when used as one of many reading activities, can positively influence reading fluency and comprehension (Kodan & Akyol, 2018), whole class or group chorusing can be misleading because it creates the impression that everyone is reading, it does not provide teachers with opportunities to observe individual reading behaviours and identify areas that need attention. Some teachers did not organise activities to engage the other groups when they were busy with their ability groups, so the rest of the class played and made noise.

According to the initial planning, teachers knew in advance that there would be observations so that they could prepare their reading lessons; however, none of the teachers produced evidence that they were prepared for their Group Guided Reading lessons, suggesting that what was observed seemed to be a true reflection of what is usually happening in most Foundation Phase classrooms, which is not in line with what is recommended in the curriculum policy document. This also suggests that teachers did not plan beforehand because they do not know how to organise and plan for teaching that accommodates diversity (Mahlo, 2017; Adewumi & Mosito, 2019. Omodan & Ige, 2021).

Opportunities for Reading in the Home Language

Although teachers had challenges conducting Group Guided Reading activities according to what is stipulated in the curriculum, it was intriguing to note that in most classrooms (except School C) observed, they used the anthologies provided to conduct a choral reading with learners. For example, in the classroom of School A, choral reading was done during Group Guided Reading in pairs/independently and in groups, as shown in Figure 3 below. This seems to have increased the amount of time spent reading in the learners' isiZulu home language during school time.

Figure 3: Group Guided Reading Activities in School A Classroom

Teacher's Guide

The provision of RAs in KwaZulu-Natal schools included the Teacher's Guide to help teachers use the anthologies in line with what is recommended. However, from what was noted during observations, there was no evidence showing that teachers used the guide to support teaching and learning in their classrooms. This was supported by the fact that none of the teachers had a reading record to note the reading progress of the learners as recommended in the guide and neither did they seem to understand how to conduct Group Guided Reading.

Implications of Findings

This section presents implications relating to the following findings: classroom environment that supports reading, the use of Grade-level Reading Anthologies, and lack of knowledge to conduct Group Guided Reading.

Classroom Environment That Supports Reading: Findings revealed that most classrooms were not print-rich environments – they lacked creative reading corners. These deprived learners of the opportunity to easily access graded readers or to read them for enjoyment.

The Reading Anthologies in all the classrooms observed did not seem to have been covered to sustain their use. Given that soft covers are used on these books, it is likely that they may get torn easily and lose pages if they are not taken care of. Therefore, learners may not enjoy reading books which have incomplete pages.

The Use of Grade-Level Reading Anthologies: The Reading Anthologies provide teachers with opportunities to use the texts according to the learners' reading level. However, findings showed that most teachers gave all the learners the same Reading Anthologies, suggesting that they do not have the knowledge to accommodate differences and diversity in their classrooms. According to Tomlinson (2003), struggling learners require additional support to foster their understanding and fill in knowledge gaps. These findings have negative implications for struggling learners who are unlikely to be afforded individual learning support and may rarely catch up with their peers.

Lack of Knowledge to Conduct Group Guided Reading Activities: Findings also revealed that most teachers did not seem to have acquired sufficient knowledge and skills in conducting Group Guided Reading. This was in spite of the provision of the Teacher's Guide which was meant to help teachers use the anthologies for teaching reading according to what is prescribed which raises the question of whether the Teacher's Guide was worthwhile. Given the importance of these activities in providing teachers with opportunities to implement differentiation, this suggests that the 'one size fits all' approach prevails at the disadvantage of struggling learners who need extra support.

In view of the findings in this study, it is evident that reading challenges in the South African classroom are not necessarily about the shortage of reading material because the Department of Basic Education strives to ensure that each learner has a copy of a text to read in the classroom and at home. As mentioned earlier, this could be about the teachers' lack of knowledge in teaching reading according to the methodologies recommended in the curriculum in terms of implementing differentiated instruction (Jager, 2016; Onyishi & Sefotho, 2020). Hence, it is recommended in this study that in terms of following Tomlinson's (2003) model of differentiation, teachers should be provided support through

coaching from relevant stakeholders such as Non-Profit Organisations, education district officials and academic experts in teaching reading in line with the principles of inclusion and differentiated model in the Foundation Phase classroom. This will enable them to teach reading cognisant of the differences existing in their classrooms. Nonetheless, there's a need for studies to look at the use of Grade-Level Reading Anthologies in the other Foundation Phase grades, as this study focused on Grade 3 only.

Limitations of the Study

Data collected in this study was not without limitations. According to the initial planning, teachers knew in advance that there would be observation so they could prepare their lessons; however, none of the teachers observed had a lesson plan prepared for their reading lesson. This suggested that what was observed seemed to be a true reflection of what usually happens in the classroom, which is not in accordance with the recommendations in the Teacher's Guide.

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Bridging the Gap Between Research and Education: The µNet Project and High School Science Education in Greece

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Abstract
Many educators believe that hands-on experience is more effective than classroom learning for science education. However, incorporating rapidly-evolving branches of science, such as Astronomy and Astroparticle Physics, into secondary education can be challenging due to the complexity and cost of equipment and the need for advanced scientific methodologies. To address this issue, the Physics Laboratory of the Hellenic Open University created the µNet project. This project engages Greek high school students in the experimental methodology of Particle and Astroparticle Physics by having them build, test, and operate their own telescope to observe high-energy cosmic rays. The project also aims to develop a school network of educational cosmic ray telescopes throughout Greece, allowing for collaboration and idea exchange among students. The project engaged over 500 students and 70 science teachers in its first year of operation during the 2022-2023 school year. This report presents the status and latest developments of the µNet project, as well as the results of the first year of operation, including the tools and methods that have been developed, such as gamification methods used to enhance attendees' interest.

Keywords: Physics Education, Cosmic Ray Physics, Remote Laboratories, Distance Learning

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Introduction

In classical Astronomy, astrophysical objects are observed by detecting the emitted light which may be visible (i.e. optical telescopes) or not (i.e. radio astronomy). However, not only light is emitted by such objects; in many interesting cases high energy particles like protons, nuclei and neutrinos, are also produced and propagate through space until they enter the Earth's atmosphere (Gaisser, 2016). These high energy subatomic particles and atomic nuclei that reach the Earth from all directions in the sky are called cosmic rays. When such an energetic cosmic ray enters the Earth's atmosphere interacts with a nucleus in the atmosphere and produces many new particles (secondary) in cascade interactions, usually called an air shower (Fig, 1).

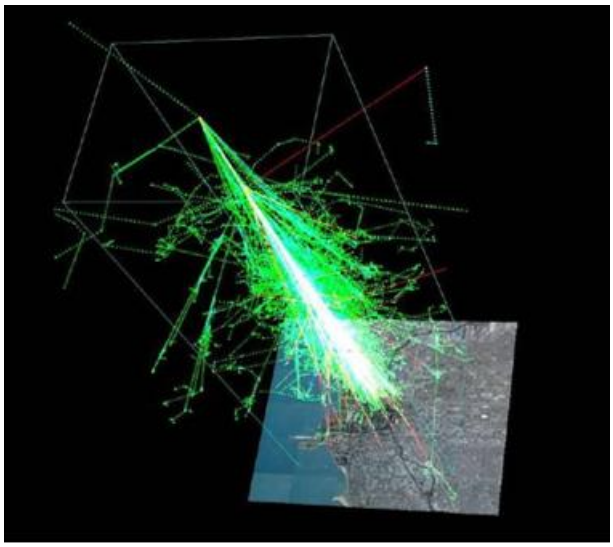

Figure 1: An artistic view of an Air Shower above a city.

The generation and absorption of particles is continuous and as a result a very thin (a few meters) but large disk (the radius can reach hundreds of meters) is formed that is perpendicular to the direction of the initial (primary) cosmic ray moving with the speed light (Fig. 2). If the energy of the primary particle is big, the disk can reach the ground level and the particles spread in an area hundred or even thousands of meters in radius. In this case we call the shower Extensive Air Shower (EAS).

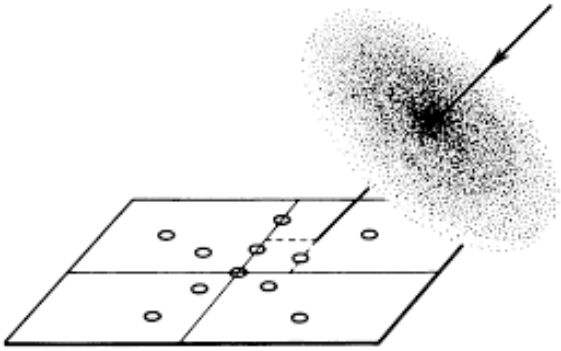

Figure 2: The EAS disk of particles.

Educational Cosmic Ray Telescopes

An educational telescope designed for cosmic ray observation typically consists of three particle detectors arranged in a horizontal triangle on the ground, spaced around 10 to 20 meters apart. By analyzing the relative timing of shower particles passing through these detectors (information provided by the particle detectors) and employing basic geometric principles, it becomes possible to accurately reconstruct the direction of the shower axis and, consequently, the trajectory of the primary cosmic particle. This reconstruction can be achieved with a precision of a few degrees (Leisos, 2019).

The Physics Laboratory at HOU has developed an affordable (approximately 3000 Euros), compact, and portable cosmic ray telescope called the μCosmics detector (Tsirigotis, 2019). The μCosmics detector (shown in Figure 3) consists of three detector units, a PC-based oscilloscope, and a PC for real-time data monitoring and storage. The detector unit itself is quite small, easily portable, and weighs approximately 6 kilograms. The μCosmics telescope offers a resolution of around 5 degrees and can record approximately 10 cosmic ray showers per hour. This recording rate is sufficient even for the relatively short duration of a high school class period.

Figure 3: The μCosmics telescope with 3 detection units (white boxes) and the interior of the detection unit (right).

The μNet Project

The development of the μCosmics detector, coupled with the creation of corresponding educational initiatives during summer schools, gave rise to the inception of the μNet project. μNet's primary objective is to actively engage high school students in hands-on experimental procedures within the field of Astroparticle physics, particularly focusing on Cosmic Ray physics (Petropoulos, 2020a). Within the framework of μNet, 20 educational cosmic ray telescopes have been set up in Greek high school laboratories. Moreover, remotely operated instruments deployed on the HOU campus are accessible to over 50 schools annually. These institutions equipped with μCosmics detectors, along with those participating in distance education efforts, collectively form the μNet network (depicted in Figure 4) - the first Greek school network dedicated to educational cosmic ray telescopes.

The central facet of the educational curriculum lies in students' active involvement in constructing and operating the detection units themselves. Pupils from different schools collaborate on assembling the detection unit, gaining a deeper comprehension of its operational principles. The functioning of these stations takes place via an online web-based application. Participating students access the application to either operate their local station or

choose a remote telescope (situated at HOU) to work with. The tasks related to data management encompass unit calibration and describing the attributes of showers based on the collected data.

The comprehensive μNet educational program comprises a sequence of structured educational tasks, executed by students under the guidance of their educators (Petropoulos, 2020b). This program encompasses seven primary educational activities:

- Construction of the detection unit
- Calibration of the telescope
- Estimation of atmospheric muon flux characteristics
- Operation of the Data Acquisition System and Online Monitoring
- Exploration of Detector Geometry
- Telescope Operation

Upon the conclusion of data collection (at the end of the school year), students proceed to assess the detection rate as well as the distribution of air shower arrivals, subsequently comparing their findings with measurements conducted by other schools.

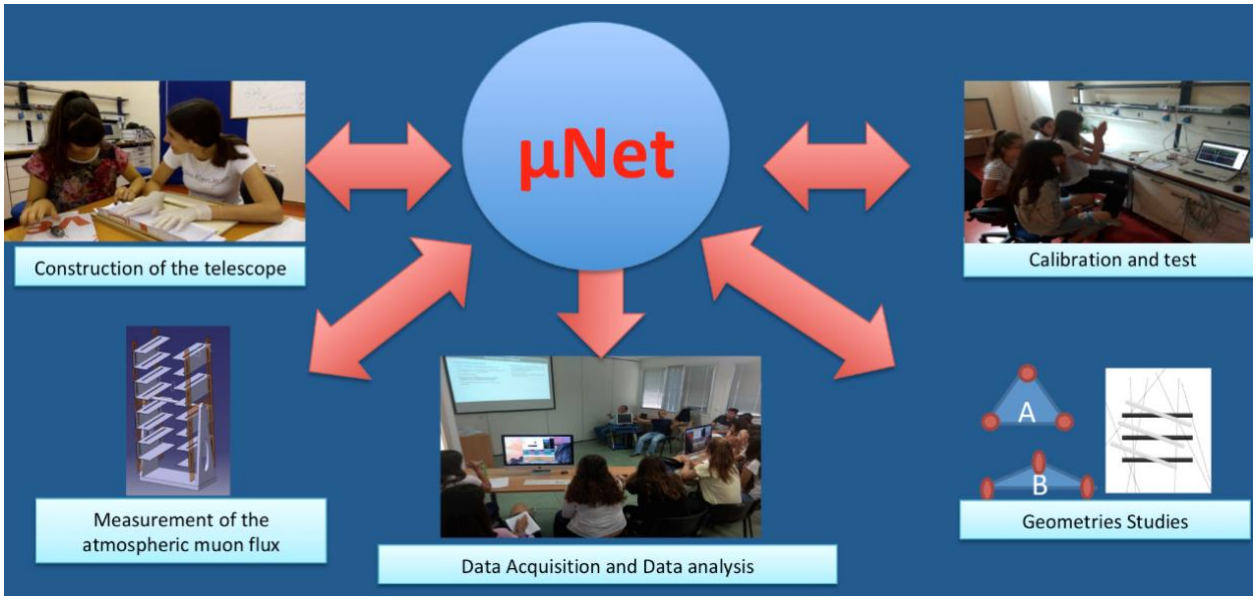

Figure 4: The μNet educational activities with the μCosmics detector.

The μNet in Action

The μNet project has demonstrated continuous evolution over the past several years, notwithstanding certain challenges faced during the pandemic. The initial phase of the μNet project involved a five-day educational initiative conducted in 2018 and 2019, as part of two summer schools organized by the Physics Laboratory at HOU. During this inaugural endeavor, student feedback was highly positive, and the overall outcomes were notably encouraging.

In 2020, a pilot program was launched for the academic year 2020-2021. This pilot initiative aimed at establishing a small network of educational cosmic ray telescopes within five high schools located in the Achaia prefecture, the same region where HOU is situated. However, due to the constraints posed by COVID-19, the entire training program had to be executed

remotely. Despite this challenge, the evaluation revealed that the pilot program's objectives were achieved to a significant extent.

More recently, the μNet project secured funding from the Hellenic Foundation for Research and Innovation, earning the top rank among proposals in the thematic area of "Research & Innovation Hubs in Education." As a preliminary phase of the project, a modest network of schools was organized for the academic term 2021-2022. The aim was to establish experimental educational activities and develop the requisite educational materials.

The inaugural year of μNet's full operation occurred during the academic year 2022-2023. Over 500 students from 60 schools across Greece participated in these educational activities. Among these, 40 schools engaged with the educational telescopes through remote access, while 20 schools were afforded the opportunity to host a telescope within their own laboratory setting. The progressive journey of the μNet project is illustrated in Figure 5.

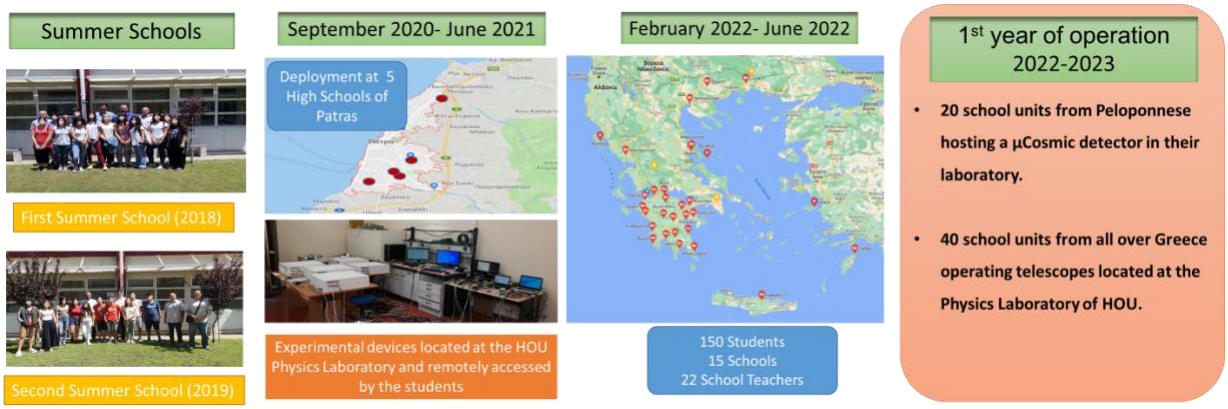

Figure 5: The evolution of the μNet project

The primary instrument utilized in the educational curriculum was a web-based application (depicted in Figure 6), which facilitated the calibration and operation of the telescopes (accessible at https://mnet-online.eap.gr). Each participating school employed this platform to monitor various aspects, including the detection rate and the reconstruction rate of air showers. Furthermore, the application provided access to acquired pulse data for each detected shower. An animation showcased the reconstructed shower direction, and the final tab of the online monitoring interface displayed histograms illustrating the data quality of the telescope.

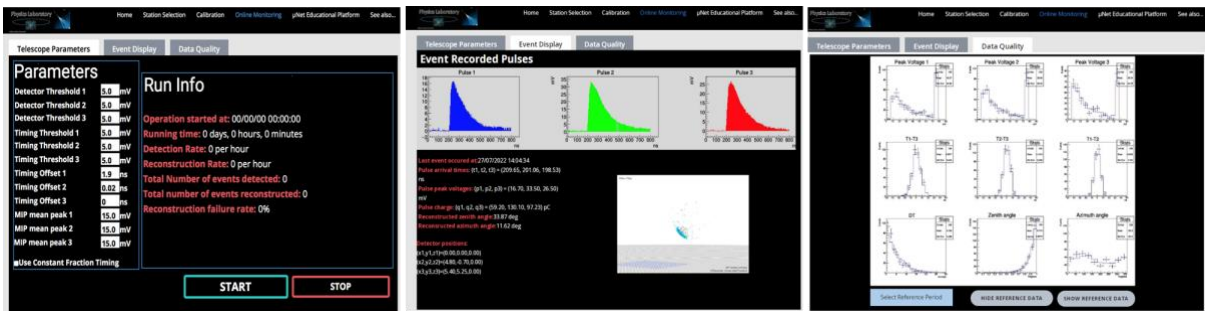

Figure 6: The online web app for the telescope operation (left, middle) and the LMS educational platform (right)

For the educational program, we developed an LMS platform (Blas, 2009) that included many sessions each one with a series of analytical and short, videos, avoiding any (written)

manuals. The enrollment of the students was based in gamification methods where each student collected badges, items and points either for her/himself or for her/his school. Additionally, game contests where organized where the schools were competing each other answering questions.

The general outcome was that the schoolteachers as well as the students improved substantially their knowledge about cosmic rays (Xiros, 2023). The score for each answer of the questionnaire was given based on a Likert Scale: 1 corresponded to the answer “not at all,” 2 corresponded to the answer “a little,” 3 corresponded to the answer “moderate,” 4 corresponded to the answer “quite a lot,” and 5 corresponded to the answer “very much.” For the students the score for the knowledge about cosmic rays before the educational program was 1.6±0.2, while after the completion of the program 3.7±0.2. On the other hand, for the teachers the relevant scores were 2.6±0.3 (before) and 4.1±0.2 (after).

Conclusion

In conclusion, the μNet project, initiated by the Physics Laboratory of Hellenic Open University, addresses the challenge of integrating complex sciences like Astronomy and Astroparticle Physics into secondary education. Recognizing the efficacy of hands-on learning, the project engages Greek high school students in constructing, testing, and operating their own telescopes to observe high-energy cosmic rays, promoting experiential learning. This initiative has not only established a school network of educational cosmic ray telescopes across Greece, enabling collaboration and idea exchange among students, but has also yielded impressive outcomes in its inaugural year, engaging over 500 students and 70 teachers. The project's innovative use of web-based applications, gamification techniques, and remote-operated devices has facilitated an enriched learning experience, leading to significant improvements in both students' and teachers' understanding of cosmic rays. The μNet project stands as a remarkable model for enhancing science education in a dynamic and interactive manner.

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Analysis of External Influence on Implementing Innovative Technologies in Higher-Education Institutions of Developing Countries

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Abstract

Technology-enhanced teaching is influenced by numerous and varied factors such as individual characteristics, users' perception of technology, and external factors. External factors usually comprise of four variables: Organizational Characteristics, External Pressure, Technical Support, and Social Influence. To examine these components, a survey was conducted with 384 staff and students across two higher-education institutions in Nigeria. The use of stratified sampling method was applied in gathering information from a broad classification of universities. Correlation and multiple regression analysis were conducted to understand the relationship and impact between external factors for implementing innovative technologies and its adoption in higher-education institutions in Nigeria. The outcome of this study confirmed that three components: Technical Support, Social Influence, and External Pressure are statistically significant as external factors for implementing innovative technologies in higher-education institutions in Nigeria.

Keywords: External Influence, Innovative Technologies, High Education Institution, Nigeria

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Introduction

Cloud computing is a recent technological concept that is still evolving in all facets of life, academia, information technology, industry, Health among others. and had been christened as a disturbance in software copping and technological tools within all sectors of the economy of which education sector is inclusive (Ogunjobi, 2015). Government, Proprietors and Schools managers across the globe are at the cliff's edge upon their realization of the transformation and changes being brought about by the digital phenomena to their individual sector (Oguntala, et al., 2017).

Cloud computing is being viewed as kernel or "imperatives" of the digital transformation technology ecosystem" (Al-Ruthie, Benkhelifa and Hameed, 2018). As against being a buzzword, it currently represents the development direction of Information Technological industry in the recent times which made it a highly sort after innovation. With the rising up of cloud computing adoption worldwide, the research and statistics had shown that the public adoption of cloud service is projected to reach $266 billion in year 2025 and an estimated $623 billion by the year 2028 (Gartner, 2019; Hosting tribunal, 2020). According to Buyya, Yeo and Venugopal (2008) affirmed that cloud computing is perceived as the last utility apart from water, gas, electricity, and telephone which emphasize the importance of cloud computing in today digital world.

In addition, with cloud computing being perceived as a fundamental part of information technology (Senyo, Effah and Addae, 2016, p. 506), cloud computing brings about potential growth for educational institutions, corporate organizations businesses as well as improvements in governmental strategies and regulation of developed countries in a way to improve their rates of performance and services (Senyo, Effah and Addae, 2016).

As obtained from the report of the World Economic Forum in their "Future of Jobs", there is possibilities of disappearance of over five (5) million jobs in the world within the next five years due to automation and redundancy (Dixit & Prakash, 2018). Technological advancement like cloud computing technology will cause or led to disruption in labour market / business model in the next five (5) years (Dincă, Dima, & Rozsa, 2019). The high active working competitive academic environment within the confine today's working world depend on digital communities and applied technology (Fagbolu, & Atoloye, 2018). However, students and staffs in Nigeria higher institution are being confronted with issue such as lack of technological know-how in the optimization and adoption of cloud computing technology for educational programme. Digital education force had been the order of the day for those who want to be in tandem with the modern educational system of the world (Dahunsi, & Owoseni, 2015). Therefore it is imperatives to know the extent of cloud computing technology adoption in the higher education system in Nigeria. The essence of cloud computing technology is to enable all the major players in higher institutions (Colleges of education, Polytechnic and Universities) to access the services being provided by the three (3) platforms; infrastructure-as-a-service (IaaS), software-as-a-service (SaaS) and platform-as-a-service (PaaS) (Fathali, & Okada, 2018). Cloud computing system is now an important and veritable facilitator of online and distance educational programme such as mobile and e-learning (Ferri, Spano, & Tomo, 2020); (Gumuşoğlu,. & Akay, 2017). The interest of both practitioners and academicians are now on studying the factors that aided user's rejection or acceptance of the cloud computing system. The purpose is to unravel more efficient methods towards evaluating and predicting the users' response Comprehensive Technology Acceptance Model (CTRAM) in the educational field is being influenced by varied factors

such as individual characteristics, users' perception of technology, and external factors, as summarized by Yasir (2023). These external factors serve as the central subject of analysis in this study.

The essence of studying external factors is borne out of the significance of environmental and organisational contexts in which technologies operate, ranging from market competition to government regulations, from cultural influence to social impact (Lee, Trimi, & Kim, 2013; Oliveira and Martins, 2010). It is on the premise of this that this study intends to critically conduct analysis of external influence on the implementation of cloud computing technology in higher institution in Nigeria. This paper addresses the external factor / aspects of computing requirements in general, with respect to university settings in developing nations of the world (Nigeria). The paper concludes with proffering some set of recommendations, implication and plans for future work.

The central aim of this research is to investigate the influence of external factor on the implementation of cloud computing technology in higher institution in Nigeria with a view to improve academic performance in Nigeria higher institution. In a view to actualize the above stated aim, the following research questions were addressed by this study:

(i) What are the variables influencing external factors impact on cloud technology adoption in Nigeria Higher Institution?
(ii) What are the effects of external Influence on implementing Cloud Technology in Higher-Education Institutions in Nigeria?
(iii) What are the relative contributions of Technical Support, Social Influence, Organizational Characteristics and External Pressure as external factors for implementing Cloud technologies in higher institutions in Nigeria?

Theoretical Framework

The main rationale and analysis of this article are based on the framework of Comprehensive Technology Readiness Adoption Model (CTRAM) (Yasir, 2023). Several theories were selected for the proposition of the CTRAM model, namely the diffusion of innovation (DOI) as championed by Rogers (1995), technology, organization, and environment (TOE), unified theory of acceptance and use of technology (UTAUT) by Venkatesh et al (2003); the technology acceptance model (TAM) founded by Davis et al (1989), desire framework (DF), and technology readiness (TR). These models have been applied in various fields towards evaluating the adoption of cloud computing as well as other aspects of technology usage and uptake. The derived CTRAM contains eleven variables that are classified into three main groups, namely individual characteristics, perception of technology, and external factors as shown in Figure 1.

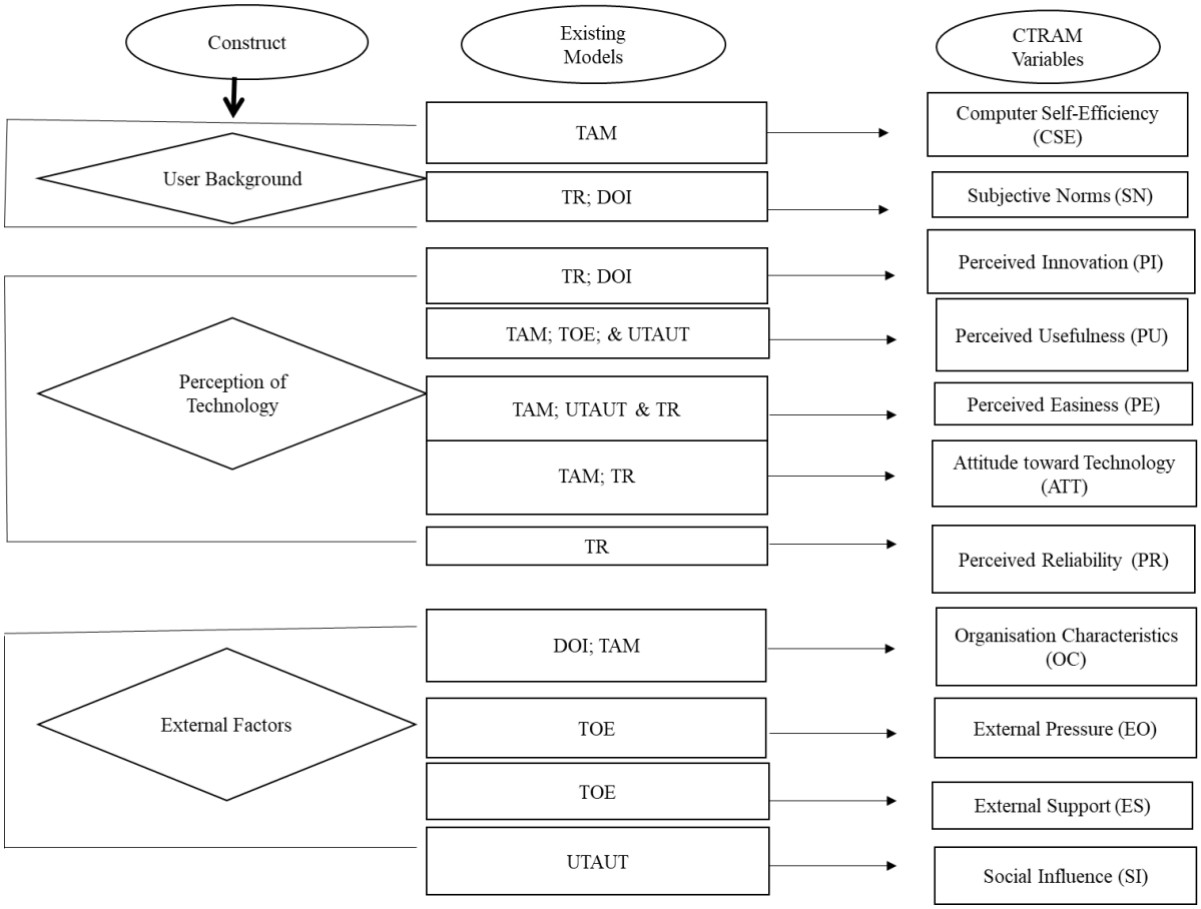

Figure 1: CTRAM Model (Yasir, 2023)

Out of the three factors, external factor is the most significant factor, the essence of studying external factors is borne out of the significance of environmental and organisational contexts in which technologies operate, ranging from market competition to government regulations, from cultural influence to social impact (Lee, Trimi, & Kim, 2013; Oliveira and Martins, 2010). External factors are made up of four variables: First is Organizational Characteristics, which refer to the extent to which an organisation supports the adoption of a technology. Second is External Pressure, which relates to the degree of pressure or influence from external parties such as competitors, peers, or management. Third is Technical Support, that entails the perception of any assistance received from an organisation or colleagues in which the technology is being deployed. Fourth is the Social Influence of how a technology can affect a community as shown in Figure 2.

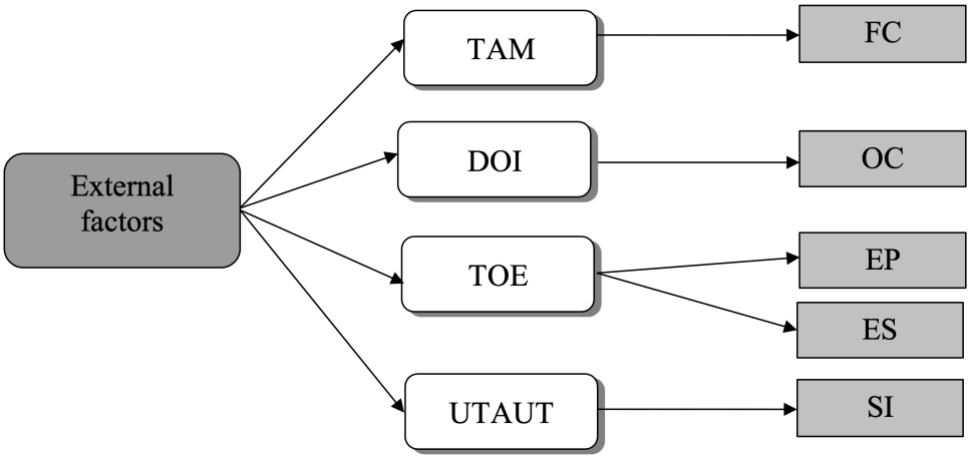

Figure 2: External Factors as Derived from Yasir (2023)

Methodology

A. Survey and Samples

The study participants were made up of staff and students in higher institutions of learning in Nigeria (i.e. universities). At the time of writing, Nigeria had the capacity of about 1.9 million university staff and students (Statista, 2021), which represent a substantial number of respondents that the survey could not aim to target fully. However, the survey employs the use of sample population with the aid of Krejcie and Morgan's (1970) recommendations that centred on an extrapolation from the entire population. Krejcie and Morgan (1970) provided a recommended sample sizes for varying population ranges (as shown in Table 1), this provided the basis that a population of over one million should be based on a sample of 384 participants to achieve meaningful findings. It was on this premise that a total number of 384 questionnaires were served and administered to the target respondents, as represented by the students and staff in selected higher institutions in Nigeria.

N	S	N	S	N	S	N	S	N	S
10	10	100	80	280	162	800	260	2800	338
15	14	110	86	290	165	850	265	3000	341
20	19	120	92	300	169	900	269	3500	346
25	24	130	97	320	175	950	274	4000	351
30	28	140	103	340	181	1000	278	4500	354
35	32	150	108	360	186	1100	285	5000	357
40	36	160	113	380	191	1200	291	6000	361
45	40	170	118	400	196	1300	297	7000	364
50	44	180	123	420	201	1400	302	8000	367
55	48	190	127	440	205	1500	306	9000	368
60	52	200	132	460	210	1600	310	10000	370
65	56	210	136	480	214	1700	313	15000	375
70	59	220	140	500	217	1800	317	20000	377
75	63	230	144	550	226	1900	320	30000	379
80	66	240	148	600	234	2000	322	40000	380
85	70	250	152	650	242	2200	327	50000	381
90	73	260	155	700	248	2400	331	75000	382
95	76	270	159	750	254	2600	335	1000000	384

Table 1. Determining Sample Size of a Known Population (Krejcie and Morgan, 1970)

A primary survey with the aid of questionnaire was designed and implemented. The questionnaire full contents are being outlined in Table 2. The survey contents were classified and grouped into three core categories; of 91 questions in all. The first category depicts the measures for individual characteristics that consists of three sub-group: subjective norms, demographic, and computer self-efficacy. The second category entails the perception of technology, which includes the five sub-group: perceived reliability, attitude towards technology, perceived easiness, perceived usefulness, and perceived innovation. Finally, the third category captures information on external factors through the four sub-groups: social influence, technical support, external pressure and organizational characteristics. The other various practical implementation of cloud computing like infrastructure-as-a-service (IaaS), platform-as-a-service (PaaS), software-as-a-service (Saas), and service models comprise of storage-as-a service (Staas), which are adequately reflected in the questions as observed in Table 2.

B. Analytical Approach

The collected primary data with the use of questionnaire were analyzed using descriptive and inferential statistical techniques like regression, correlation analysis and percentages. The motive of chosen these techniques are borne out of their suitability in answering the research questions which would help in providing objective and measurable insights on the chosen topic.

VARIABLES	SURVEY QUESTIONS
Organizational Characteristics	*Is the university willing to pay for extra storage, computers, and services?* *Are there sufficient computers in the university labs for students to practice with?* *To what extent do you agree that campus Wi-Fi cloud is a good idea?* *Do other universities have far more advanced computers than our university lab?*
External Pressure	*Are there universities in Nigeria that have already adopted cloud computing?* *Various pressure from the university to work with students via digital technology?* *Is there pressure from the government to teach using digital technology?*
Technical Support	*Does the university have enough for routine check and maintenance of computing resources?* *Is IT support team always happy to help?* *Rate the efficiency and promptness of response from IT support team?* *Rate the level of knowledge and skills of the IT support staffs?*
Social Influence	*What is the degree to which a person feels a technology can affect a community?*

Table 2. CTRAM Variables for External Influence (Yasir, 2023)

Data Analysis

Table 3 reveals the contribution of the independent variables to the dependent variable expressed as beta weights. Using the regression coefficients to determine the relative contributions of the independent variables to the explanation of the dependent variable, the positive value of Effect of External Influence (β = 0.534, t = 15.245, P < 0.05), has relative contribution on implementing cloud technology in Higher Institutions in Nigeria

In a nutshell, External Influence has significant effect on the implementation of Cloud Technology in Higher Institutions in Nigeria.

Coefficients[a]

Model	Unstandardized Coefficients		Standardized Coefficients	T	Sig.
	B	Std. Error	Beta		
(Constant)	2.530	.080		31.745	.000
Effect of External Influence	.534	.035	.718	15.245	.000

a. Dependent Variable: Implementing Cloud Technology in Higher-Institutions in Nigeria

Table 3. External Influence on Implementing Innovative Technologies

Table 3 reveals the contribution of the independent variables to the dependent variable expressed as beta weights. Using the regression coefficients to determine the relative contributions of the independent variables to the explanation of the dependent variable, the positive value of Effect of External Influence (β = 0.534, t = 15.245, P < 0.05), has relative contribution on implementing Cloud Technology in Higher Institutions in Nigeria. In a nutshell, External Influence has significant effect on the implementation of Cloud Technology in Higher Institutions in Nigeria.

Model	**Sum of Squares**	**Df**	**Mean Square**	**R**	**R Square**	**F**	**Sig**
Regression	50.747	1	50.747	.718	.616	232.425	.000[a]
Residual	47.598	383	.218				
Total	98.345	384					

Table 4. Significance Level of External Influence

Table 4 were used to test for the significance of the relationship using Regression ANOVA which produced ($F_{value} = 232.425 > F_{tab} = 3.89; P < 0.05$). Since F-value is greater than F-tabulated and P-value (0.000) was less than 0.05 alpha levels, this implies that there is no evidence for the acceptance of H_0 (i.e. H_0 is rejected). The result indicates that there is a

significant effect of External Influence on the implementation of Cloud Technology in Higher Institutions in Nigeria.

Also it can be deduced from the table the degree of relationship between the External Influence and the implementation of Cloud Technology in Higher Institutions in Nigeria, with correlation coefficient R=0.718. This indicates that there was a strong positive relationship between the independent variables and dependent variable. This clearly shows that External factors or variables n R-square is used to know the degree of the implementation of Cloud Technology in Higher Institutions in Nigeria are equal to 0.616. Therefore External influence or factors contributed 61.6% proportion to variation on the implementation of Cloud Technology in Higher Institutions in Nigeria. The other variations accounting for the remaining 38.4% can be explained by other factors which cannot be known by this study. The result of this study is similar to the findings of Abdalrahman et al (2018), Mishra & Yadav (2020) and Malik (2018), as observed in Table 4 show that organisational characteristics as an external factor do explain changes on the cloud computing technology implementation by 61.6%.

Variables	B	SEB	Brta	T	P	Remark
Implementation of Cloud Technologies in higher institutions in Nigeria	54.891	2.270		24.183	.000	
Social Influence had effect on the Implementation of Cloud Technologies	.094	.036	.078	2.626	.009	Sig
Organizational Characteristics had effect on the Implementation of Cloud Technologies	-.029	.020	-.052	-1.450	.147	Not. Sig
Technical Support had effect on the Implementation of Cloud Technologies	.092	.018	.180	4.978	.000	Sig
External Pressure had effect on the Implementation of Cloud Technologies	.0900	.027	.178	3.687	.000	Sig

Table 5. Relative Contributions of Variables to External Factors

Table 5 revealed the relative contribution of each of the independent variables to the prediction of the dependent variable (Implementation of Cloud Technologies in higher institutions in Nigeria). Technical Support had effect on the Implementation of Cloud Technologies (Beta = .180; t = 4.978; $p < 0.05$) was the most potent predictor out of the four variables; followed by External Pressure had effect on the Implementation of Cloud Technologies (Beta = .180; t = 4.978; $p < 0.05$) Social Influence had effect on the Implementation of Cloud Technologies (Beta = .078; t = 2.626; $p < .05$); while Organizational Characteristics (Beta = -.052; t = -1.450; $p > .05$) was not a potent predictor of Implementation of Cloud Technologies.

This data implied that three out of four variables Technical Support, Social Influence, and External Pressure are statistically significant as external factors for implementing innovative technologies in higher institutions in Nigeria. On the other hand, Organisational Characteristics does not have a statistically significant effect on implementation of Cloud Technology in higher institutions in Nigeria. This result corroborates the view of Charles, Emily and Catherine (2021) on critical success factors of cloud computing in public universities in Kenya which reveal that, factors like management support, technical support

and users' preparedness are key variables contributing to the critical success of cloud computing adoption in universities in Kenya at a significant level. It also supports the finding of Mohamed, Elesanmi and Bushra (2019) and that of Pathak and Sudhir (2018).

Variables	Mean	Std. Deviation	N
Is the university willing to pay for extra storage, computers, and services	**44.98**	0.41	384
There are sufficient computers in the university labs for students to practice with	**44.64**	0.69	384
To what extent do you agree that campus Wi-Fi cloud is a good idea	**44.52**	0.54	384
Other universities have far more advanced computers than our university lab	**44.32**	0.55	384
There are universities in Nigeria that have already adopted cloud computing	43.50	0.61	384
Various pressure from the university to work with students via digital technology	**44.41**	0.41	384
There is pressure from the government to teach using digital technology	44.18	0.39	384
The university has enough for routine check and maintenance of computing resource	44.14	0.41	384
IT support team is always happy to help	43.92	0.57	384
Rate the efficiency and promptness of response from IT support team	44.16	0.42	384
Rate the level of knowledge and skills of the IT support staffs	44.12	0.44	384
Sharing learning resources online have a positive impact on a student's learning ability	44.20	0.40	384
The opportunity to practice another operating system gives students more experience (PaaS)	**44.34**	0.48	384
Using different software add values to knowledge and skills of students (SaaS)	**44.31**	**0.48**	384
Working together in a lab increases the chances of sharing idea with fellow peers (IaaS)	**44.89**	0.46	384
Weighted Mean	**44.31**	0.43	384

Table 6. Influencing Variables on External Factors

Table 6 reveals the respondents' opinion with respect to their perception of external influence on the adoption and implementation of cloud technology in Nigeria higher institution. To answer this research question, the weighted mean was determine and taken as the benchmark.

The weighted mean coefficient is 44.30. The table reveals that some of the items buttress the fact that many variables determine the external factors which in turn depict Cloud computing technology usage and adoption in Nigeria higher institution, as just 8 items out of 15 items used to capture the variables influencing external factors impact on cloud technology adoption in the study area are having mean above the weighted mean (44.30) set as bench mark. For instance, *"Is the university willing to pay for extra storage, computers, and services"* with **($\bar{x}$ = 44.98), "***Working together in a lab increases the chances of sharing idea with fellow peers (IaaS)"* **($\bar{x}$ = 44.89), "***There are sufficient computers in the university labs for students to practice"* with **($\bar{x}$ = 44.64), "***To what extent do you agree that campus Wi-Fi cloud is a good idea"* with **($\bar{x}$ = 44.52), "***Various pressure from the university to work with students via digital technology"* with **($\bar{x}$ = 44.41), "***The opportunity to practice another operating system gives students more experience (PaaS)"* with **($\bar{x}$ = 44.34)** and *"Other universities have far more advanced computers than our university lab"* with **($\bar{x}$ = 44.32).** Also **"***using different software add values to knowledge and skills of students (SaaS)"* with **($\bar{x}$ = 44.31).** However, there are six items ($\bar{x}$) means that are below the set benchmark including: "*There are universities in Nigeria that have already adopted cloud computing";* "*There is pressure from the government to teach using digital technology";* "*There is pressure from the government to teach using digital technology";* "*The university has enough for routine check and maintenance of computing resources",* "*The university has enough for routine check and maintenance of computing resources",* "*Rate the level of knowledge and skills of the IT support staffs".* The outcome of this study is similar to the work of further investigated the factors affecting the adoption of cloud computing technology in educational institutions in Chandigarh. They argued that despites the mammoth promising advantages of cloud computing for been the latest asset of information technology for various organisation. Evidence from the statistical test outcome of the research indicated that adopting cloud computing in Chandigarh is affected by *"support and integration of institution services with cloud computing and top management tendency to support cloud computing adoption"*. In 2016, Appiahene, Yaw, and Bombie evaluated the cloud computing technology model for teaching and learning of information and communication technology. It was reported that the adoption of cloud computing has eliminated the existed boundary to student learning, while allowing adopters of the technology to access work anywhere, anytime, and share. With this juicy merit, this research work will implement the comprehensive technology readiness adoption model (CTRAM) in higher education in Nigeria.

Factor analysis **(**Grand Bassa) is used to establish the relationship among independents variables of category captures information on external factors via four sub-divisions: organizational characteristics, external pressure, technical support, and social influence.

Variable	1	2	3	4	5	6
Computer Self-Efficacy	1.000					
SN1 (P value)	.229 .000	1.000				
SN2 (p value)	.053 .142	.780 .000	1.000			

SN3 (p value)	.043 .195	.665 .000	.645 .000	1.000		
SN4 (p-value)	.141 .002	.631 .000	.506 .000	.599 .000	1.000	
SN5 (p-value)	.065 .096	.533 .000	.525 .000	.658 .000	.422 .000	1.000
	47.13	**18.04**	**38.66**	**14.35**	**51.69**	**33.55**
Standard Deviation	**12.61**	**3.820**	**6.074**	**2.627**	**8.964**	**6.08**

**Correlation is significant at the 0.01 level (1-tailed).

Table 7. Inter-correlation Matrix of Independents and Dependent Variables

Table 7 showed that: there was a significant relationship among independents variables of category captures information on external factors via four sub-divisions: organizational characteristics, external pressure, technical support, and social influence. That is, N1 ($r = .229$, N= 1266, $p < .01$, and N2 ($r = .200$**, N= 1266, $p < .01$) has significant with Cloud computing adoption while N3 ($r = .043$, N= 1266, $p > .01$), and N4 ($r = .065$, N= 1266, $p > .01$) has no significant with category captures information. It implies that, there was a relationship among independents variables of external factors via four sub-divisions: organizational characteristics, external pressure, technical support, and social influence.

Conclusions

The results from this study have contributed to the relative paucity of studies specific to Nigeria in this field through the examination of the external factors influencing acceptability of cloud computing in higher education in the country. The findings from the analysis revealed that the perception of cloud computing increases in line with the increase participants' knowledge of the existence of cloud computing. Similarly, the perception of cloud computing also increases in tandem with subject norms. This observation is also consistent for organizational characteristics as an external factor, which was found to explain changes on the feasibility and implementation of cloud computing by 59.1%. Combining the factors for external pressure revealed that it has the potential of inhibiting or creating barriers to the deployment of cloud computing in the Nigerian higher institutions. However, among the external pressure factors.

The study asserted that External factors has a significant effect or relative contribution in implementing Cloud Technology in Higher Institutions in Nigeria at ($\beta = 0.534$, $t = 15.245$, $P < 0.05$) Some of the implications of this study are: the outcome of this study may serve as a knowledge base from where IT administrators in Nigeria Educational sector for them to address various external factors influencing the challenges connected with cloud computing adoption in Nigeria higher education. Also the outcome of the study further shows that there are many factors that determine the adoption of cloud computing technology in higher institution in Nigeria of which the external factors happened to be the chief factor.

Pertaining to the issue of challenges affecting cloud computing in which the IT administrators are seriously concerned with data availability preservation, integrity and confidentiality preservation which the IT administrators will like to confirm whether the cloud computing adoption in the country can preserve the integrity and confidentiality of the data.

The study findings would serve as valuable information source for the government of Nigeria towards IT administrator knowledge in cloud computing system management. This service improvement from the government would ensure business and citizen benefit tremendously from the government policies. Based on findings of the study, the study recommends the following: Higher institutions in Nigeria should intensify efforts to enable increased and more speedy adoption of cloud computing, as well as to make its usage compulsory for all staff and students, especially given that the results indicate high levels of readiness for the adoption of cloud computing among participants. Finally, the devised CTRAM model has been shown to be effective and accurate as a tool for assessing the broader elements concerning the adoption of cloud computing, and hence may be reliably used in future studies and similar cases.

The study further recommend that IT leaders and researchers should endeavour to make use of this research as a basin of pedestal to have a conduct of more research on cloud computing technology adoption in the country. There is need for understanding of different challenges confronting cloud technology adoption in Nigeria when developing policies, strategic action plans and capacity plan in cloud computing system improvement within the Nigeria contexts.

Some of the limitation recorded during the course of the study was that the study was conducted in Nigeria among the higher educational sectors operators, students and administrators. Another limitation was the sample size used which was relatively small across the two regions (Northern and Southern Nigeria). Therefore, there is need for further studies to increase the sample population scope to include other administrator aside those identified in this study located in other part of Nigeria especially using the political zone of Southwest, Southeast, South-South, Northwest, Northeast, and North Central. This recommendation may help increase the result generalizability and accuracy of the study to that of the target population. Also, this recommendation would equally help in understanding the varying challenges affecting cloud computing adoption in Nigeria private sector should equally be unravelled by future scholar in this cloud computing, adoption in educational sectors. Finally, the researchers in the future can equally be conducted using adoption in Health sector as well as establishing adoption of cloud computing practice performance among other sectors in Nigeria.

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Introducing Mobile Learning Into the Primary School Curriculum: A Case Study of the Continuous Pedagogical Use of Mobile Devices

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Abstract
The present paper is a brief overview of an innovative educational program in Primary Education regarding the pedagogical use of mobile devices in teaching. The program adopted Puentedura's (2010) SAMR model, which is based on Bloom's Revised Taxonomy, and proposes four levels of integration of digital applications into teaching practice. The program, which was implemented at the same time as a continuous intra-school training program, aimed at the integration and pedagogical utilization of portable devices (tablets) in the teaching of all the basic subjects of the Primary School for a very long period of time in order to contribute to the transformation of the educational process. The experiences from the first phases of the program demonstrate that the learning process was significantly enriched and strengthened, 21st century skills were cultivated and developed, while the professional development of teachers and the active participation of students were enhanced. These conditions therefore led to the change of previous attitudes of teachers and students towards the specific technological medium.

Keywords: Educational Innovation, Mobile Learning, Digital Applications, Primary Education

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Introduction

In the modern digital age, many researchers talk about the educational use of mobile devices (Fokidis, 2019; Sanders & George, 2017; Meletiou Mavrotheris, Paparistodemou & Christou, 2019; Haßler, Major & Hennessy, 2016; Camilleri & Camilleri, 2020) since their presence in educational systems has been continuously increasing in recent years. However, although mobile devices seem to be included and used more often in school classrooms, the duration of their use (mainly in Greece) seems to be short or for a specific period of time, the teaching subject or application that is usually used is defined while an appropriate pedagogical framework for mobile learning is absent. In an effort to effectively integrate mobile devices into teaching, as modern ICT, this innovative program was carried out. The innovation of the program lies in the fact that for a very long time a multitude of digital applications were used in all the basic subjects of the Primary school within a defined pedagogical framework. The purpose of the program is to actively contribute to the transformation of traditional teaching practice, leading to the acceptance of new constructive learning approaches directly intertwined with the social reality of the time we are going through.

Methodology

Pedagogical Framework of an Innovative Program

The use of mobile learning in teaching is a process that develops within a pedagogical context and is not meant to be arbitrary (Camilleri & Camilleri, 2020). The basic consideration on which the specific program was based, as well as the educational activity that was implemented at the same time to support it more effectively, is the fact that the pedagogical dimension must determine the educational use of mobile devices. For example, when teachers identify an exciting, new app the first thing they should do is think about how that app can be used and contribute to their overall educational goals for the subject they want to teach. Directly related to this consideration, Puentedura's (2010) SAMR model is considered, which is based on Bloom's Revised Taxonomy. According to the model, four levels of integration of digital applications are proposed: a) the Substitution Level, b) the Augmentation Level c) the Modification Level and d) the Redefining Level. As the levels progress, mobile devices become more and more essential for teaching while the focus is placed on the student himself/herself as his/her creative involvement also increases.

More specifically, the first two stages of the SAMR model represent improvements of existing ways of working. Digital technology is not necessary to carry out the learning task, but mobile devices are a digital medium for learning, which can enhance learning. At the third level, the first step of crossing the traditional way of teaching with the transformation of the classroom through mobile devices is observed. Mobile devices have the potential not only to enhance the learning activity, but also to significantly modify it. An illustrative example is the creation of a blog by the students, in which they open their "work" to a global audience. At the fourth and final level mobile devices are used for activities that were previously impossible to perform. An example could be the collaboration of students or class groups to create a documentary, utilizing sources outside the school environment with the use of multimedia tools and applications. This video can then be "uploaded" to the class blog where relevant comments can be received and/or exchanged, acting as feedback. The essential differentiation of this level is that now the mobile device and ICT in general have the role of "Partner" of a student-centered education. Students acquire the necessary skills and master the expected goals of each activity driven by the challenge of creating a complex result.

Technology allows and enforces the cooperation and communication of students with each other, especially in the context of a social constructivist perspective, while the questions that are raised or the comments that arise are in an authentic context and are highlighted mainly by the students themselves /three (Puentedura, 2012). The research carried out in the framework of the program aims to evaluate the effect of this framework: a) on the attitudes and perceptions of the teachers regarding the teaching of Primary school subjects with the use of mobile devices b) on the teaching practices of the teachers with the use of mobile devices.

Elements and Structure of Innovative Program

The specific innovative program, which was developed in the context of a two-year doctoral research (2021-2023), was implemented during the school year 2021-2022 (October 2021-June 2022) in a public 12/semester Primary school in Greece. Although the program followed a systemic approach to the integration of mobile devices in the school unit (principal, teachers, parents, education consultant, local agencies, etc.), 6 of the school's teachers, who were the teachers of the three largest classes of the elementary school (4th, 5th, 6th-6th grades), 96 students, who were the students respectively of these classes as well as the parents of the specific students. For this effort, the school was equipped with 11 Android-type mobile devices (tablets). During the entire duration of the program, continuous in-school training was simultaneously implemented by the researcher (her dual role) in order to familiarize the teachers with the mobile devices on a technological and pedagogical level. The program for the integration and utilization of mobile devices in teaching as well as the educational activity was decided to be divided into three phases (see Diagram 1).

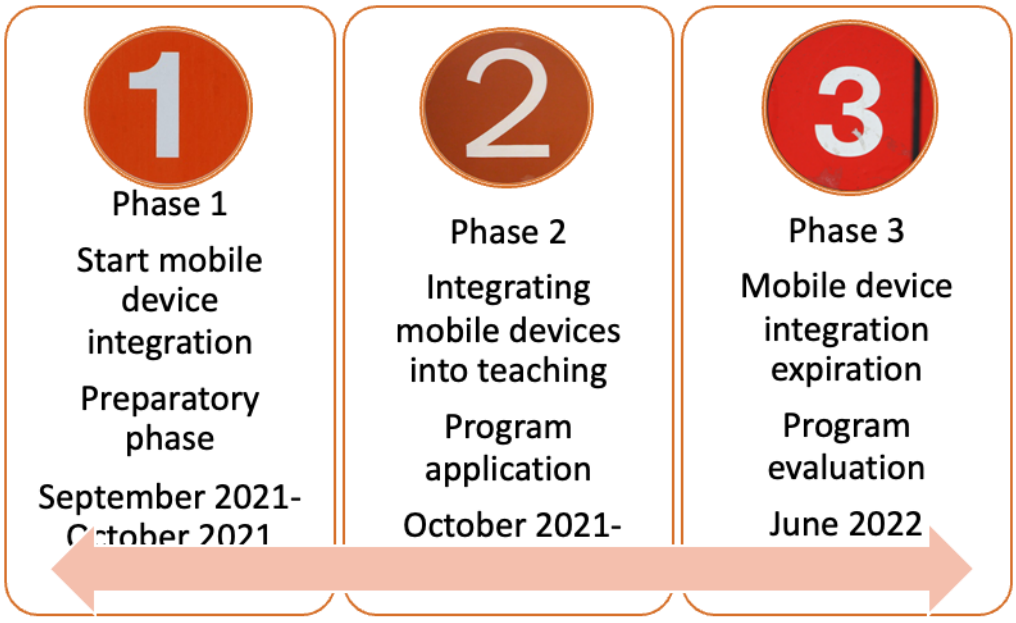

Diagram 1: Phases of program implementation

Phase 1: The first phase of the research concerned the beginning of the *integration of mobile devices* in the school unit and was conducted at the beginning of the school year (September-October). Before the start of the program, a general and detailed briefing was held for all involved members (principal, teachers, students and parents, education consultant) regarding the purpose, goals and context of the program, the actions that were expected to take place in the future (e.g. teaching using portable devices) but also the educational activity that would accompany the implementation of the research program. In relation to the training program, in the first stage, all teaching staff were trained (4 two-hour training sessions) aimed at a) all

school teachers, and not only those who integrate mobile devices into their teaching, get to know the theoretical framework that is behind mobile learning b) to familiarize themselves with mobile devices as a technological means c) to know their educational possibilities but also techniques of integration into teaching and finally d) to be informed about a number of applications that can be connected to the AP of the courses Elementary school. Finally, during the first phase information forms were given to the parents/guardians as well as the children, where they were informed about the actions that were going to be implemented in the school in the near future. The forms also requested the written consent of the parents/guardians for any questionnaire completion by students, audio recording or even video recording in any phase of the implementation of the program.

Phase 2: The second and longest phase of the research started at the end of October 2021 and lasted until the beginning of June 2022 and concerned the *implementation of the program*. In this phase, the principal of the school, the 6 teachers and the 96 students of the three largest classes (4th, 5th, 5th) were involved (directly involved). In particular, throughout the second phase, the teachers were asked to implement a variety of pedagogical activities or even entire teaching scenarios with specific teaching objectives and expected learning outcomes in various teaching subjects in which they effectively incorporated the new modern technologies and were strengthened by the use them as predicted by the SAMR model.

The inclusion of such an activity could be done at the beginning, in the middle or even at the end of the teaching scenario. This kind of activity/s aimed at the highlighting of previous knowledge, at the introduction of new knowledge, to function as a central activity for the consolidation of the new knowledge but also as an activity for evaluating/highlighting the new knowledge respectively. The focus has always been on the student, with the aim that through the cultivation of digital skills, the students will become creators of their own knowledge. The applications or digital tools that were included in the learning process were selected with specific criteria such as the age group of the children it is aimed at, their free use, the safe environment (e.g. absence of advertisements) but also the pedagogical purpose it serves.

The educational activity during the second phase was divided into two parts. In the first months of the second phase (October 2021-January 2022), several sample lessons were carried out by the researcher-educator in all the classes that participated in the research (4^{th},5^{th},6^{th}), which were mainly attended by the directly involved teachers, without this meaning that another teacher of the school could not attend them if he/she wished. The sample lessons were designed in a different lesson each time in order to highlight to a greater extent the use and usefulness of mobile devices in all subjects of the Primary school. During the following months, however, in order to highlight the initiative of the teachers involved and to enable them to become capable of implementing and effectively implementing pedagogical activities using the portable devices, they organized the lessons themselves (each at a different frequency) using the mobile devices in their lesson without the presence of the researcher-educator. At the end of these lessons there were informal conversations of a feedback nature with the researcher-educator but also between the teachers themselves regarding the conduct of the teaching, their own views on the teaching practice they followed and its effectiveness, the pedagogical benefits they identified, positive or negative that they found regarding the way students learn through the use of mobile devices as well as their reactions as well as problems or difficulties that arose.

Phase 3: The third phase of the integration of mobile devices was carried out at the end of the first academic year, i.e. in the month of June, and concerned the *general evaluation of the program as well as the educational activity.* The multiple sources of data collected in Phases 1 and 2 were analyzed in detail to assess the effectiveness of the program and identify potential improvements.

Data Collection and Analysis Methods

During the project, various sources of data were collected to explore the attitudes and practices of the involved members towards the use of mobile devices in teaching as revealed in each phase of the implementation of the project. At the beginning all the teachers of the school, including the principal, who were twenty-three (n=23) in total were given to complete anonymously three vignettes (hypothetical scenarios). Although the directly involved teachers who participated in the research and used mobile devices pedagogically throughout the school year were 6, we nevertheless wanted to investigate the previous attitudes and perceptions of all teachers towards the inclusion of this particular innovation/change. The students of only the three largest classes (4^{th},5^{th},6^{th}), who were about one hundred (n=96), filled out an online questionnaire created through Google forms while a group semi-structured interview was conducted with each department separately. Finally, an online questionnaire created via Google forms was also completed by the parents of the specific students in order to investigate and understand some additional aspects of the research compared to those of the children, such as for example the students' previous contact and use with mobile devices in their daily life (home) or if parents are informed about the educational possibilities that mobile devices can offer.

Throughout the second phase, observation and field notes and a reflective diary were kept regarding the daily interactions/actions of the teachers and the principal, their teaching practices and the training program that ran alongside the effort to integrate mobile devices into teaching. Finally, in the third phase, wanting to investigate and capture any changes or shifts from the initial attitude of the involved members towards the usefulness and utilization of mobile devices in teaching, a more complete picture of the teaching practices and interactions of the teachers as well as the effect of the training provided throughout the year, semi-structured group interviews were carried out with the students of the departments of the three largest classes, individual interviews with the directly participating teachers and an individual interview with the principal of the school, as well as the school counselor.

At this point, it needs to be clarified that the data of the individual interviews of the teachers who participated directly in the research, as there were 6 people, were combined and strengthened with data from individual research tools (observation, field notes, diary) that were utilized and related to the final beliefs and attitudes of the rest teachers of the school unit regarding the integration of mobile devices in teaching. In addition, without focusing to a large extent, some data was also collected regarding the final opinions of the parents regarding the specific innovation/change as a result of this effort. This combination of data helped significantly on the one hand in sketching and capturing the overall picture of the school at the end of the program of integrating mobile devices in teaching and on the other hand it was a measure of comparison with the initial situation that prevailed before the adoption of the innovation of mobile learning. The quantitative data obtained from the questions of the hypothetical scenarios and the questionnaires were analyzed through descriptive and inductive statistics with the help of the SPSS statistical package. The analysis of the qualitative data on the other hand was done with the method of thematic analysis.

In-School Teacher Training

The training, which was designed and organized by the researcher, had a flexible format and functioned throughout the program as a professional learning community. Like the mobile device integration program, the educational activity was also divided into phases. All phases are detailed in the diagram below (see Diagram 2).

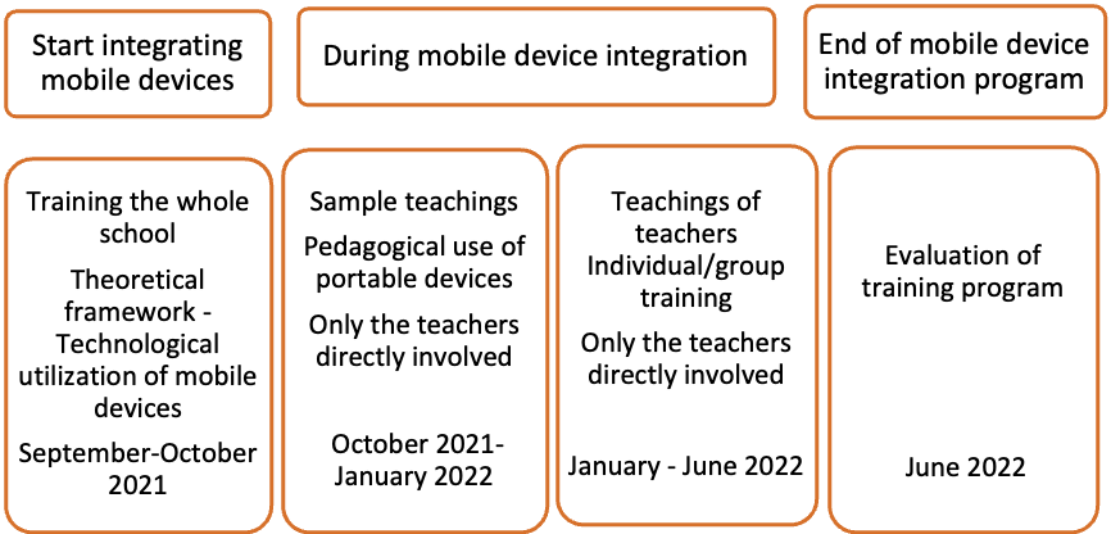

Diagram 2: Phases of in-school training program

Before the start of the training program, the principal of the school was informed about the context, objectives and organization process of the in-school training, while there was continuous and close cooperation with the teachers' association in order to meet the training needs and priorities of the teachers. The topics of the training were related to technological as well as pedagogical issues of the use of mobile devices and were mainly based on the theoretical framework of the SAMR model but also on some learning theory approaches (eg constructivism, constructionism). More specifically, the technological part concerned:

- getting to know the basic technical characteristics of a mobile device and their importance.
- exploring and changing basic settings of a mobile device.
- internet connectivity.
- searching, installing applications/software.

On the other hand, the training issues related to the pedagogical part were connected to:

- *content consumption.* Mobile devices as multimedia devices for content consumption enable students to access documents, books and presentations, photos, audiobooks, radio broadcasts, podcasts, videos, educational TV, 360 videos, explore interactive objects, 3D models, augmented reality models, virtual worlds (virtual tours) and even experimenting in virtual laboratories.
- *content creation*. Of course, the training did not focus only on the consumption of content, but had as the main and ultimate goal the motivation of the students to create with the mobile device and to become knowledge builders themselves. With the right apps, students can create documents, presentations, interactive books, photo collages, posters, comics, videos, concept maps, and more. In the same way, teachers can also create educational content and interactive objects.

- *classroom and learning management.* Learning management systems (LMS) such as Google Classroom, Class Dojo, Moodle can be integrated into teaching in order to implement the "flipped classroom" method and/or to support teaching and asynchronous learning. Such applications, such as the ones mentioned for example, also help in the organization of the course. Through them, material can be collected, tasks can be assigned and/or students' progress can be monitored.
- *the creation of formative assessment tests* with simple questions or enriched with multimedia by incorporating game techniques (gamification) to attract the students' interest.
- *the introduction and exploration of a number of educational applications (apps) suitable for mobile devices and their essential inclusion in teaching* (e.g. in which phase of the lesson to be included and in what way, their duration, the pedagogical benefits, etc.) The choice of application was made based on specific criteria, such as being relevant to one of the basic teaching subjects of the Primary school (language, mathematics, geography, environmental study, history, physics, etc.) or the age group to which it is addressed. Educators at this point could suggest educational applications that they may know about or have used so far.
- *the creation of educational scenarios* that utilize mobile devices.

Results

Although the data collected also related to other aspects of the wider research carried out in this work, we focused our interest on the attitudes and perceptions of teachers (and students by extension) but also on their teaching practices towards the adoption of this specific innovation as a case of educational change. Through the analysis of the vignettes and focusing on the investigation of teachers' beliefs towards the specific technological, educational tool, useful information emerged. Initially, most teachers of the school unit (86%) expressed positive opinions regarding various aspects of the inclusion of mobile devices in teaching. These attitudes were expressed because they considered the existing situation unsuitable for the modern era, the goals of innovation/change met the needs of society, or because they considered the differentiation of teaching methods as a modernization of education. Of course, there were also some (14%) who, although they were not negative about the use of mobile devices, expressed caution and hesitation regarding its application. More specifically, regarding the opinion that mobile devices have the ability to modify the learning process, the majority of teachers interviewed (68%) share this belief, while regarding the perception that mobile devices can contribute to a better understanding of the lesson, comparatively in the traditional way and to be useful teaching tools almost all teachers (92%) agreed. Consequently, the same number of teachers (92%) considered the use and exploitation of modern mobile devices in teaching and learning to be particularly effective, while most (86%) believed that their use increases the involvement of students in the learning process and can to improve learning outcomes. Regarding the primary school subjects where mobile devices can be used better, most teachers (68%) mentioned the secondary subjects (History, Geography/Environmental Studies and Physics) while all the teachers who answered (100%) agreed that they find it more difficult to include them in Language and Mathematics. Also, most teachers (92%), although they showed that they are aware of the new educational data and the modern pedagogical requirements imposed by the 21st century, admit that they are not ready to respond to their new role as needed. In relation to this, a large number of the interviewed teachers (86%) answered that they want to be trained often mainly in techniques related to the integration of modern ICT in teaching and

their pedagogical use as they recognize that it is the only way to be trained in this regard and to empower themselves professionally.

At the end of this effort, through the individual semi-structured interviews, it was briefly shown that those teachers who were particularly positive about the change strengthened their belief in the value of mobile learning even more as they realized practically the educational possibilities of mobile devices. On the other hand, the more hesitant teachers (who were fewer) showed that they modified and shifted their initial opinion by adopting a more positive attitude towards the inclusion and integration of mobile devices in teaching. Regarding the usefulness of mobile devices in primary school lessons, all 6 directly involved teachers who used mobile devices in their classroom throughout the school year through their interviews underlined the great and extensive educational usefulness of mobile devices, demonstrating positive perceptions but in a different way, degree and intensity. Particularly important factors that negatively affected teachers' attitudes towards the inclusion and utilization of mobile devices were seen from their statements to be technological issues such as unsatisfactory internet connection and the existence of insufficient and adequate equipment. The training program that was implemented at the same time as the effort to integrate and implement this particular innovation seems to have had a significant positive effect on the change of teachers' attitudes towards the use of mobile devices. As mentioned by all the teachers who systematically attended it, the continuous support that existed at a technological but mainly at a pedagogical level contributed to a large extent to the greater acceptance of the specific technological medium.

From the answers to the questionnaires filled in by the students (n=57) in the 2021-2022 school year and also by their parents (n=54), it appeared that mobile devices are used daily on a personal level. All students have access to a mobile device at home, while more than half of children (59%) have their own device. Impressive are the results regarding the use of mobile devices as 96% of students know how to use them at a very good or excellent level. The main reason they used mobile devices was to play digital games (90%) of a recreational nature (e.g. Mindcraft, Roblox) while the next choice was to listen to music (77%) or communicate with friends (67%). For engaging in educational games, 56% of students stated that they use them, but even this portion of students who used mobile devices for educational purposes, the examples they mentioned were limited to practical and practice-type applications and mainly concerned exercises that related to the Maths course (e.g. multiplication, division, tangram, etc.) or general knowledge exercises (e.g. quizzes, knowledge tests). Few students (24%) played educational games related to a school subject. But even at school, although about half of the children (40%) stated that they used educational games or other applications almost every day in the classroom, they were games of the practice and practice type. Important at this point was the statement of several students (31%) that the technology was used by the teacher in the classroom and not by the children themselves. When asked if they wanted to make more use of mobile devices at school, 71% of students said they would very much like to use apps related to all subjects, while half of students (49%) said they wanted receive assignments through a platform or do assignments at home through a mobile device.

Like teachers and students, parents also showed a positive attitude towards the pedagogical use of mobile devices. The majority of parents (90%) stated that it is useful for the children to know the teaching part of the specific technological media as it is now part of their daily life. Most (84%) agree that the use of mobile devices in teaching significantly contributes to an easier and better understanding of the lessons by the students. Finally, an equally large

percentage of parents (82%) agreed that they would like to be informed about the educational use of mobile devices at home through a seminar.

Conclusions

In conclusion, the implementation of the specific M-Learning program developed within a defined pedagogical framework led for the first time a Greek public school to the pedagogical use of mobile devices on a daily basis for an entire teaching year in all the basic subjects of the Primary School. Undoubtedly, the adopted SAMR model can be a valuable guide for teachers in their efforts to effectively incorporate modern technological media such as mobile devices and effectively utilize digital technologies. Based on the results, as presented, we conclude that M-Learning can significantly contribute to the cultivation and acquisition of learning knowledge, be connected to the syllabus of the Primary School courses and transform the educational process by connecting the educational work with the social reality of 21st century.

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A Quantitative Exploration of Academic Motivation in Online Higher Education

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Abstract
Academic motivation (AM), the desire for behaviors connected to academic functioning and success, determines the level of student engagement in academic activities. Due to the increase in online learning environments in universities in the post-pandemic period, it is significant to explore the AM level among students in online higher education to offer a more effective program. In this study, it was aimed to investigate the AM level among undergraduate students taking online courses in terms of different motivational constructs; namely, intrinsic motivation (IM), extrinsic motivation (EM) as well as amotivation, and whether there is a relationship between AM and demographic variables of gender, age and year of study. Adopted as a quantitatively-designed study, the AM scale with 7 sub-scales including IM towards knowledge, accomplishments, and experience stimulation; and EM external, introjected, and identified regulations; and amotivation was conducted to 220 undergraduate students taking online courses in different universities in Turkey. The collected data were analyzed by using SPSS for Windows 26.0 and IBM AMOS v24.0. The descriptive results indicated that the IM level of the sample was low, whereas the levels of EM and amotivation were moderate. The highest mean score was detected in the construct of amotivation. The results of MANOVA and ANOVA analyses to determine the variability of IM, EM, and amotivation by the demographics revealed that the participants' mean scores did not vary based on their year of study while some statistically significant findings were detected between EM and gender as well as amotivation and age.

Keywords: Academic Motivation, Intrinsic Motivation, Extrinsic Motivation, Amotivation, Online Learning, Higher Education

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Introduction

Motivation, regarded as one of the psychological factors in education, has been a center of interest for researchers and studied to explore its impact on a variety of topics in higher education (Dunn & Kennedy, 2019; Ferrer et al., 2022; Haji Vosoogh et al., 2022). Usher and Morris (2012) defined motivation as "the process responsible for the initiation, intensity, and persistence of behavior" and explained academic motivation (AM) as "the cause of behaviors that are in some way related to academic functioning and success". In other words, AM refers to the drive or desire to engage in academic activities such as learning, studying, carrying out educational tasks and doing assignments, etc.

Different motivational constructs have been categorized for AM in the literature based on self-determination theory; namely, intrinsic motivation (IM), extrinsic motivation (EM), and amotivation (Ryan & Deci, 2017; Vallerand et al., 1997; Vallerand & Ratelle, 2002). Ryan and Deci (2017) defined IM as participating in an activity for the inherent satisfaction and enjoyment it brings by being motivated by internal factors, such as curiosity, interest, and personal fulfillment. Vallerand et al. (1993) defined three types of IM "the IM to know (to do something for the pleasure and satisfaction experienced while learning), to accomplish things (to do something for the pleasure and satisfaction experienced while trying to accomplish things), and to experience stimulation (to do something in order to experience stimulating sensations)" (p.160). In other words, IM towards knowledge is a reflection of a person's desire to discover, learn, and acquire new knowledge or skills for their own sake (Deci & Ryan, 1985; Sansone & Harackiewicz, 2000). IM toward experience stimulation entails seeking out pursuits or experiences that offer novelty, excitement, challenge, or sensory stimulation (Ryan & Deci, 2017; Vallerand, 1997).

Contrarily, EM is influenced by outside forces such as grades, rewards, or social recognition and requires engaging in behaviors to obtain external rewards or avoid punishment (Deci & Ryan, 1985). Vallerand et al. (1993) explained three types of EM "external regulation (e.g., to do something because one is pressured by someone to do it), introjected regulation (to do something because one pressures him/herself to do it), and identified regulation (to do something because one has decided to do it although it is not fun)" (pp.160-161). Particularly, the lowest level of self-determination in EM is defined as external regulation, which entails engaging in an activity solely to receive rewards from outside sources or to avoid punishment, and individuals driven by external regulation feel controlled by external factors and lack personal volition or interest in the activity itself (Ryan & Deci, 2017; Vallerand, 1997). Introjected regulation is the process of engaging in behavior that is motivated by internal pressures such as guilt, shame, or ego involvement., and individuals with introjected regulation may engage in the activity to maintain self-esteem, avoid feelings of guilt, or meet self-imposed standards, even though their motivation is not fully autonomous (Ryan & Deci, 2017; Vallerand, 1997; Vallerand et al., 1993). Identified regulation reflects a higher level of internalization in IM involving the engagement in an activity because the individual recognizes its personal importance, relevance, or alignment with their values and goals, and individuals with identified regulation perceive the activity as personally meaningful, even though the initial motivation may have been external (Ryan & Deci, 2017; Vallerand, 1997; Vallerand et al., 1993).

Amotivation, representing a lack of motivation, is a state of disinterest or apathy toward participating in academic activities (Vallerand et al., 1997). In other words, it alludes to the absence of IM and EM (Vallerand et al., 1993). Amotivation can arise when individuals

perceive a lack of control or autonomy in their actions, do not find meaning or value in the task, or experience a sense of incompetence or helplessness (Vallerand, 1997; Standage et al., 2003).

With its different constructs, AM is a significant factor associated with some outcomes such as higher academic achievement (Levitt et al., 2016; Mueen et al., 2016), increased persistence and retention (Howard et al., 2021), enhanced learning engagement (Martin et al., 2017), improved self-regulated learning (Cho & Heron, 2015), and positive psychological well-being (Howard et al., 2021; Ryan & Deci, 2017). Due to its positive outcomes for student learning, AM is required to be increased for face-to-face as well as online teaching settings. Unlike face-to-face instruction, online learning has its own set of challenges such as the lack of social interaction, technological issues, self-regulation difficulties, and a sense of isolation (Broadbent & Poon, 2015; Picciano, 2002; Richardson & Swan, 2003). AM can be negatively affected by online learning procedures and processes because of the lack of in-person social interactions and peer support found in traditional face-to-face classroom settings (Richardson & Swan, 2003). Technological issues and challenges with online tools and platforms can also frustrate students and lower their motivation and engagement in their academic endeavors. Even though it is assumed that online courses are flexible, this type of learning necessitates that students have strong self-regulation abilities as well as efficient time management skills (Broadbent & Poon, 2015). Lack of in-person interaction and physical presence in online learning can exacerbate feelings of loneliness among students, which can lower motivation and cause a sense of disconnect (Picciano, 2002).

Due to the increase in online learning environments in higher education in the post-pandemic period, it is significant to explore the level of AM among students in online higher education in order to offer a more effective program. Because of the distinctive features of online learning environments such as asynchronous communication, self-directed learning, and fewer social interactions, students' motivational orientations may be affected more differently than in traditional learning settings. Therefore, this research aimed to examine the level of AM among undergraduate students taking online courses in terms of different motivational constructs such as IM, EM as well as amotivation and whether there was a relationship between AM and demographic variables of gender, age, and year of study.

Methodology

Research design

Adopted as a quantitative design, this research aimed to investigate the level of AM among undergraduate students taking online classes in terms of various types of motivation including IM, EM, and amotivation, and whether there was a relationship between AM and demographic variables of gender, age and year of study. For this purpose, the following research questions (RQs) are developed:

RQ1. What is the overall level of AM among undergraduate students?
- 1.1. What is the level of IM among undergraduate students?
- 1.2. What is the level of EM among undergraduate students?
- 1.3. What is the level of amotivation among undergraduate students?

RQ2. Is there a relationship between AM and demographic variables among undergraduate students?

- 2.1. Is there a relationship between AM and gender?
  - 2.1.1. Is there a relationship between IM and gender?
  - 2.1.2. Is there a relationship between EM and gender?
  - 2.1.3. Is there a relationship between amotivation and gender?
- 2.2. Is there a relationship between AM and age?
  - 2.2.1. Is there a relationship between IM and age?
  - 2.2.2. Is there a relationship between EM and age?
  - 2.2.3. Is there a relationship between amotivation and age?
- 2.3. Is there a relationship between AM and year of study?
  - 2.3.1. Is there a relationship between IM and year of study?
  - 2.3.2. Is there a relationship between EM and year of study?
  - 2.3.3. Is there a relationship between amotivation and year of study?

Sample

Non-probability sampling method was used based on the convenience sampling technique to determine the study group. Accordingly, 220 undergraduate students taking online courses in different universities in Turkey were involved in the study on a voluntary basis participation. The characteristics of the sample profile are presented in Table 1.

Demographics		**N**	**%**
Gender	Female	115	52.3
	Male	105	47.7
Age	18	117	53.2
	19	34	15.5
	20	25	11.4
	21+	44	20.0
Faculty of	Education	72	32.7
	Engineering	96	43.6
	Science and Literature	25	11.4
	Management	16	7.3
	Law	9	4.1
	Health Sciences	2	0.9
Year of Study	1st year	124	56.4
	2nd year	37	16.8
	3rd year	30	13.6
	4th year	19	8.6
	5th and more	10	4.5
	Total	**220**	**100.0**

Table 1: Characteristics of sample profile

As observed in Table 1, 52.3% (n=115) of the participants were female, and 47.7% (n=105) were male. More than half of the participants (n=117; 53.2%) were 18 years old, 15.5% (n=34) were 19 years old, 11.4% (n=25) were 20 years old, and 20% (n=44) were 21 years old or older. Regarding the faculty where the students were studying, 32.7% (n=72) of the

participants were studying in the faculty of education, while 43.6% (n=96) were studying in the faculty of engineering. More than half of the participants (n=124; 56.4%) were in their first year of education.

Research Instrument

Designed as a quantitative data collection tool, the questionnaire used in this study consisted of two sections. First, the demographic information of the participants was asked including their gender, age, faculty, and year of study. Second, the Academic Motivation Scale (AMS) was used consisting of 28 items structured in 7 sub-scales including IM towards knowledge, accomplishments, and experience stimulation; EM external, introjected, and identified regulations; and amotivation. The original AMS was developed by Vallerand et al. (1993) with a 7-point Likert-type scale. However, the 5-point Likert type was preferred in this study regarding its familiarity, standardization and comparability, and practical considerations in Turkish culture. During the data collection phase of the scale, the statements were arranged as a 5-point Likert scale. Therefore, a confirmatory factor analysis was applied to determine the compatibility of the original 7-point scale's factor structure as presented in Figure 1.

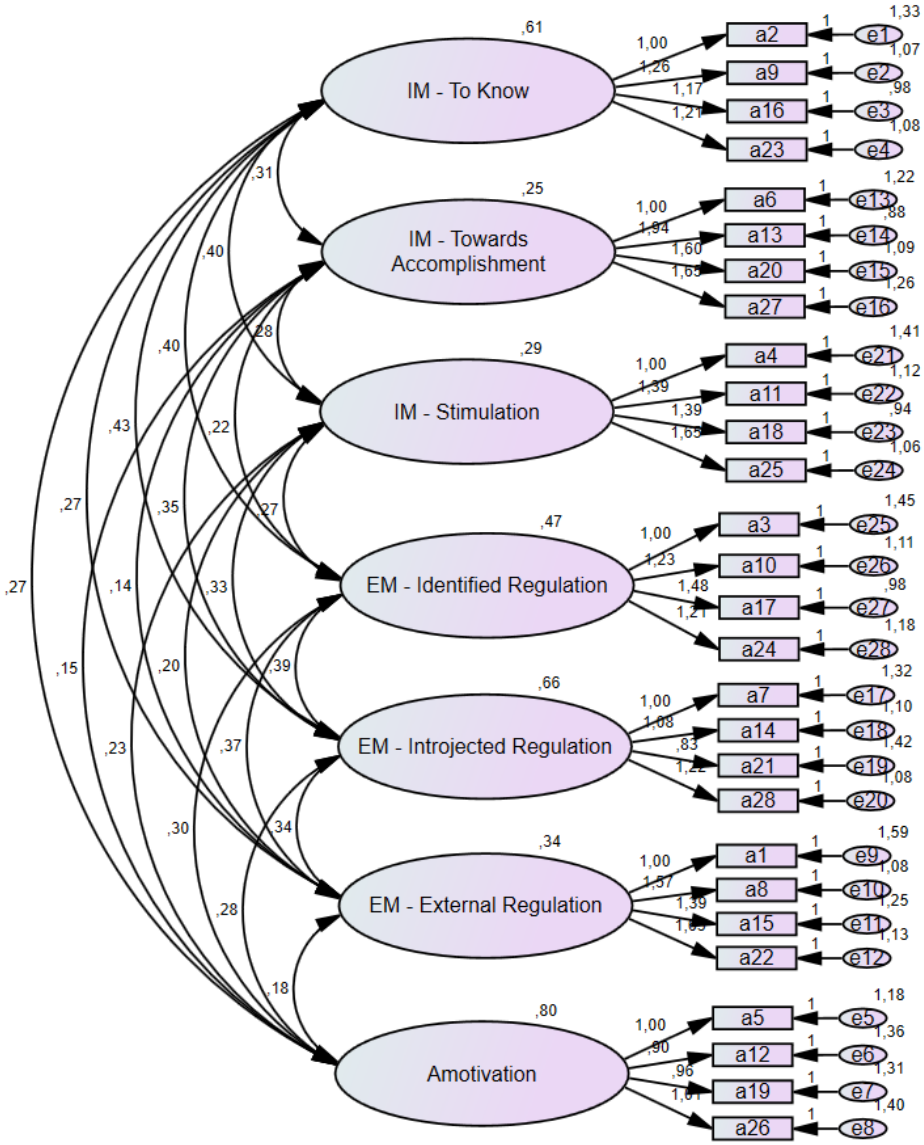

Figure 1: Path diagram of confirmatory factor analysis

The path diagram of the confirmatory factor analysis for the AMS is illustrated in Figure 1, and the fit indices for the diagram are presented in Table 2.

	X^2/df	GFI	CFI	RMSEA
Academic Motivation Scale	1.56	0.86	0.90	0.05
Good Fit	<3	>0.950	>0.950	<0.05
Acceptable Fit	3 <X^2/df<5	>0.900	>0.900	<0.08

Table 2: CFA fit indices

After the examination of the fit statistics for the 7-factor structure of the scale, it was observed that the Chi-Square/degrees of freedom and RMSEA and CFI criteria showed a very good fit, while the GFI criterion demonstrated a low fit. Since three of the four criteria examined met a very good fit, it could be claimed that the data collected through the AMS was consistent with the original factor structure of the scale. Therefore, the weighted averages for the 5-point Likert scale were calculated and interpreted as depicted in Table 3.

Ranges of Weighted Averages	Opinion	Ranges of Weighted Averages of AMS	Result Interpretation
1.00 – 1.80	Strongly Disagree	4.00 – 7.20	Very Low
1.81 – 2.60	Disagree	7.21 – 10.40	Low
2.61 – 3.40	Neutral	10.41 – 13.60	Moderate
3.41 – 4.20	Agree	13.61 – 16.80	High
4.21 – 5.00	Strongly Agree	16.81 – 20.00	Very High

Table 3: Weighted averages for 5-point Likert scales and AMS

Regarding the reliability of the AMS, descriptive statistics, skewness and kurtosis values, and reliability coefficient (Cronbach's Alpha) values for the sub-dimensions were analyzed and presented in Table 4.

Academic Motivation Scale	$\bar{x}$	S.D.	Skewness	Kurtosis	Alpha
Intrinsic Motivation (IM)	*10.210*	*3.359*	*0.661*	*0.304*	*0.859*
To know	9.905	4.240	0.276	-0.883	0.753
Towards accomplishment	10.255	3.738	0.588	0.284	0.669
Experience stimulation	10.473	3.644	0.532	0.033	0.651
Extrinsic Motivation (EM)	*10.560*	*3.336*	*0.425*	*-0.151*	*0.837*
Identified regulation	10.509	4.023	0.227	-0.763	0.703
Introjected regulation	10.509	4.055	0.589	-0.115	0.697
External regulation	10.659	3.958	0.119	-0.927	0.665
Amotivation	*12.986*	*4.142*	*0.158*	*-0.970*	*0.691*

Table 4: Descriptive statistics, normality, and reliability

According to the results, it is observed that the kurtosis and skewness values of all sub-dimensions of the AMS were within the limit values of -1 to +1, and the normal distribution assumption was met. Therefore, parametric tests were applied to the collected data.

Data Collection

Before the data collection phase, the Board of Ethics for Human Studies in Social Sciences and Humanities granted permission for this study's compliance with scientific and ethical standards. The questionnaire form, which was configured on an e-platform, was implemented after receiving participants' approval of the consent for participation in the research. Distributed to more than 300 students, valid results were obtained from 220 participants.

Data Analysis

Initially, descriptive statistics, normality, and reliability were calculated to identify the statistical limits for the appropriateness of the AMS. Next, based on the application of parametric tests, MANOVA was conducted to determine whether IM and EM varied according to gender, age, and year of study; and independent samples t-test was performed to identify the variability of amotivation by gender. Additionally, ANOVA was performed to determine whether amotivation varied by gender, age, and year of study. Post hoc analyses were carried out to find out the sources of the detected statistically significant differences. All the analyses were conducted via SPSS for Windows 26.0 and IBM AMOS v24.0.

Results

The data collected from 220 undergraduate students taking online courses were analyzed based on the RQs. Accordingly, the level of AM with its 7 sub-scales (RQ1) and whether there was a relationship between AM and demographic variables (RQ2) were investigated, the results of which are presented below.

Academic Motivation Among Students

The level of AM with its 7 sub-scales among university students was examined by performing descriptive statistics in SPSS and the results are presented in Table 5.

Academic Motivation Scale (AMS)	$\bar{x}$	S.D.	Result Interpretation
Intrinsic Motivation (IM)	*10.210*	*3.359*	*Low*
To know	9.905	4.240	Low
Towards accomplishment	10.255	3.738	Low
Experience stimulation	10.473	3.644	Moderate
Extrinsic Motivation (EM)	*10.560*	*3.336*	*Moderate*
Identified regulation	10.509	4.023	Moderate
Introjected regulation	10.509	4.055	Moderate
External regulation	10.659	3.958	Moderate
Amotivation	*12.986*	*4.142*	*Moderate*

Table 5: Mean scores for academic motivation

As observed in Table 5, the IM level of the sample (RQ1.1) was "low" ($7.20 < \bar{x}=10.210 < 10.41$)", while the EM level of them (RQ1.2) was "moderate" ($10.40 < \bar{x}=10.560 < 13.61$). The level of amotivation of the sample (RQ1.3) was also "moderate" ($10.40 < \bar{x}=12.986 < 13.61$), but it was the highest pointed subdimension. Accordingly, the overall level of AM

was detected "moderate" ($10.40 < \bar{x}=11.252 < 13.61$). Regarding the IM subdimensions, it was detected that IM to know ($7.20 < \bar{x}=9.905 < 10.41$) and IM towards accomplishment ($7.20 < \bar{x}=10.255 < 10.41$) were revealed "low", whereas experience stimulation was "moderate" ($10.40 < \bar{x}=10.473 < 13.61$). The levels of EM identified regulation ($10.40 < \bar{x}=10.509 < 13.61$), EM introjected regulation ($10.40 < \bar{x}=10.509 < 13.61$), and EM external regulation ($10.40 < \bar{x}=10.659 < 13.61$) were found "moderate".

Academic Motivation and Demographic Variables

The results of MANOVA and ANOVA are presented to determine whether IM, EM, and amotivation vary according to gender (RQ2.1), age (RQ2.2), and year of study (RQ2.3).

Variability of Academic Motivation by Gender

First, concerning the gender variable, MANOVA was performed to determine the variability of IM based on gender (RQ2.1.1). The findings of MANOVA are listed in Table 6. According to the results, participants' intrinsic motivation did not vary based on their gender ($\lambda=0.983$; $F_{(3.216)}=1.255$; $p>0.05$).

Intrinsic Motivation (IM)		**To Know**		**Towards Accomplishment**		**Experience Stimulation**	
Gender	**N**	**$\bar{x}$**	**S.D.**	**$\bar{x}$**	**S.D.**	**$\bar{x}$**	**S.D.**
Female	115	9.852	4.179	9.852	3.662	10.209	3.409
Male	105	9.962	4.326	10.695	3.788	10.762	3.882
MANOVA Wilks' Lambda = 0.983; $F_{(3.216)}=1.255$; $p=0.291>0.05$							

Table 6: Variability of intrinsic motivation by gender

Second, to identify the variability of EM by gender, MANOVA was used, and the findings of MANOVA are presented in Table 7 (RQ2.1.2). In line with the results, participants' extrinsic motivation varied based on their gender ($\lambda=0.915$; $F_{(3.216)}=6.669$; $p<0.05$). Accordingly, female students' identified regulation and external regulation were higher than male students, while the perception of male students' introjected regulation was higher than female students.

Extrinsic Motivation (EM)		**Identified Regulation**		**Introjected Regulation**		**External Regulation**	
Gender	**N**	**$\bar{x}$**	**S.D.**	**$\bar{x}$**	**S.D.**	**$\bar{x}$**	**S.D.**
Female	115	10.748	4.152	9.67	3.668	10.730	4.081
Male	105	10.248	3.88	11.429	4.272	10.581	3.838
MANOVA Wilks' Lambda =0.915; $F_{(3.216)}=6.669$; $p=0.000<0.05$							

Table 7: Variability of extrinsic motivation by gender

Finally, independent samples t-test was applied to detect the variability of amotivation by gender (RQ2.1.3). The findings related to the t-test analysis are illustrated in Table 8.

	Gender	N	x̄	S.D.	t	p
Amotivation	Female	115	13.252	4.217	0.996	0.320
	Male	105	12.695	4.058		

Table 8: Variability of amotivation by gender

As reported by the results presented in Table 8, it was detected that the participants' level of amotivation did not vary based on their gender (p=0.32>0.05).

Variability of Academic Motivation by Age

Regarding the age variable, firstly, MANOVA was performed to reveal the variability of IM by age, and the findings of MANOVA are depicted in Table 9 (RQ2.2.1). According to the results, participants' intrinsic motivation did not vary based on their age (λ=0.939; $F_{(3.216)}$=1.512; p=0.140>0.05).

Intrinsic Motivation (IM)		To Know		Towards Accomplishment		Experience Stimulation	
Age	N	x̄	S.D.	x̄	S.D.	x̄	S.D.
18	117	9.427	4.207	10.128	3.559	10.282	3.414
19	34	9.382	3.877	10.235	3.814	10.235	3.394
20	25	10.8	4.387	10.48	4.665	9.92	4.212
21	44	11.068	4.342	10.477	3.682	11.477	4.014
MANOVA Wilks' Lambda =0.939; $F_{(3.216)}$=1.512; p=0.140>0.05							

Table 9: Variability of intrinsic motivation by age

Next, MANOVA was carried out to determine the variability of EM by age (RQ2.2.2). The findings related to MANOVA are presented in Table 10. According to the results, participants' extrinsic motivation did not vary based on their age (λ=0.959; $F_{(3.216)}$=1.012; p=0.429>0.05).

Extrinsic Motivation (EM)		Identified Regulation		Introjected Regulation		External Regulation	
Gender	N	x̄	S.D.	x̄	S.D.	x̄	S.D.
18	117	10.684	4.051	10.53	3.921	10.65	3.907
19	34	10.353	3.868	9.912	3.995	10.441	3.628
20	25	9.32	4.289	10.68	4.688	9.32	4.347
21	44	10.841	3.923	10.818	4.167	11.614	3.995
MANOVA Wilks' Lambda =0.959; $F_{(3.216)}$=1.012; p=0.429>0.05							

Table 10: Variability of extrinsic motivation by age

Finally, ANOVA was used to identify the variability of amotivation by age (RQ2.2.3). The findings of ANOVA are listed in Table 11.

	Age	N	x̄	S.D.	F	p
Amotivation	18	117	13.539	4.215	2.776	0.042
	19	34	12.471	4.187		Diff.
	20	25	11.040	3.348		1-3
	21+	44	13.023	4.061		

Table 11: Variability of amotivation by age

According to the results, the levels of participants' amotivation varied based on their age ($F=2.776$; $p=0.042<0.05$). As a result of the Tukey analysis conducted to detect the source of the difference, it was found that the level of amotivation of 18-year-olds was higher than that of 20-year-olds.

Variability of Academic Motivation by Year of Study

Respecting the variable of year of study, initially, MANOVA was performed to determine the variability of IM based on year of study (RQ2.3.1). The findings of MANOVA are presented in Table 12. Concerning the results, participants' intrinsic motivation did not vary based on their year of study ($\lambda=0.939$; $F_{(4.215)}=1.124$; $p=0.337>0.05$).

Intrinsic Motivation (IM)		To Know		Towards Accomplishment		Experience Stimulation	
Year of Study	N	x̄	S.D.	x̄	S.D.	x̄	S.D.
1st year	124	9.452	4.297	10.040	3.544	10.266	3.429
2nd year	37	9.270	3.827	10.162	3.708	10.162	3.444
3rd year	30	11.067	4.346	10.667	4.521	10.367	4.263
4th year	19	11.632	4.139	10.895	4.332	11.737	4.188
5th year +	10	11.100	3.814	10.800	2.741	12.100	3.755
MANOVA Wilks' Lambda =0.939; $F_{(4.215)}=1.124$; $p=0.337>0.05$							

Table 12: Variability of intrinsic motivation by year of study

Secondly, to identify the variability of EM by year of study, MANOVA was applied, and the findings of MANOVA are presented in Table 13 (RQ2.3.2). Accordingly, participants' extrinsic motivation did not vary based on their year of study ($\lambda=0.946$; $F_{(4.215)}=1.004$; $p=0.443>0.05$).

Extrinsic Motivation (EM)		Identified Regulation		Introjected Regulation		External Regulation	
Year of Study	N	x̄	S.D.	x̄	S.D.	x̄	S.D.
1st year	124	10.548	4.129	10.403	3.903	10.629	3.985
2nd year	37	10.270	3.724	9.919	3.854	10.459	3.509
3rd year	30	9.867	4.305	10.867	4.584	9.933	4.339
4th year	19	10.895	3.814	12.053	4.790	12.263	3.984
5th year +	10	12.100	3.446	10.000	3.399	10.900	3.900
MANOVA Wilks' Lambda =0.946; $F_{(4.215)}=1.004$; $p=0.443>0.05$							

Table 13: Variability of extrinsic motivation by year of study

Finally, ANOVA was used to reveal the variability of amotivation by year of study (RQ2.3.3). The findings related to ANOVA are depicted in Table 14.

	Year of Study	N	X	S.D.	F	p
Amotivation	1st year	124	13.532	4.247	1.845	0.121
	2nd year	37	12.351	4.050		
	3rd year	30	11.433	3.510		
	4th year	19	13.000	4.667		
	5th year +	10	13.200	2.860		

Table 14: Variability of amotivation by year of study

According to the results observed in Table 14, the levels of participants' amotivation did not vary based on their year of study ($F=1.845$; $p=0.121>0.05$).

Discussion

In online higher education, AM plays a crucial role in student engagement, learning outcomes, and overall success. Recognizing the pivotal role of AM in this context, the present study sought to delve into the levels of AM among undergraduate students enrolled in online courses. Therefore, this study aimed to investigate the AM level among undergraduate students taking online courses in terms of different motivational constructs such as IM, EM, and amotivation and whether there was a relationship between AM and demographic variables of gender, age, and year of study by contributing to a deeper understanding of the intricate dynamics surrounding AM in the realm of online higher education.

The results indicated that the overall level of AM of the students was detected as "moderate", which was the same as the level of EM including the mean scores of EM identified, introjected, and external regulations as well as amotivation. However, the IM level of the sample was "low" in addition to the levels of IM to know and IM towards accomplishment. Similarly, Ramos and Habig (2019) found that the level of nursing students' EM was higher than IM, but detected low levels of amotivation among students. Consistently, Teo et al. (2023) detected, in a study on AM and online learning with 288 Malaysian university students, that the highest mean scores were calculated for EM and IM, but the lowest for amotivation. Unlike the results of this research, Malinauskas and Pozeriene (2020), in their study on a comparison of AM between university students of traditional and online education, reported higher levels of IM including its sub-scales, IM to know, IM towards accomplishment, and IM to experience stimulation for university students taking online courses. Moreover, Fryer and Bovee (2016) argued that there was a chance that the motivation of many students would decline and eventually turn to amotivation because online learning environments would not be motivationally regulated.

Regarding the results of the variability of AM by gender, age, and year of study, some significant findings were identified to reveal the relationship between AM and demographics. Accordingly, it was detected that the levels of the students' IM and amotivation did not vary based on their gender. Nevertheless, the level of the participants' EM varied according to their gender, and the results pointed out that the levels of identified and external regulations for female students were higher than for male students, while the perception of male students' introjected regulation was higher than female students. Similarly, Pugh (2019) identified a strong correlation between motivation and gender by revealing that a higher proportion of

male students were extrinsically motivated in online education settings. Inconsistently, some studies in the literature did not detect any statistically significant differences between AM and gender (Malinauskas & Pozeriene, 2020; Ramos & Habig, 2019). Overall, the results highlight the significance of taking gender into account as a potential factor that influences specific aspects of AM, especially in the area of EM.

According to the results of the variability of AM by age, the participants' levels of the IM and EM did not vary based on their age. However, it was found that the sample's level of amotivation varied based on their age, and the level of amotivation of 18-year-olds is higher than that of 20-year-olds. Contrarily, some previous research did not identify any differences between AM and age (Malinauskas & Pozeriene, 2020; Pugh, 2019; Ramos & Habig, 2019). The complexity of the connection between age and AM is highlighted by these contradictory findings, which emphasize the need for more research and comprehension of the factors influencing the differences in amotivation between age groups.

As for the variability of AM by year of study, it was reported that students' levels of IM, EM, and amotivation did not vary based on their year of study. This finding suggested that regardless of whether they were in their first year or almost finished with their education, students' motivational orientation remained largely unchanged. Furthermore, regardless of the students' respective years of study, there were no discernible differences in the levels of demotivation among them. It indicated that the progression through various educational stages had little effect on the lack of motivation or disengagement from academic pursuits. The conventional belief that AM naturally changes or declines as students move through their academic careers is called into question by these findings.

Conclusion

This study contributes to the understanding of the AM levels and their connections to demographic variables in online higher education. The results highlight how important it is to take AM into account when promoting student engagement and success by emphasizing the need for customized support and interventions to improve motivation, particularly in the IM and amotivation dimensions. By comprehending the complexities of AM, educators, and policymakers can develop strategies to foster a motivational climate conducive to online learning environments. In order to create effective strategies and interventions that promote motivation, engagement, and student success, educators and institutions must first understand the importance of AM in online higher education. Online learning environments should become more active, interactive, and supportive of fruitful academic experiences by encouraging and nurturing AM.

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The Influence of Growth Mindset and Grit on Self-Efficacy Among Chinese Undergraduates

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Abstract
In recent studies, growth mindset and grit have been widely adopted as two common indicators of undergraduates' self-efficacy. However, the majority of studies are conducted among western samples. Moreover, the extent to which growth mindset and grit would impact self-efficacy simultaneously has not been systematically studied. The study first explores the influence of the two indicators in China and then examines the two dimensions of grit - consistency of interest and the perseverance of effort - and compares their influences on self-efficacy. 150 questionnaires were collected from undergraduate students across China, measuring their responses on Learning Questionnaire Manual, GRIT-S and 8-item Growth Mindset Scale. Multiple linear regression models were used to study their relationships while controlling GPA as an important covariate. The study concludes that while grit is an effective indicator of self-efficacy, only the effort preservation dimension contributes to the statistical significance. Another noteworthy finding is that compared to growth mindset, grit (with its effort dimension alone) is a stronger predictor of undergraduate students' self-efficacy.

Keywords: Self-Efficacy, Grit, Growth Mindset

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1. Introduction

Self-efficacy has been one of the hotspots in psychological research in recent years. It denotes a person's belief in his or her abilities to carry out behaviors needed to perform certain attainments (Bandura, 1977). Self-efficacy is a meaningful indicator of an individual's confidence and capacity to control over his or her motivation and endeavors. In psychological terms, it serves as a reliable representation of an individual's perception of surrounding social factors (Miller & Dollard, 1941). Regarding the development of university students, self-efficacy is widely accepted as a predictor of academic success - an individual with high self-efficacy tends to think they can do well, and is more likely to actually perform well (Gist & Mitchell, 1992). In a university where each student serves as an active part of a large social group, self-efficacy is also crucial in realizing one's potential to contribute to the group setting (Ormrod, 1999).

The interrelationships between self-efficacy, grit and growth mindset have obtained great empirical attention. A great variety of studies incorporate self-efficacy with grit and growth mindset. For instance, Alhadabi and Karpinski (2020) demonstrated that grit and self-efficacy, as two types of personalities, can jointly offset negative factors in academic study. Further, several recent studies revealed that self-efficacy is a complex attribute not only correlated to, but also dependent on grit and growth mindset. Specifically, Usher et al. (2019) found a positive correlation between grit and self-efficacy, and De La Cruz et al. (2021) further discovered that grit contributes to self-efficacy. Similarly, Rhew et al. (2018) designed a quasi-experiment to conclude that a growth mindset intervention would improve students' self-efficacy. Wangwongwiroj and Yasri (2021) further indicated such a positive correlation between growth mindset and self-efficacy with surveys.

From former western studies one may conclude that both growth mindset and grit correlate positively to self-efficacy. However, there are three major challenges in the extant literature. Firstly, relevant conclusions are yet to be proved reliable in global terms. Also, it remains unresolved whether growth mindset or grit is a stronger predictor of self-efficacy. Moreover, out of the two different dimensions of grit, namely consistency of interest and the perseverance of effort, there are controversies about which attribute contributes more to self-efficacy. In response, our study used questionnaire to examine the contribution of growth mindset, grit to self-efficacy. Referring to principles advocated by Ato et al. (2013), we built multiple linear regression models on an explanatory cross-sectional basis. The paper reports the results of our models and provides insights to tackle the three challenges mentioned above.

2. Literature Review

2.1 Self-Efficacy

The concept of self-efficacy was brought into research scope in the 1970s, and was formerly described by Albert Bandura (1997), which refers to people's belief in their abilities to make plans for prospective attainments. Mastery experiences, vicarious experiences, social persuasion, and emotional states are the most important factors that influence self-efficacy (Bandura 1997). To some extent, self-efficacy not only reflects one's judgement and confidence level of his or her capability, but also provides motivations and polar attitudes to one's behavior.

Previous research shows that self-efficacy plays an indispensable role in academic success.

Students who have high self-efficacy would be actively engaged in risky and chronically increasing goals, making greater efforts, and working with patience and persistence (Bandura 1997; Zimmerman 2000). Subsequent research dives deeper into this topic, discovering that high self-efficacy students credit success to their internal traits and attribute failures to situational factors, while low self-efficacy students consider success to their good luck and think failures as the representation of their weak ability (Hsieh 2010; Salanova 2012). In general, recent researchers concluded that students with high self-efficacy tend to have fewer sensitive feelings and more motivations for their academic outcomes and goals (Kurbanoglu 2010).

2.2 Grit

Grit was first informally introduced in early psychological research as a trait related to adherence and passion in plan fulfillment. Duckworth et al. (2007) defined grit as an indicator of an individual's passion and perseverance for a difficult task without being confronted or frustrated with it. They developed a 12-item grit scale which includes two dimensions - the consistency of interest and the perseverance of effort. Based on the 12-item grit scale, Duckworth and Quinn (2009) later established an 8-item grit scale to improve the efficiency and accuracy of grit measurement.

Duckworth (2007) conducted a series of studies, verifying the causal link that people's talent and effort determine to what extent they are able to achieve academic success. The studies conclude that grit can be a reliable index in assessing the intensity, direction, and duration of one's exertions towards a goal. Specifically, higher grit level is correlated to higher education level, fewer career changes, and higher GPAs at school (Duckworth and Quinn 2009; Strayhorn 2013). In recent years, extensive research has concluded positive relations between grit and self-efficacy. For example, Wolters and Hussain (2015) found that grit can be a predictor of self-regulated learning which builds on self-efficacy.

2.3 Growth Mindset

Psychologist Carol S. Dweck (1999) conducted research on people's beliefs when evaluating the meaning of every event. She classified these beliefs into the fixed mindset and the growth mindset. Individuals with a fixed mindset usually believe that their intelligence is natural and unchangeable, regarding failures as proof of their limited intelligence. As a result, their expectations, as well as possibilities for success, are small. On the contrary, people with a growth mindset believe that their intellect can be learned or changed by hard work, embracing failures as chances to accumulate experience and success as their further motivations to challenge new events (Dweck 2006). From a development point of view, while students with a fixed mindset tend to avoid risk and choose easy tasks to conduct in the fear of failure, students with a growth mindset will make every effort to attain their goals and integrate new learned experiences with the old ones (Dweck 1999).

Recently, researchers have also discovered a direct correlation between growth mindset and self-efficacy. Ferguson (2017) discovered that both traits correlate to academic success to a similar extent, and Keenan (2018) observed that growth mindset impacts self-efficacy directly.

3. Method

A cross-sectional survey was conducted questionnaires with multiple-choice questions were collected from the selected population to deduce each participant's level of growth mindset, grit and self-efficacy as latent variables.

3.1 Participants

A total of 150 students were recruited, including exactly 75 males and 75 females. All participants in this study were sophomores, juniors, and seniors from three universities with similar rankings in mainland China. The selection of the universities is meant to account for the geological and cultural diversity in China. The three universities are all comprehensive universities with very similar admission cut-off line for the Chinese College Entrance Examination, ensuring that the GPA percentages of individuals from all three universities have equivalent reference value. To address the impact of university social settings, the study chose not to include first-year students who had just matriculated. Among all participants, 44 individuals were sophomores, 58 individuals were juniors, and the remaining 58 were seniors. As for field of study background, 53 students were liberal arts majors. 31 students were science majors. 66 students were engineering majors.

3.2 Instruments

Our questionnaire produces two classes of variables – independent variables and dependent variables. Demographic variables include gender, major field, year of study and age. It also includes blanks for the ranking of each individual's grade point average (GPA) and the class size, such that the GPA percentage can be automatically computed. All these variables can be directly collected upon students' completion of the background section of our questionnaire. On the other hand, for each individual, the scales of self-efficacy, growth mindset and grit were calculated from his or her responses to a set of relevant multiple-choice questions according to the guidance of the Learning Questionnaire Manual, GRIT-S and 8-item Growth Mindset Scale (all translated into Chinese). Cronbach's alpha (Cronbach, 1951) is utilized to ensure the reliability of the calculated scales.

3.2.1 Scale of Self-Efficacy

To measure an individual student's self-efficacy, our questionnaire utilized the scale 'Self-Efficacy for Learning and Performance' from Motivated Strategies for Learning Questionnaire Manual (Pintrich et al., 1991). To compute the actual scale of self-efficacy, a student is given seven questions about an item related to his or her self-feeling or thinking tendencies in a particular situation, and is required to choose one of the rates on a seven point Likert scale ranging from 'not at all true of me (1)' to 'very true of me (7).' An example question is 'I believe I will receive an excellent grade in this class.' Taking each one of the seven questions as a distinct variable, we are able to calculate their mutual covariance, and hence Cronbach's Alpha. The Cronbach's Alpha in this study is satisfactory (0.901). Upon good internal consistency within the set of numerical values retrieved from each question, we simply take the mean of a student's selected rates as the scale of self-efficacy.

3.2.2 Scale of Grit

The Short Grit Scale (GRIT-S) in 2009 contains 8 items (Duckworth & Quinn, 2009), all of which are referred to in a one-to-one correspondence with a question in our questionnaire. Specifically, GRIT-S is made up of two subscales - consistency of interest and perseverance of effort, each containing 4 items. Similarly, in the questionnaire, students choose a rate for themselves from 'not at all like me (1)' to 'very much like me (5)' on eight questions that each covers an item. As the items which correspond to the consistency of interest subscale are negatively worded items, the numerical values associated with students' ratings need to be reversed. For example, for a person who chooses a rate of 1 in a question corresponds to consistency of interest, our study will record the response as a score of 5. An example item for perseverance of effort is 'setbacks don't discourage me', and an example item for consistency of interest is 'new ideas and projects sometimes distract me from previous ones. Using the computation routines, the same as that of self-efficacy, we obtained satisfactory internal consistency satisfactory for both the subscales 'consistency of interest' and 'perseverance of effort', as their correspondent Cronbach's Alpha are 0.747 and 0.603, respectively. To compute the scale of grit as well as its subscales, we also take the mean of the scores - in reversed form if correspondent to consistency of interest - for each participant.

3.2.3 Scale of Growth Mindset

The study makes use of the 8-item Growth Mindset Scale (Dweck, 1999). According to Dweck, the scale includes two subscales – growth mindset and fixed mindset. In the study, only the subscale of growth mindset - with 4 correspondent items - was used. The questionnaire also contains a section with 4 questions in one-to-one correspondence with each respective question, with responses chosen from 'extremely unlikely (1)' to 'extremely likely (5).' An example is 'no matter who you are, you can significantly change your intelligence level.' Similarly, we use the same computation routine as above to obtain satisfactory internal consistency, as Cronbach's Alpha is equal to 0.841. Analogously, we take the mean of each participant's scores as his or her scale of growth mindset.

3.3 Data Collecting and Analysis Procedure

The questionnaire was designed as an online form, and we promote it in the social media groups of the three universities. The distribution of the questionnaire was in compliance with the principle of voluntary participation, and those who finished the questionnaire were awarded with a gift card. The questionnaire remained open for answers until a total of 70 questionnaires were collected from each of the three universities. We first pre-processed the response dataset to exclude collected questionnaires that contained incomplete information, were filled in within 2 minutes, or showed a possibility of hasty or randomized answer selection. We also pruned out a few extra data points to make sure that we have equal male and female data points. After data collection, multiple linear regression models are built with self-efficacy as the outcome variable, two dimensions of grit, growth mindset and GPA as the independent variables. The independent variables were entered into the model sequentially to examine the change of model prediction.

4. Result

After the preprocessing and computation routines described in the above sections, 150 data points are each associated with a scale of grit (both dimensions), growth mindset and

self-efficacy, respectively. With these variables we're able to calculate the inter-correlations between variables and the median, standard deviation, skewness and kurtosis of each variable. This information is shown in Table 1.

	Variable	1	2	3	4	5	Mean	SD	Skewness	Kurtosis
1	Self-efficacy	1					4.96	1.06	-0.54	0.15
2	Grit(interest)	0.13	1				2.92	0.83	-0.08	-0.59
3	Grit(effort)	0.46**	0.37**	1			3.40	0.74	-0.15	0.06
4	Growth mindset	0.37**	0.05	0.20*	1		2.97	0.82	-0.01	-0.33
5	GPA Percentage	0.45**	0.02	0.21*	0.09	1	67.37%	24.49%	-0.49	-0.92

Note: Values with corresponding P value < 0.01 and <0.05 are marked with 2 and 1 asterisks respectively.

Table 1: Inter-correlations and Descriptive Statistics

The five variables in our study all showed reasonable standard deviation, mild negative skewness and comparatively low kurtosis. This suggests that our data has a moderate form of dispersion, does not include significant distortion, and has a low propensity for outlier generation. These metrics suggest that our data is rather unbiased and reliable.

The inter-correlations data (the lower triangular 5*5 matrix on the left half of the Table 1) shows that self-efficacy is greatly correlated with the subscale of grit in perseverance of effort, growth mindset and GPA. It has a non-significant correlation with grit in consistency of interest. It is also noteworthy that the two dimensions of grit are greatly correlated, so it makes logical sense to conclude that grit, as a whole, is greatly correlated with self-efficacy. We also find that grit in perseverance of effort is moderately correlated with growth mindset and GPA percentage, so it can be itself a predictor of multiple relevant traits.

From the table one may also observe that grit, if only considering its effort perseverance dimension, has a stronger correlation with self-efficacy than growth mindset does.

To better study the interrelationships, we stratify our set of variables and build multiple regression models based on a subset of all variables. The first model only considers the two dimensions of grit; the second model accepts both the grit dimensions and the growth mindset; the last model considers an additional variable - the GPA percentage. The output of the models is shown in Table 2.

Regression Equations		Fit Index	Coefficient	
	Predictor	R^2	Standardized Beta Coefficient	t-statistic
1	Grit(interest)	0.21	-0.04	-0.54
	Grit(effort)		0.48	6.10***
2	Grit(interest)	0.28	-0.04	-0.48
	Grit(effort)		0.42	5.52***
	growth mindset		0.29	4.14***
3	Grit(interest)	0.41	-0.01	-0.20
	Grit(effort)		0.34	4.83***
	growth mindset		0.27	4.24***
	GPA percentage		0.36	5.53***

Table 2: Multiple Regression Relationships

From the first model reported by Table 2, we can see that the effort perseverance dimension of grit has a significantly greater beta coefficient, and thus a much more significant t-statistic, than the interest consistency dimension does. This further proved our previous observance that perseverance of effort is the only significant dimension in grit in self-efficacy prediction.

Considering the second model reported in Table 2, we can similarly conclude from the coefficient beta and t-statistic that both grit (effort perseverance dimension) and growth mindset can be reliable predictors of self-efficacy, and that growth mindset appears as the weaker predictor. These findings are also consistent with our observance of Table 1.

Moreover, we can see that the R-squared indices for the first two models are intermediate, while the last model achieves a significantly higher R-squared. This suggests that the data fits more precisely with regression models when GPA percentage is included. Also, considering the strong correlation between GPA percentage and scale of self-efficacy, it suffices to conclude that GPA, or academic performance in a wider scope, is itself a very important predictor of self-efficacy. That being said, when we consider grit and growth mindset as indicators of self-efficacy, GPA must be controlled as a crucial covariate. In the third model reported by Table 2, GPA percentage is included in the regression model, yet the prediction power of grit (effort perseverance) and growth mindset persists. This model suggests that grit (effort perseverance) and growth mindset are indeed reliable predictors of self-efficacy, even if GPA, or academic performance, is strictly controlled as the most important covariate.

5. Discussion

From the results of our study, we have successfully extended western research on grit, growth mindset and self-efficacy to the circumstances of China, and we find that the prediction capacity of “grit - self-efficacy” and “growth mindset - self-efficacy” applies to Chinese students as well.

Similar to previous studies, we conclude grit and growth mindset as reliable indicators of self-efficacy. However, our study also finds that only the effort perseverance dimension of grit correlate to self-efficacy significantly. We have also pioneered the comparison of

prediction power between grit (effort perseverance) and growth mindset, and claimed that the former is a slightly better predictor.

The study expanded the practicality of state-of-the-art theory to the Chinese group and verified its cross-cultural consistency. Our study can also provide global literature support on relevant topics. We look forward to inspiring further research on relevant topics.

Also, our study has several limitations. As cross-sectional models cannot eradicate the possible existence of confounders, we are not able to claim explicit causal relationships. We hope that a longer and more rigid experimental study could be done on this subject to formally prove grit and growth mindset as direct causes or constructive factors of self-efficacy. Another drawback of our study is the limitation of data collection. We were not able to perform random sampling to ensure objectivity, and the range of sources as well as the sample size of our study were limited. We expect to see future studies with random samples and larger or more diversified participants to ascertain our findings.

6. Conclusion

Our study concludes that the recent western findings regarding the correlation between grit, self-efficacy and growth mindset apply to China. Moreover, we claim that at least in a Chinese cultural background, the effort perseverance dimension is the only dimension in grit that is significantly correlated with undergraduate students' self-efficacy. It is the effort perseverance dimension, also turned out to be a better predictor of undergraduate students' self-efficacy than growth mindset, though both are indeed reliable predictors.

We hope that our findings can assist educational psychologists in their efforts to propose ways to increase one's self-efficacy, either towards undergraduate students or all social individuals in general. We also expect our findings may break the ice in the relevant field, arousing more rigorous research studies to both formally prove possible causal links and dive more into the specifics of grit, growth mindset and self-efficacy as an organic integration.

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Examining the Impact of Teachers' Assessment Competency on Learners in Academia: A Study of Selected HEIs of Uzbekistan

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Abstract
Assessment evaluates students' performance against established criteria, standards, or learning objectives to analyse learning outcomes through formative or summative techniques through ongoing feedback and opportunities for improvement so that curriculum, instruction, and educational policies are adjusted according to the student's needs. In this light, the need for transformation is anticipated as never before, and teachers' initiative in becoming more assessment competent is a sine qua non. As Ashraf & Zolfaghari (2018) view it, students' academic performance outcomes and assessment quality are representatives of teacher assessment literacy (p425). Therefore, teachers must equip themselves with knowledge, skills, values, and attitudes to contribute to the well-being and sustainable development of the entire educational milieu. This research aims to analyse *what teachers of selected HEIs in Uzbekistan think about the impact of their assessment literacy on encouraging learners' during seminars*. This topic has been excessively researched in various levels of education in many European countries and the United States (Carroll, 1995, p67; Sadler, 1998, p77; Keppell & Carless, 2006, p181; Weurlander et al., 2012, p759), but suffers a dearth of focused studies in Uzbekistan. A quantitative technique is applied to collect data from more than 100 teachers of HEIs from different reputed universities of Tashkent, Uzbekistan. The findings reveal the extent to which students' in-class involvement and greater responsibility for learning and self-assessment improvement depends on the teacher's level of assessment literacy. Besides, the obtained findings suggest measures to develop teachers' assessment competency and consistently adhere to several essential principles for encouraging learners in active learning.

Keywords: Active Learning, Assessment Competency, Formative and Summative Assessment, HEIs Teachers

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Introduction

Assessment has been acknowledged as a crucial component of the teaching and learning process across all levels of education. Teachers who possess proficiency in assessment play a vital role in the educational process by designing assessments that foster active learning among students. Despite the idealistic nature of this proposition, the reality is often less optimistic, as many encounter challenges in acquiring assessment competency. This issue was first raised by Knight (2002) over two decades ago, who contended that summative assessment was in a state of 'disarray' for the paucity of reliability. Subsequently, Knight & Yorke (2003) concluded that formative assessment failed to realize its potential, and Gibbs & Simpson (2004) observed a sharp decline in both summative and formative assessment. In this context, the development of teacher assessment literacy represents an ethical and moral obligation, as it provides every student with an opportunity to learn (Willis, Adie, & Klenowski, 2013).

The government of Uzbekistan has proposed a five-year Education Sector Plan (ESP) for the period 2019-2023, which aims to enhance teacher effectiveness and improve student performance through progress in assessment practices and teacher assessment literacy for both in-service and pre-service teachers (Sankar, 2021, p 109-110). There are 209 local and international universities operating in Uzbekistan, and the majority of them are located in the capital city Tashkent which focus primarily on the content knowledge of teachers rather than their competency in assessment. As such, the role of higher education institution (HEI) teachers in Tashkent in driving transformation at the state level is crucial. However, there is a dearth of research on teacher assessment competency and its relationship with students' active learning. Therefore, this study aims to contribute to the scientific pool of data by analyzing HEI teachers' perceptions of the impact of their assessment competencies on students. Specifically, the purpose of this research is to examine how Tashkent HEI teachers comprehend formative and summative assessments, identify the techniques and principles they employ to promote active learning in their teaching, investigate the methods they use to evaluate their own assessment competency and analyze the training and professional development opportunities related to assessment that they attend.

The attempt to investigate the problem statement, driven by the researchers' personal interest, aims to contribute to the existing literature on such broader areas as education research, assessment literacy, teacher professional development as well as learning and instruction, particularly within the higher education sector. The outcomes of this study may purvey valuable data for a number of stakeholders, namely the HEI teachers and students themselves, researchers, teacher training institutions, HEI administrators and the Ministry of Education. Besides, with the obtained results, it becomes more feasible in the observable future to further research the problem of HEI teachers' assessment literacy and students' active learning and integrate the best practices not only of universities in Tashkent but also in the regional ones.

In the following sections, there is a focused literature review, combined with a thematic analysis of articles addressing the research problem, followed by a detailed description of the applied research methodology, analysis of obtained data in the results section, discussion and conclusions.

Literature Review

Introduction

Assessment in higher education is the most debatable issue facing several challenges. While summative assessment is asserted to be in 'disarray' for the dearth of reliability (Knight, 2002, p276), formative assessment fails to fulfill entrusted potential (Knight & Yorke, 2003, p7) or even suffers a decline (Gibbs & Simpson, 2004, pp9-10). Students start to take charge of their learning when they can differentiate themselves from content and learning strategies that help in achieving their learning objectives.

Formative and Summative Assessment: Definitional Variations and Parameters

Although summative and formative assessments are regarded as processes, assessment cannot only be entirely formative with preceding judgments of a summative nature. Knowing about these processes and combining them effectively to encourage students' learning is known as "teacher assessment competency" (Taras, 2005, p467). Both "summative" and "formative assessment" concepts were introduced to measure the overall value of a programme (Bennett, 2011, p6). In this earlier context, while the summative assessment was used to indicate how one programme was similar or different to an alternative one, the formative assessment was aimed at finding ways to facilitate the improvement of a programme heavily relying on its results. For Bloom (1969, p48), the main purpose of the formative evaluation was feedback and appropriate correctives provided at each stage of the process in teacher-student interaction; as for summative assessment, it was undertaken to evaluate what the learner's achievement was at the end of a course (cited in Shuichi, 2016, p81).

Nevertheless, despite not distorting the initial purpose, the definitional rhetoric of more modern researchers has taken different views, shapes, and depths due to the focus shift from educational programmes to students. Sadler (1998) defined *formative assessment* as an assessment explicitly designed to produce feedback on students' performance to enhance and expedite learning (p77). The researcher Carless, (2007) warns about the power of summative assessment to drown formative approaches to assessment with the lack of productive synergies (p62).

One of the most recent definitions proposed by Cobeña et al. (2021) promulgates that formative assessment is the type of evaluation that is transformed into an achievement of both the teacher and the student due to the goal being made visible and understandable by the former so that the later could recognize the degree to which the educational process has been understood (p133). Summative assessment of students is more transparent when correlated with formative assessment (Fasih, Shamim, & Ali, 2019, p117); nevertheless, its primary purpose remains not ongoing learning but reporting on students' extent of learning at a particular time (Dolin et al., p63).

Impact of Teachers' Assessment Competency on Students' Active Learning

The development of teacher assessment literacy represents ethical and moral obligations because this gives every student a chance to learn (Willis, Adie, & Klenowski, 2013, p253). Through the mediation of an assessment-literate teacher implementing conscious intervention design (teamwork, feedback giving and receiving, and reflective self-evaluation), a harmonious combination of pedagogic approaches and continuous ipsative affordances,

undergraduate student performance can significantly develop (Hoo, Deneen, & Boud, 2021, p12). Following a 2-year case study on 175 undergraduate students by Viegas, Alves, & Lima (2015), it was revealed that readjustment from didactic design to a wide range of assessment tasks (i.e. "...weekly homework with peer revision in class during the problem discussion; competence and concept questions in the recitation and problem-based classes and, the development of a [mini] project work") accompanied by teacher feedback affected a change in most students (pp930-934).

Factors Underlying Students' Engagement in Active Learning

Assessment literacy of teachers is a foolproof way to increase students' academic progress and, in the meantime, their knowledge about assessment practices in general. Smith et al.'s study on 369 undergraduate first-year business students, revealed a 10% increase in the marks following the implementation of formative assessment as part of the 50-minute "intervention process" (i.e. develop students' ability to judge their own and others' work against pre-set criteria and standards), thus enhancing their learning outcomes (2013, pp23-24). This suggests that interventions intended to improve learning through assessments raise assessment literacy. Nicol & Macfarlane-Dick's (2006) observations show that in higher education, despite encouraging students to take greater responsibility for their assessment learning, teachers were reluctant to let students have responsibility for formative assessment processes, without which the ability to self-regulate learning seems unlikely.

Importance of Varying and Combining Formative and Summative Assessments to Promote Students' Active Learning

The teacher decides on assessment tasks; if done consciously and consecutively, the tasks are likely to improve and facilitate students' learning. Learning-oriented assessment yields effective results (i.e. supporting student learning in different ways) when combined assessment tasks (Keppell & Carless, 2006, p181; Offerdahla & Tomanek, 2011, p792; Weurlander et al., 2012, p759). Teachers can significantly contribute to students' learning by integrating continuously active learning activities, diversifying approaches to meet student needs, assessing students' progress and eventually making relevant adjustments (Lumpkin, Achen, & Dodd, 2015, p131; Adkins, 2018, p39). Threlfall (2014) suggests reflective discourse and journaling are genuine assessments for the effective development of active student learning, especially teaching a smaller number of students (pp323-329).

In conclusion, reviewing the existing literature helped in identifying significant themes and trends related to the relationship between teachers' assessment competency and its influence on students' active learning. It was ascertained that students undeniably depend on their teachers' literacy in the assessment domain and significantly benefit when effective combinations of versatile formative and summative assessments are implemented. However, this issue is predominantly studied in the context of European countries. There needs to be more data on this relationship about many HEIs operating in Tashkent, Uzbekistan. With this gap in the reviewed body of secondary data, there evolves the need to analyze perceptions of teachers employed by HEIs in Tashkent to reveal how and whether their assessment competency contributes to encouraging students'.

Methodology

The following section outlines the methodology applied in the current study to investigate what Tashkent HEI teachers think about the impact of their assessment competency on encouraging students' active learning. Outlined are the design of the research, its participants, employed instruments, methods of data collection and employed procedures in data analysis.

To collect data from HEI teachers about their assessment practices and perspectives, this study employed a cross-sectional survey design using an online questionnaire. The rationale behind choosing this design was that it allowed for a large sample size to be recruited simultaneously within a short span of time and was convenient for both the respondents and researchers and enabled the former to obtain high-quality data considering the degree of anonymity of participants.

The target population chosen for this study consisted of interdisciplinary in-service teachers employed by higher education establishments. To recruit them, non-probability convenience as well as snowball sampling techniques were used. Since any instructor of the Tashkent HEI population had an equal chance of participating in the survey, simple random sampling techniques were employed. The questionnaire link was distributed to teachers at various higher education institutions via webmail and social media platforms. A total of 100 teachers completed the online survey built on a cloud-based application called Survey Monkey. The sample included 67 females and 33 males whose age predominantly ranged within a 31-51+ age bracket. A sizable majority (68%) held an MA degree while 14% were PhD holders and Doctoral students. The respondents taught a variety of subjects across different program levels.

The questionnaire, categorized in conjunction with the research question and objectives, was made up of 20 questions, mainly consisting of Likert scale format questions, including closed-ended questions as well as open-ended, multiple choice, ranking and hypothetical ones. Before being sent to a larger sample, the questionnaire passed two stages of modification and approval. First, to identify and revise different issues (ambiguous or confusing questions), some technical flaws and respondent fatigue, facilitate clarity and ensure validity and reliability, it was piloted among 6 highly skilled teachers; secondly, the questionnaire was reviewed and approved by the WIUT Research Committee so that it could be disseminated among WIUT academic staff and across other universities in Tashkent. This process increased the credibility of the study, facilitated access to a large sampling frame, helped to avoid any potential legal issues and ensured that the studies were conducted without breaching ethical guidelines.

To summarize the data obtained from the questionnaire, descriptive statistics, including percentages and frequencies were calculated. To this end, various trends, patterns and associations were identified while analyzing the content. To examine common patterns and compare categories such methods as cross-tabulation and frequency analyses were found to be particularly effective.

Results

The survey included respondents from a total of 37 universities. Its findings indicate a gender imbalance, with females comprising two-thirds of the respondents and males representing only one-third. In terms of age distribution, the largest group falls within the middle age

category of 31-40, while the oldest age category (51+) is the least represented. In terms of educational qualifications, 68% of participants held a Master's degree, while the number of PhD/EdD holders was significantly smaller, with only 14 participants. DSc degree holders represented the lowest percentage at 3%, and 10% of participants were Doctoral students pursuing their Ph.D. Regarding teaching positions, the largest group (38%) taught in the first year of BA/BS/BL programs, followed by those teaching foundation courses (31%). Postgraduate teachers accounted for only 15% of respondents. Additionally, 14% of respondents fell into the "other" category, indicating that their specific teaching levels were not provided in the survey options (Table 1).

Variables	Category	Frequency Number	Per cent
Gender	Female Male	67 33	67 33
Age	20-30 31-40 41-50 51 and above	19 49 26 6	19 49 26 6
Highest Educational Attainment	Master PhD/EdD Doctoral Student DSc Other	68 14 10 3 5	68 14 10 3 5
Levels taught	Pre-university Foundation 1 year BA/BS/BL* 2 year BA/BS/BL 3 year BA/BS/BL Postgraduate Other	8 31 38 30 31 15 14	8 31 38 30 31 15 14

*(Bachelor of Arts/Science/Law)

***Table* 1: Demographics: gender, age, educational attainment and length of teaching**

The survey encompassed a wide range of academic modules, with over 150 subjects mentioned. These modules were categorized into eight areas, including English Language Teaching, Economics/Finance/Business Management, Education, Computer Science, Mathematics, Linguistics, Social Sciences, and Law (Figure 1).

***Figure* 1: Academic modules/courses taught by the participants**

The majority of respondents (66%) understood summative assessment as evaluating learner achievement at the end of a course, while only 20% viewed it as assessment-based data for academic judgments. In contrast, formative assessment was seen as providing feedback and correctives at each stage of the process (57%), enhancing learning through performance feedback (nearly half), focusing on learner needs (29%), and implementing tailored assessments (34%) (Table 2).

Variables	Category	Frequency Number	Per cent
Definitional relevance of "summative assessment" to the context of teaching	Assessment undertaken to evaluate learner's achievement at the end of a course	66	66
	Assessment occurring through the accumulation of evidence over an extended time by testing students either within or at the final stages of assessment periods to provide an overview of previous learning	66	66
	Assessment applied to the use of assessment-based data for making judgments on academic issues that have already occurred	20	20
	Assessment instigated by accountability needs in response to constraints and pressures exhibited externally	6	6
	Other	4	4

Definitional relevance of "formative assessment" to the context of teaching	Feedback and appropriate correctives provided at each stage of the process in teacher-student interaction	57	57
	Assessment explicitly designed to produce feedback on students' performance to enhance and expedite learning	48	48
	Assessment focused on the process to provide evidence for strengthening students' learning	42	42
	Assessment implemented cyclically either between or within lessons, which is then tailored to the learners' needs	34	34
	Type of evaluation that is transformed into an achievement of both the teacher and the student due to the goal being made visible and understandable by the teacher so that the student can recognize the degree to which the educational process has been understood	33	33
	Assessment focused on the learner's needs	29	29

***Table* 2: Formative and summative assessments defined within the context of the participants' teaching**

The study also examined the correlation between summative and formative assessment transparency among HEI teachers. The majority (81%) agreed or strongly agreed that transparency increases when the two assessments are linked, with only a small percentage (10%) expressing disagreement (Figure 2).

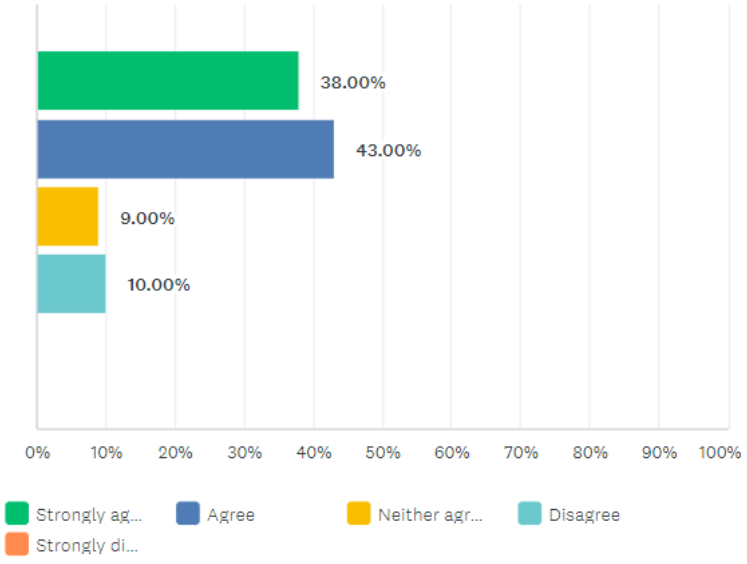

***Figure* 2: Respondents' perception about the transparency of summative assessment when aligned with formative assessment**

The study aimed to understand HEI teachers' perception of "assessment competency" in their teaching. While a small portion (7%) demonstrated limited awareness, 54 respondents linked it to objective and reliable student assessment, with one stating, "*...when formative assessment leads to achieving summative assessment*" (R28). Another 33 teachers associated it with designing effective assessments aligned with learning outcomes. Constructive

feedback as a guiding tool was emphasized by 13 respondents, with one stating, "*...accurately measure students' progress and achievements*" (R35). A more comprehensive understanding was expressed by R85, mentioning collecting evidence, adapting curriculum, and meeting student needs. Furthermore, 49 teachers believed assessment competency identifies areas for improvement through objective assessment. Reflecting on the relationship between assessment and active learning, some teachers emphasized the importance of feedback guiding both students and teachers. Additionally, designing effective assessment tasks and rubrics was highlighted by 14 respondents (Table 3).

Common patterns collected from respondents' response	**Selected quotations from the participants' responses**
1). Gaps in knowledge (7 Responses)	*"I am not familiar with this concept."* (R4) *"To be honest, I don't know. Anyway, I believe that any person with strong knowledge, big passion and strong communication skills can be a great teacher."* (R52) *"To give a mark."* (R86)
2). Knowledge and skills to assess students objectively and reliably (54 Responses)	*"It is when formative assessment leads to achieving summative assessment."* (R28) *"Ability of teacher to encourage students to learn better by providing timely feedback based on their performanc.e"* (R48) *"To measure the knowledge and skills that were taught by applying the appropriate tool."* (R67) *"Being able to reach objectives based on assessment."* (R97)
3). Ability to design and implement effective assessments correlated with LOs (33 Responses)	*"Teacher's ability to create relevant for the student's academic growth assignments and activities all of which are linked to the learning outcomes."* (R1) *"instructional and assessment approach according to students' needs, comprehension."*(R12) *"Set of assessment-related skills and experience."* (R87)
4). Ability to provide constructive feedback to guide students (13 Responses)	*"Teacher assessment competency means, for me, that teachers are good at figuring out how well their students are learning."* (R21) *"Knowing what to assess and how to assess using summative or formative assessment) and modifying curriculum to meet student's needs or areas where their knowledge is lacking."* (R85)
5). Objective assessment of students' knowledge to identify areas for improvement (49 Responses)	*"The capability of a teacher providing valid and reliable assessment"* (R13) *"The ability to be objective"* (R27) *"Knowledge about the subject and ability to properly assess the students."* (R32) *"Knowledge of where to lead and how to teach."* (R73) *"... the ability of a teacher to assess the student appropriately."* (R84) *"... ability to certify that students possess certain skills or knowledge."* (R99)
6). Providing constructive feedback to guide students and to inform teaching (14 Responses)	*"The main competency of a teacher is to learn (study) all the time."* (R17) *"It is the ability of a teacher that can evaluate learners' skills by giving constructive feedback and guiding for higher achievements in the learning process."* (R29) *"For me, it is the teacher's ability to evaluate students' achievements, academic progress through various learning activities."* (R50)

7). Designing effective assessment tasks and rubrics that promote learning (14 Responses)	*"I think it is how competent a teacher is about assessment i.e. whether they can design and use assessments appropriately."* (R2) *"... can use appropriate assessment tasks following principles of assessment."* (R41) *"It is understanding and appropriately comprehending graduate attributes, learning outcomes and assessment criteria."* (R71)

***Table* 3: Teachers' understanding of assessment competency**

Determining the impact of teachers' assessment competency on students' active learning, the majority (52%) strongly believe it encourages active participation, while 40% consider it moderately influential. Only 3% see little to no correlation (Figure 3).

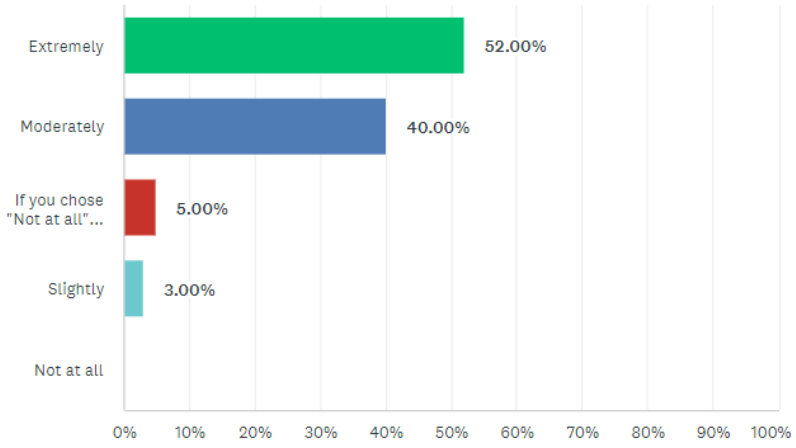

***Figure* 3: The extent to which teachers' assessment competency encourages students**

Besides, the study revealed a positive correlation between effective teacher assessment practices and students' engagement in learning. The majority (78%) associated teacher assessment competency with increased student responsibility for learning. Half of the participants (50%) believed it improved students' self-assessment skills. Additionally, 36% reported enhanced peer assessment, while 25% noted increased marks/grades. Other benefits mentioned by 11% of the respondents were deeper subject engagement, greater satisfaction with achievements, and higher study incentives (Table 4).

Variables	Frequency Number	Per cent
Greater responsibility for learning	78	78
Improvement in self-assessment	50	50
Improvement in peer-assessment	36	36
Increase in the marks	25	25
Other	11	11

***Table* 4: Effect of teacher assessment competency on students' active learning**

In terms of assessment techniques employed to promote active learning, group projects and peer reviews were the most preferred, utilized by approximately half of the teachers (49.5% and 17.3% respectively). Self-reflection and case studies were common among one-third of respondents (35.5% and 33.3% respectively). Presentations, quizzes, and portfolios were less

frequently used (23.7%, 16.4%, and 14% respectively). Additionally, a variety of other techniques, mentioned once each, were seen as important, including minute papers, surveys, checklists, peer teaching, debates, inquiry-based learning, verbal reporting, self-directed learning, interviews, exit tickets, and problem-based learning (Table 5).

Variables	Frequency Number	Per cent
Group projects	46	49.5
Peer review	44	47.3
Self-reflection	33	35.5
Case studies	31	33.3
Presentations	22	23.7
Quizzes	15	16.1
Portfolios	13	14
Other techniques related to active learning	13	14

***Table* 5: Assessment techniques integrated into teaching for active learning**

According to the survey, the majority of HEI teachers (86%) consider providing constructive feedback as the most crucial principle for promoting active learning. Welcoming feedback from students and facilitating self-assessment through reflection were also highly valued, accounting for 68% and 65% respectively. Giving opportunities to bridge performance gaps (56%) and encouraging learning-related dialogue (55%) were seen as important too. Encouraging self-esteem and motivational beliefs, as well as delivering high-quality information about students' learning, received relatively lower percentages (31%) compared to other principles (Table 6).

Variables	Frequency Number	Per cent
Providing constructive feedback	86	86
Facilitating the development of self-assessment in learning through reflection	68	68
Delivering high-quality information about students' learning	65	65
Encouraging learning-related dialogue between teachers and between students	56	56
Encouraging self-esteem and uplifting motivational beliefs	55	55
Giving opportunities to bridge the performance gap between present and desired performance	49	49
Welcoming feedback from students to shape teaching	31	31
Other	2	2

***Table* 6: Principles to which teachers should adhere to encourage students' active learning**

To assess their own competency in assessment, respondents favoured attending professional events (77%) and engaging in self-reflection (76%). Feedback from others was also valued, with teachers relying more on students' feedback (70%) than on that of their colleagues (64%). Among those, the least favoured option was self-assessment opted for by slightly less than six-tenths (57%). Additionally, observation, reading research articles, and expecting compensation for skill development were mentioned as ways to gauge assessment competency (Table 7).

Variables	Frequency Number	Per cent
Participating in professional events (workshops, training sessions, conferences, etc.)	77	77
Self-reflection (reflecting on one's own behaviour, attitudes, or beliefs in a particular situation)	76	76
Seeking feedback from students	70	70
Seeking feedback from colleagues	64	64
Self-assessment (reflecting on one's own performance or abilities in a particular area)	57	57
Other	7	7

***Table* 7: Methods used by Tashkent HEI teachers to assess their own assessment competency**

Regarding training and formal courses related to assessment, 65% of respondents had received some training. Among them, 25.8% felt a very high impact (71-100) on their assessment practices, while equal figures were reported for moderate (51-70) and some (31-50) influence. A small percentage (11.4%) rated their training as having low influence. Finally, the most popular courses were MALT and PGcert offered by WIUT (27.7%), followed by Webster University (4.5%) and British Council (9.1%). Surprisingly, only 3% obtained assessment knowledge during pre-service studies or abroad (Table 8).

Variables	Category	Frequency Number	Per cent
Experience in undertaking any formal training/course related to assessment competency	Yes No	65 35	65 35
The effect training had on assessment competency (70 responses)	0-30 responses 31-50 51-70 71-100	8 22 22 18	11.4 31.4 31.4 25.8
Type of training and where accomplished	MALT/PGcert at WIUT: Assessment Matters Module	18	27.7
	British Council Training	6	9.1
	Online courses (Coursera, World Bank, etc.)	5	7.6

Webster University	3	4.5
Pre-service part of the course	2	3
ERASMUS + CACTLE project	2	3

***Table* 8: Training in Assessment: Experience, Impact and Types**

Discussion and Implications

The quantitative analysis provided valuable insights into the impact of teacher's assessment competency in encouraging active learning among learners of HEIs in Tashkent. Despite diverse age groups and educational backgrounds, the sample lacked gender diversity, likely due to teaching being more popular among females in Uzbekistan. Most respondents were middle-aged with Master's degrees, teaching various modules.

The participants demonstrated a proper understanding of formative and summative assessments, recognizing their correlation and the transparency they bring to students' achievements (Fasih, Shamim, & Ali, 2019, p117). This balanced perspective could enhance learner engagement. HEI teachers view summative assessment as a means to evaluate student learning and achievement at the end of a course (Bloom, 1969, as cited in Shuichi, 2016, p81). However, it is seen as assessment-based data by a minority, suggesting a need for more training to strengthen assessment competency. Formative assessment, on the other hand, is viewed as a private concept focused on providing tailored feedback to enhance student learning (Wiliam & Thompson, 2008, p71; Lumpkin, Achen, & Dodd, 2015, p131; Adkins, 2018, p39).

The respondents' own definitions of teacher assessment competency proved to be diverse and ranged from possession of knowledge and skills to having the ability to design and implement assessments to provide constructive feedback and identify areas for improvement. The fact that some teachers admit their lack of understanding of the concept reinforces the need to encourage teachers to seek training opportunities. As stressed in various findings (Lumpkin, Achen and Dodd, 2015, p131; Adkins, 2018, p39), with teachers' reluctance to learn about it or unintentional ignorance, no significant contribution to students' learning via diverse means is likely to happen.

According to participants, their assessment competency has a moderate to strong impact on encouraging active student learning, leading to increased student responsibility, self-assessment, and peer assessment. These align with principles supporting self-regulated learning (Nicol & Macfarlane-Dick, 2006; Viegas, Alves, & Lima, 2015, pp930-934). Teachers' expertise in assessment alone may not effectively promote student learning involvement. While some teachers attributed assessment competency to increased marks, most value the benefits of formative assessment over summative (Smith et al., 2013, pp23-24). Other suggestions given by the participants, promoting deeper engagement with a subject and higher incentives to study. This could be achieved by incorporating diverse assessment techniques and strategies.

To promote active learning during seminars, respondents utilize techniques such as group projects, peer reviews, self-reflection, and case studies, reflecting their appreciation for collaborative and formative assessment (Offerdahla & Tomanek, 2011, p792; Weurlander et

al., 2012, p759). Resource constraints and a preference for standardized summative assessments may explain the relatively lower use of techniques like presentations, quizzes, and portfolios. Similarly, techniques such as minute papers, surveys, checklists, peer teaching, debates, and problem-based learning were rarely incorporated, possibly due to limited training and resistance to change. These findings align with existing literature highlighting the benefits of combining various assessment tasks to support student learning (Offerdahla & Tomanek, 2011, p792; Weurlander et al., 2012, p759).

The respondents demonstrated adherence to several essential principles for promoting active learning. These principles include providing constructive feedback, eliciting student feedback, and developing self-assessment (Nicol & Macfarlane-Dick, 2006). The emphasis on these principles suggests that teachers recognize the value of constructive feedback in deepening student understanding and establishing a reciprocal learning environment. Developing self-assessment not only personalizes students' learning but also fosters a growth mindset, increased awareness of teaching strategies, and accountability for learning outcomes. However, the relatively low emphasis on encouraging self-esteem, uplifting motivational beliefs, and delivering high-quality information about student learning may indicate a need for additional professional development courses in these areas. Further research is necessary to explore the underlying reasons for these lower figures. With targeted professional development, teachers could significantly benefit and enhance their practices in these aspects.

Teachers in the survey evaluated their assessment competency using various methods, including attending professional events, engaging in self-reflection, and seeking feedback from students and colleagues. The preference for attending events and self-reflection highlights the significance of ongoing professional development and introspection in developing assessment practices. Surprisingly, respondents relied more on student feedback than on feedback from colleagues, possibly due to their direct interaction with students and a student-centred approach that values different perspectives and student involvement (Trumbull & Lash, 2013, p2). However, incorporating student feedback into assessments requires teacher training. The low selection of self-assessment as a method may be attributed to teachers' lack of knowledge and confidence in assessing their own competence. Further research can explore the reasons behind these findings, which may include factors such as teacher compensation and motivation to improve assessment skills (observation, reading research articles, etc.).

Finally, around two-thirds of the respondents in the survey had received assessment-related training, with just over a quarter of them reporting a moderate to very high impact on their teaching (Offerdahla & Tomanek, 2011, p792; Weurlander et al., 2012, p759; Lumpkin, Achen, & Dodd, 2015, p131; Adkins, 2018, p39). This suggests that teachers have ample opportunities for professional development and motivation to engage in training and courses, although there is room for improvement. The popularity of courses such as MALT and PGcert offered by WIUT indicates their potential as models for other programs to replicate best practices. However, the limited acquisition of assessment-related knowledge during pre-service studies highlights the need for HEIs to evaluate teachers' assessment literacy during recruitment. To address this, the Ministry of Higher Education should establish mandatory core modules at the state level to raise teachers' awareness of modern assessment practices.

Limitations

In this study, several limitations were encountered that may affect the generalizability and depth of the findings. Firstly, the dominance of female MA degree holders in the sample introduced potential biases, limiting the representation of diverse perspectives related to gender. Additionally, the low participation of male subjects further exacerbated the lack of gender diversity within the study. Another limitation relates to the regional context of Uzbekistan, as the extensive nature of the modules taught by the respondents may restrict the applicability of the findings to other regions or educational contexts. Moreover, the reliance on self-reported data poses a potential source of bias and inaccuracies in the results, as participants' responses may not fully reflect their actual assessment practices. Furthermore, the study did not delve deeply into the reasons behind the low indexes observed for several principles of promoting students' active learning, leaving room for further investigation. The research also missed the opportunity to gain an insightful understanding of the rationale behind the respondents' selection of assessment techniques and strategies. Another limitation stems from the survey format employed in data collection, which may have constrained the depth and richness of information that could have emerged from alternative methods such as interviews, focus groups, or observations. Lastly, the study did not specifically examine the effectiveness of the training courses and professional development activities attended by the respondents, which could have provided valuable insights into their impact on assessment practices. These limitations highlight the need for future research to address these gaps and enhance the comprehensiveness and validity of findings in this area.

Conclusion and Recommendations

In conclusion, the current study analyzed teachers' understanding of assessment competency and its impact on students' active learning in HEIs in reference to Uzbekistan. It has been revealed that the respondents, on the whole, demonstrated a pertinent understanding of both forms of assessment and asserted that there is an obvious correlation between them leading to a higher degree of transparency in students' achievements. While summative assessment is majorly seen as a way to evaluate student learning and achievement at the end of a course, the formative assessment is majorly considered as a means of providing feedback to enhance student learning, tailored to their needs and the learning process. Teacher assessment competency lacks a comprehensive picture and is viewed as a diverse quality ranging from possession of knowledge and skills to having the ability to design and implement assessments to provide constructive feedback and identify areas for improvement. The major finding of this study, being interpreted as a means conducive to increased student responsibility, better self-assessment and peer review, suggests that Tashkent HEI teachers' assessment competency had a moderate to strong impact on encouraging their students' active learning. The research also revealed that the most widely integrated techniques to promote active learning are group projects, peer reviews, self-reflection and case studies, while the diversity of principles spread over providing feedback, eliciting student feedback, developing self-assessment, improving performance and facilitating dialogue. HEI teachers predominantly rely on competency by attending events, self-reflection, and student feedback to gauge their own competency in assessment. Finally, while most teachers have obtained related to assessment training, a sizable majority recognize little impact on their practices and expect additional opportunities to augment their knowledge and skills, and thus fill in those gaps.

The results derived in this research are open to criticism and require further refinement. However, relying on the current understanding of the investigated domain, revealed results

and reviewed literature, several actionable recommendations along with responsible parties for their implementation are outlined below:

1. HEI Research departments should replicate the research by employing a larger, more diverse sample to enhance generalizability and triangulate data to gain deeper insights by conducting interviews or observations in addition to surveys.
2. The Ministry of Higher Education and HEI administrations should provide mandatory formal training on assessment for all HEI teachers being recruited.
3. Teacher training centres and HEI administrative staff should offer ongoing professional development opportunities on formative and summative assessment.
4. HEI Research departments should examine the impact of different training programs on developing assessment literacy and investigate the impact of teacher assessment competence on student learning outcomes (e.g. engagement, motivation or achievement).
5. Department heads should promote collaborative learning and peer observation among teachers.
6. The Ministry of Higher Education and HEIs should integrate compulsory core modules on assessment in all pre-service teacher education programs.

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Using Power Tools to Automate and Scale Personalized Feedback to Learners

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Abstract
A critical strategy of motivating students and improving performance in higher education is communicating timely and personalized feedback (Koenka et al., 2019). The language used to deliver students' progress and what specific intervention can support their learning is hugely impactful especially for students who are struggling. This can also be challenging for the academic community to implement when lecturing to large cohorts of year 1 students. This paper presents how the learning analytics team in ATU Galway have developed a data pipeline to ensure students receive appropriate and personalized feedback on their progress in year 1 Science and Computing modules. This work initially began with the DANIEL project in 2015 which employed a semi-automated process and has evolved to a streamlined automated process embedding the tools of the MS Power environment. This research output is the result of a close collaboration with academics, researchers and the Computing Services team transforming Moodle data into meaningful information and insights for students. The step-by step process of how this is achieved using Power Apps (lecturer interface for feedback and progress thresholds), Power Automate to trigger large scale communication, Power BI (visualization of cohorts' performance). Learners have engaged as partners in the development at each phase of the process and their experiences of this transformed digital learning feedback systems are explored.

Keywords: Data Analysis, Students, Automate, Power Bi, Feedback, Personalized, Education

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Introduction

Feedback on assessment and course deliverables to students has been shown to be vital in their success (Faulconer et al., 2022). Research shows that effective feedback does not benefit only the students but provides constructive feedback for the teachers or lecturers as well (Obilor, 2019). Students learn more effectively when they receive clear guidance on how they can improve (Mag, 2019) and they also have diverse needs, which makes it important that feedback systems are designed to meet these diverse and personalised learning needs (Henderson et al., 2021).

There have been limitations and challenges with giving face to face feedback considering the time commitment and volume of students who need this, technology assisted feedback has gained a lot of momentum in recent years (Lopes et al., 2018). The challenges presented by Covid in 2020 created opportunity when educators were required to adopt virtual learning tools as new modalities for providing feedback to students (Carby, 2023).

However, creating feedback virtually presents different challenges, which include high workload associated with providing this feedback regularly to numerous students (Paris, 2022) and time constraints associated with disseminating personalized feedback (Michael et al., 2019). The challenges with dissemination of feedback have spurred on an interest in experimenting with latest technologies like the Microsoft Power Tools to discover how best technology can be leveraged to mitigate these challenges while providing useful personalized feedback at scale to students. This renewed interest has motivated our research. The research team are also motivated to uncover the reasons for low engagement and subsequent dropout in higher education especially in computing modules (O'Brien, C. 2022).

Methodology

In developing a data pipeline for personalized and appropriate feedback using power tools, relevant learner data is collected and processed and cleaned to be suitable for learner feedback format. Data that has been used for this study was extracted from the virtual learning environment Moodle. Eight columns were selected for building the automated system pipeline which are presented in Table 1.

Column	Description	Data Type
Average Grade	Grade scored for the math module.	Numeric values.
Interactions	Interactions count from log files based on Moodle interactions.	Numeric value.
Journal Score	Score of student participation in journal classes (designed to encourage students work together and practice topics under guidance).	Numeric value
Quiz Scores	Score of students during their quizzes.	Numeric values.
Journal Attendance	Gives a percentage of student journal attendance rate.	Numeric Value.
Lecture Attendance	Gives students general lecture attendance rate. .	Numeric value
Name	Student name for identification and personalization.	String Value.
Email Address	Student's email, unique identifier to the student registration numbers for sending personalized emails.	String values.

Table 1: Moodle data columns used for personalised feedback

Two methods were employed based on the data we have:

Method One: Jupyter and Power Automate Pipeline

The following are steps followed using this method:

Data Cleaning & Preparation: At this phase data is cleaned and formatted for analysis to avoid errors. This is achieved by replacing missing values with a specific value or getting rid of it altogether. Data extracted from Moodle is loaded into a Jupyter Notebook environment where Python code is activated to automatically clean the imported data.

- **Comment Generation:** Once the data is cleansed and formatted, another Python script is activated to loop through the selected columns and output new columns that contain unique comments for the students based on values the script identifies in the columns. Python conditional statement is used here to assign different comments to different column score values. The code presented in figure 1 illustrates how a student with a low score are encouraged and offered further support.

```
for i in range(data.shape[0]):
    #Journal
    if data['Journal_score'][i]>=4.5:
        data.loc[i,('journalcomment')]+="Your Total Journal score was way above the average. Way to go! Keep it up."
    elif data['Journal_score'][i]>=2.5:
        data.loc[i,('journalcomment')]+="Your Total Journal score was above average.
        "Good one, keep trying hard to complete all journals."
    elif data['Journal_score'][i]<2.5:
        data.loc[i,('journalcomment')]+="Your Total Journal performance was below average.
        "..We know that maths could be challenging, but we believe that with consistent and frequent work you can
        "..achieve better outcomes."

    #Quiz
    if data['Quiz_score'][i]>4:
        data.loc[i,('quizcomment')]+="You performed well above average on your Quizzes. You should be happy! Keep it up"
    elif data['Quiz_score'][i]>=2.5:
        data.loc[i,('quizcomment')]+="You performed above the average score for your quizzes,however mastery requires
        ".. repetition until can't get it wrong."
    elif data['Quiz_score'][i]<2.5:
        data.loc[i,('quizcomment')]+="Your performance on the Quizzes was below average. We believe you can achieve maste
        "..if you try to put in more effort, we can support you."

    #Attendance
    if data['Lecture_attendance'][i]>=70:
        data.loc[i,('attendancecomment')]+="Your attendance rate has been great this semester. Keep it up"
    elif data['Lecture_attendance'][i]<70:
        data.loc[i,('attendancecomment')]+="You need to attend your classes often to improve your attendance score"

    #Interactions
    if data['interactions'][i]>=690:
        data.loc[i,('interactioncomment')]+="Our systems show you are interacting very well with Moodle.
        "That is a good habit. Keep it up"
    elif data['interactions'][i]>200:
        data.loc[i,('interactioncomment')]+="Our systems show your level of interaction with moodle is below average.
            "Evidence shows that students who interact frequently with the online materials perform well in the module."

    elif data['interactions'][i]<=200:
        data.loc[i,('interactioncomment')]+="Our systems show you have not been interacting with moodle that much.
        "We hope everything is okay? Let us know how we can help you through the feedback form"
```

Figure 1: Comment Generation using Python Script

- **Secure Data Transfer through API:** As soon as the script for comment generation is run and complete in the Jupyter/Python environment, then all the newly generated data is securely transferred to the Microsoft Power environment where the power tools of flow can be applied to send unique feedback to students.

A new flow was created in Power automate. A simple flow that simply receives a HTTP request and sends an email is created as shown in Figure 2.

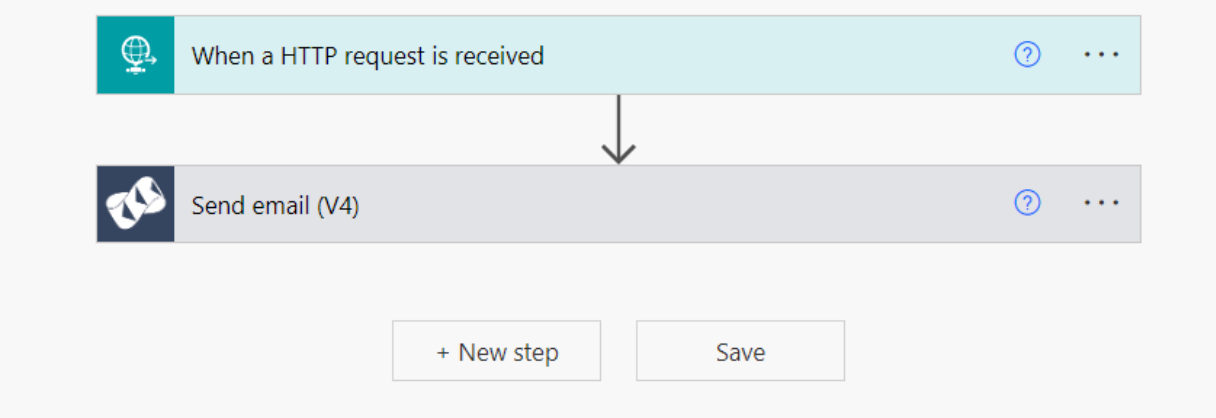


Figure 2: Power Automate Flow Steps

Data from the Jupyter environment is pointed to the URL generated by the "when a HTTP request is received" step of the above flow. Data is sent from the python environment using the requests package in a script as presented in Figure 3.

```
import requests
count=0
url='
for i in result_loads:
    headers = {'Content-type': 'application/json', 'Accept': 'text/plain'}
    r = requests.post(url, data=json.dumps(i), headers=headers)
    print(r)
    count+=1
print(str(count) + ' emails sent out via script.')
```

Figure 3: Connecting Data through API from Jupyter Environment

The URL link from Microsoft Flow created must be in the space in red for the data to move correctly and a description of the data schema coming through the API was made in the Power Automate environment. A successful connection leads us to the next stage in Pipeline which is Email design/dispatch.

- **Email Design/Dispatch:** Before the email is sent through activation of Python script, an email template is created in the Power Automate environment. All data coming through are held in variable names, this includes the unique comments for each student based on their performance earlier generated in the Jupyter/Python environment.

A template is presented in Figure 4.

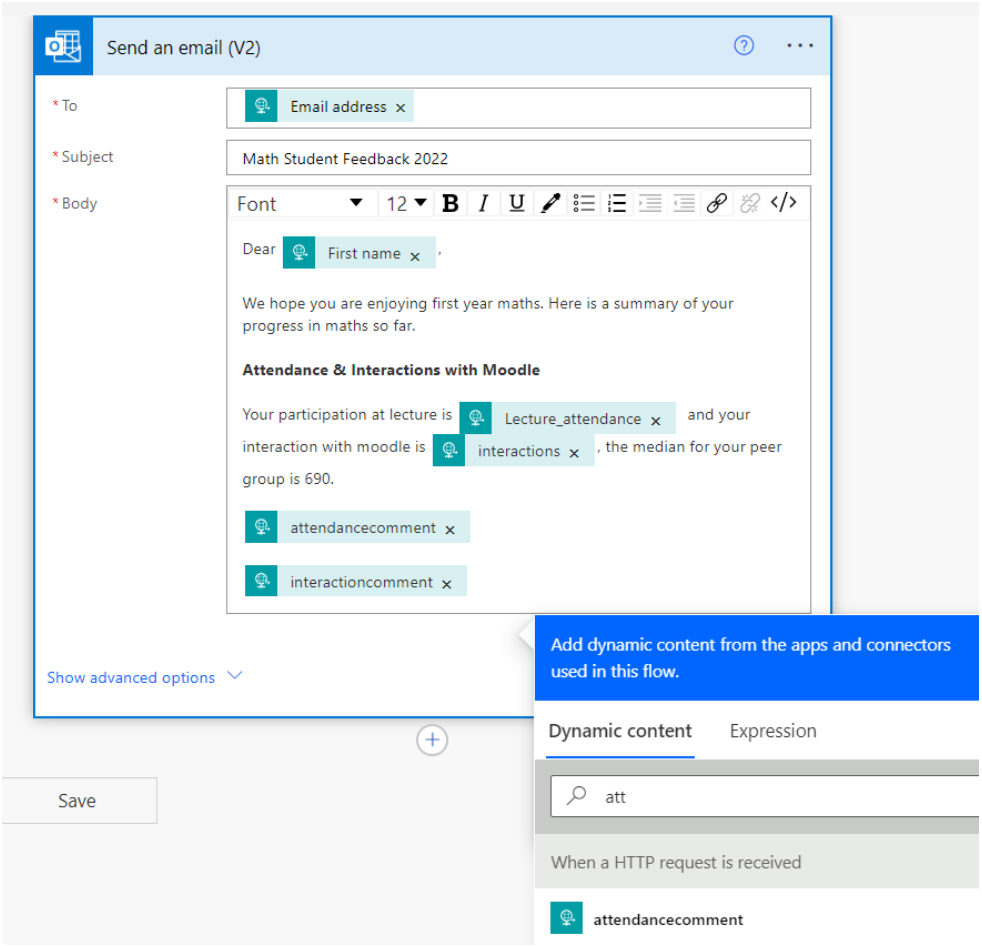
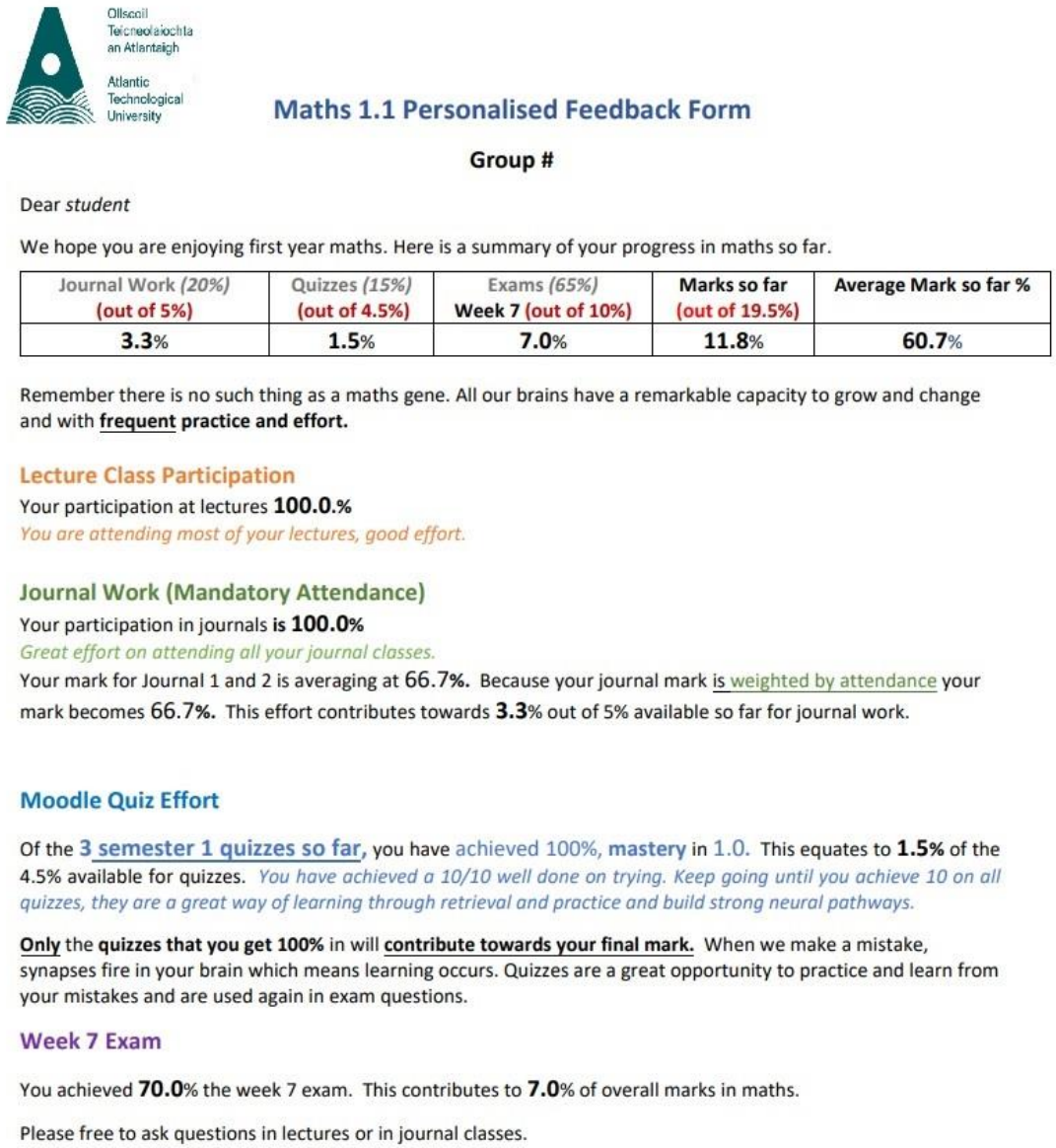


Figure 4: Email Template design

The dynamic content from the schema set in the first flow step is generated from the template. Additional edits can be made here to for the email edited to the correct format for the lecturer's preference.

Once it is satisfactory, the email is dispatched by activating the python script through the terminal and the email template is sent out with unique comments coming through for every student, personalized to their performance but taking this general template structure.

A sample email sent is shown in Figure 5.



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Atlantic Technological University

Maths 1.1 Personalised Feedback Form

Group #

Dear *student*

We hope you are enjoying first year maths. Here is a summary of your progress in maths so far.

Journal Work *(20%)* (out of 5%)	Quizzes *(15%)* (out of 4.5%)	Exams *(65%)* Week 7 (out of 10%)	Marks so far (out of 19.5%)	Average Mark so far %
3.3%	**1.5**%	**7.0**%	**11.8**%	**60.7**%

Remember there is no such thing as a maths gene. All our brains have a remarkable capacity to grow and change and with **frequent practice and effort.**

Lecture Class Participation

Your participation at lectures **100.0.%**

You are attending most of your lectures, good effort.

Journal Work (Mandatory Attendance)

Your participation in journals **is 100.0%**

Great effort on attending all your journal classes.

Your mark for Journal 1 and 2 is averaging at 66.7**%.** Because your journal mark is weighted by attendance your mark becomes 66.7**%.** This effort contributes towards **3.3**% out of 5% available so far for journal work.

Moodle Quiz Effort

Of the 3 semester 1 quizzes so far, you have achieved 100%, **mastery** in 1.0. This equates to **1.5%** of the 4.5% available for quizzes. *You have achieved a 10/10 well done on trying. Keep going until you achieve 10 on all quizzes, they are a great way of learning through retrieval and practice and build strong neural pathways.*

Only the **quizzes that you get 100%** in will **contribute towards your final mark.** When we make a mistake, synapses fire in your brain which means learning occurs. Quizzes are a great opportunity to practice and learn from your mistakes and are used again in exam questions.

Week 7 Exam

You achieved **70.0**% the week 7 exam. This contributes to **7.0**% of overall marks in maths.

Please free to ask questions in lectures or in journal classes.

Figure 5: Sample Email sent using Method one

Method Two: Jupyter /PowerApps Pipeline

This method uses PowerApps to achieve the outcomes of method 1 within an end-to-end application that can easily be used by academic staff.

This method explores the use of PowerApps platform combined with cleaned data from Jupyter notebook for the same purpose. The PowerApps platform enables anyone create custom apps.

This would allow more flexibility for educators to set their own thresholds or edit the personalized comments they want to make without having to worry about all the computational processes.

This idea was tested on a small sample dataset with three columns “Email, name and score”. The steps taken were as follows:

Data Cleaning and Preparation: Here the demo data used was formatted using Jupyter notebook to the Power App. The advantage of the PowerApps over the previous method is that it is a lot easier to directly connect a dataset to the Power App.

Comment Generation: The comment generation using PowerApps is different as it achieved in the Power environment rather than within Jupyter notebook. A simple click of a button in the PowerApps after relevant scores and comments have been added to the app enables an academic staff member set thresholds and comment fields. Some of these comments are prepopulated based on best practice in student feedback as illustrated in Figure 6

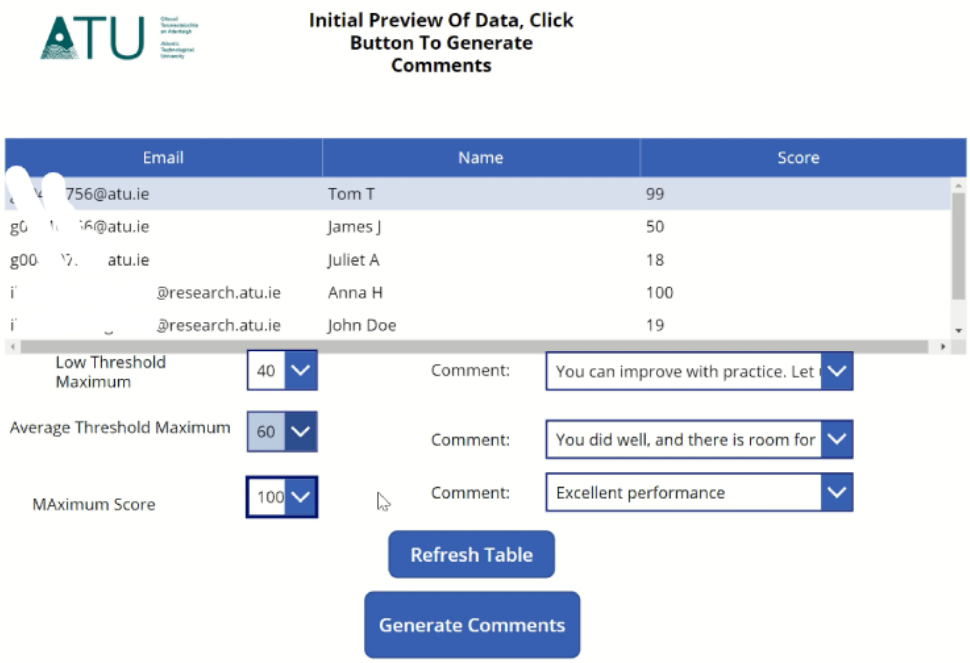

Figure 6: Power Apps initial screen

Once the generate comments button is clicked, the application proceeds to the next screen where a preview of the new column added to the table is generated as shown in Figure 7.

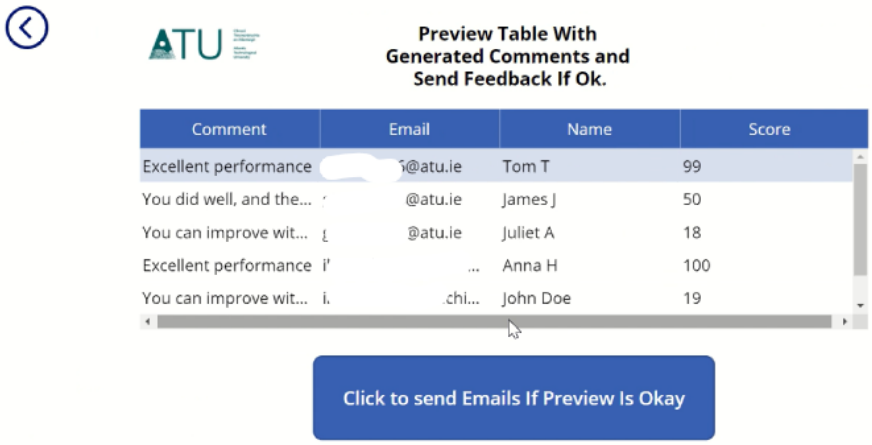

Figure 7: Power Apps Comment Generation Preview Screen

This leads on the next step.

Email Design/Email Dispatch:

The email design for this method is similar to method 1 as the "Click to send Emails if Preview is Okay" button shown in Figure 7 above triggers a Power Automate flow designed as presented in Figure 8.

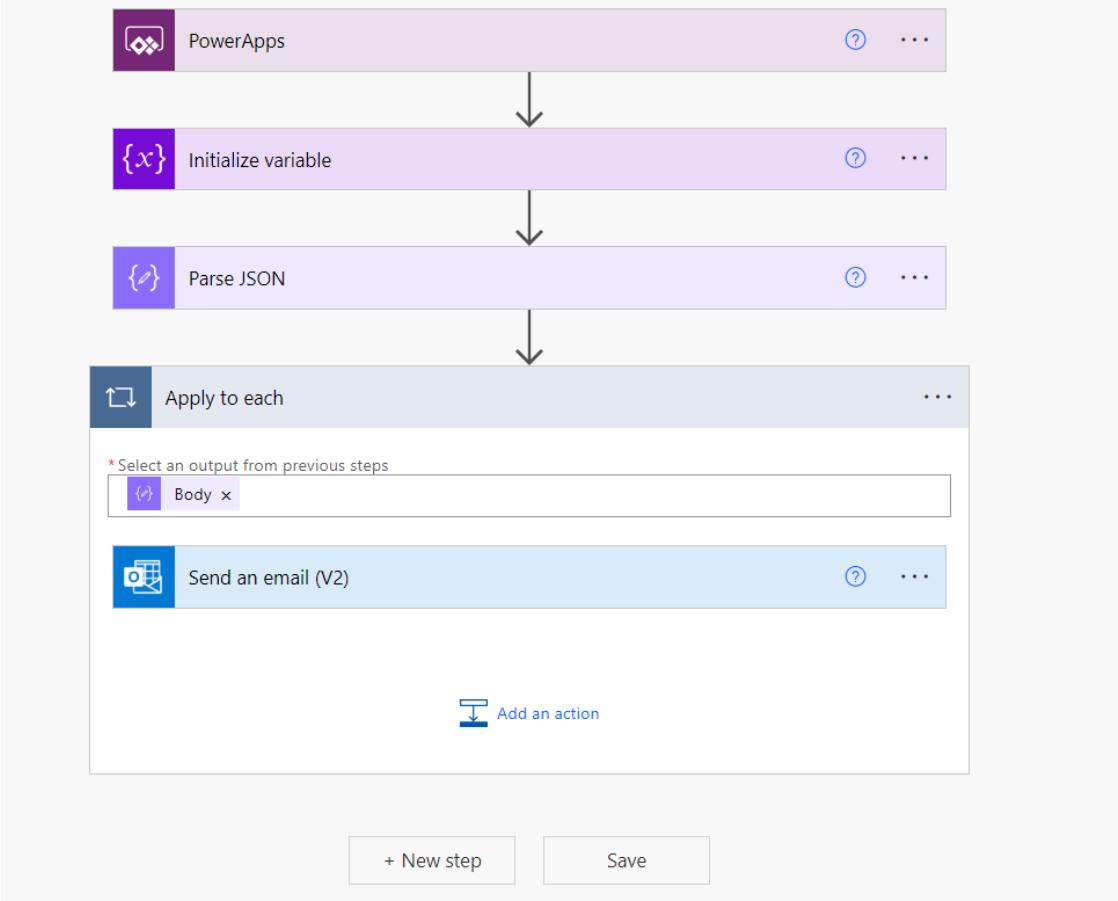

Figure 8: Power Automate Flow connection from PowerApps.

In the flow steps, data with comment generated from app is handled using the initialize variable step. Variables are used for storing and managing data from PowerApps. However, because the initialized variable contains all the data from the table and personalized feedback is to be sent to each component of the stored variable, the Parse JSON step was used to break down the stored variable in specified structure presented in Figure 9:

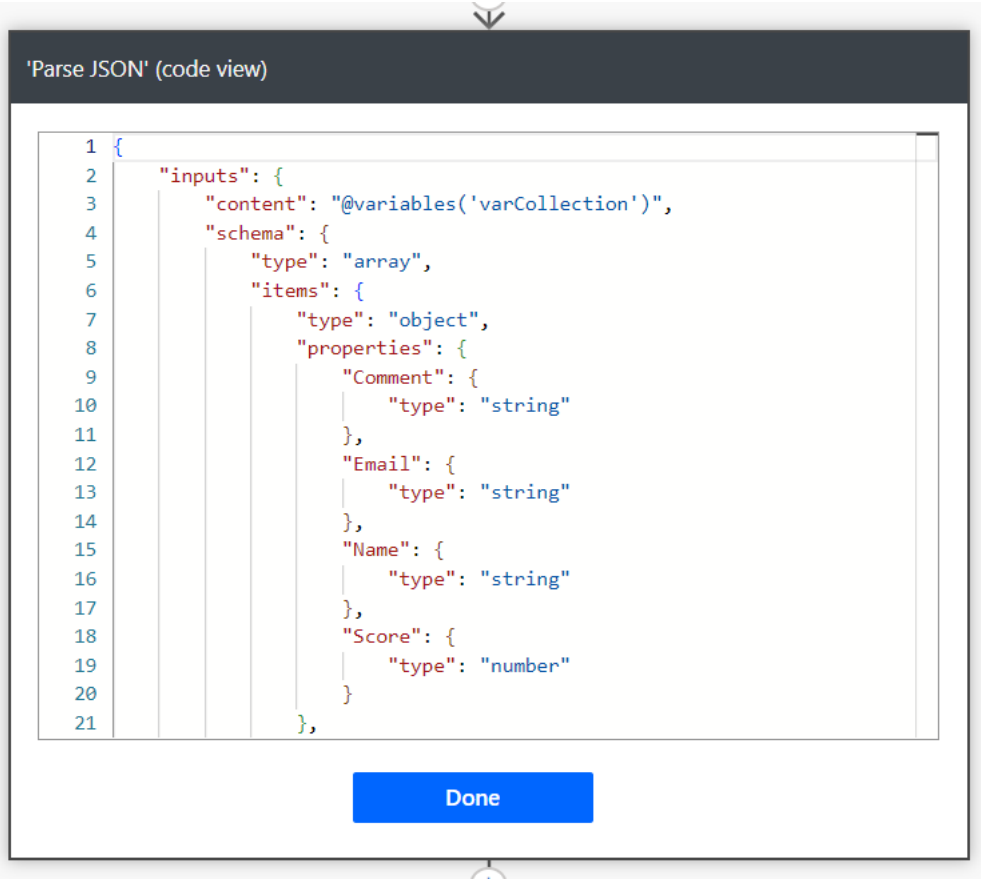

Figure 9: Parse JSON step for PowerApps button

This defines the properties of initialized variable data and enables data to be broken down into individual observations.

The next step in the flow process now sends an email to each observation from the parsed JSON step and email template for this testing purpose is shown in Figure 10.

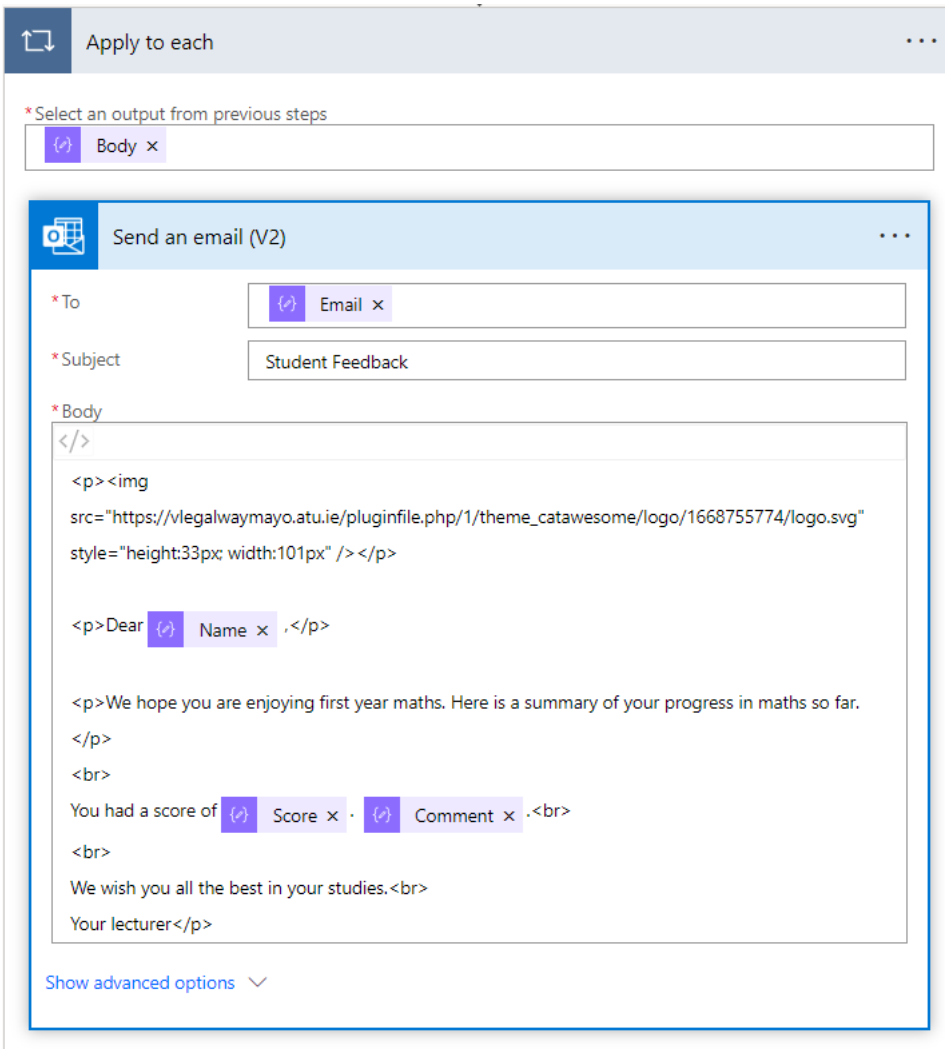

Figure 10: Email template for method two

Once the template is completed, the button configuration is saved and on clicking the button from Power Apps, the following screen appears as illustrated in Figure 11 confirming to the academic staff member confirming that the personalized feedback emails have been sent to the students.

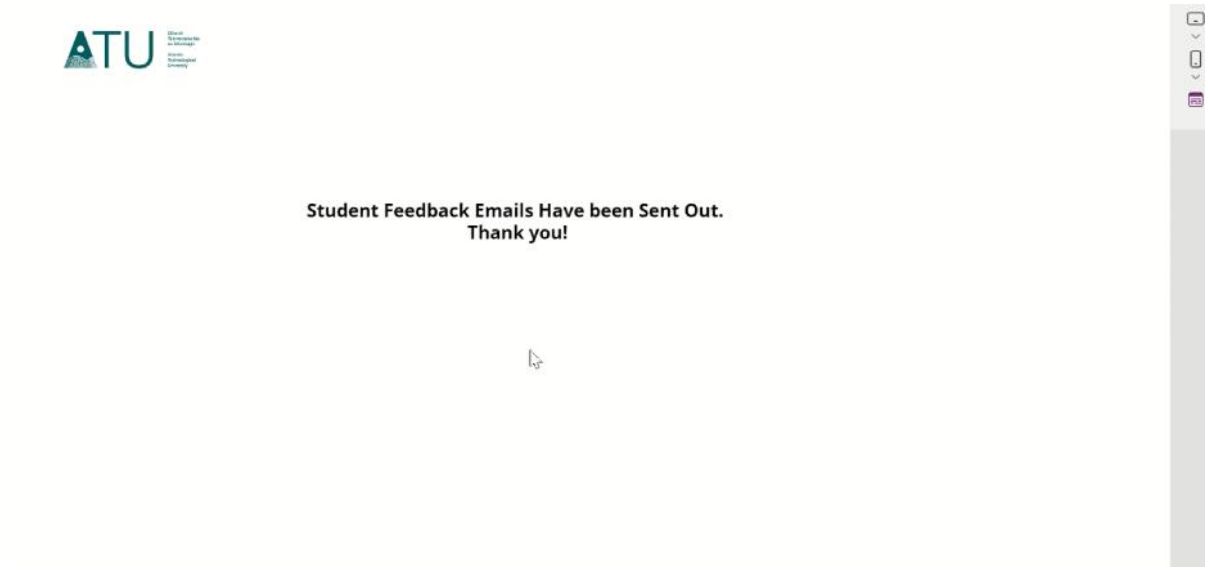

Figure 11: End Screen on PowerApps

Sample test email sent out using the second method is shown below:

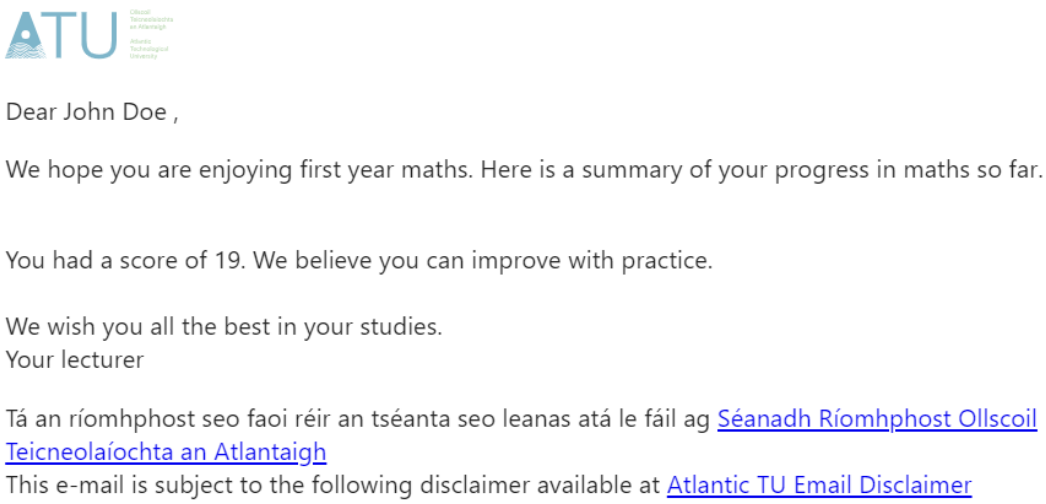

Figure 12: Sample test Email Sent out from pipeline two.

Results

We had earlier sent out to the feedback to 207 students who were consented partners in the research. To follow up students were asked for feedback on how they felt about the personalized feedback they received. Responses presented in Figure 13 showed that 93% of respondents found this feedback very useful.

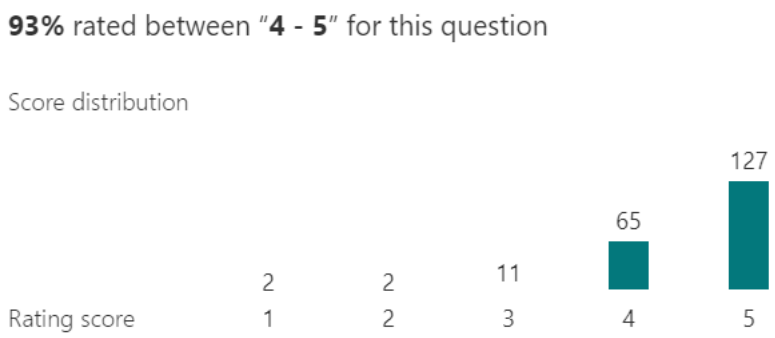

Figure 13: Students' perceived usefulness of personalized emails

The majority of the students (82%) also preferred this mechanism to receive feedback. The word cloud in Figure 14 identifies email as the preferred communication tool. Students also valued in person communication.

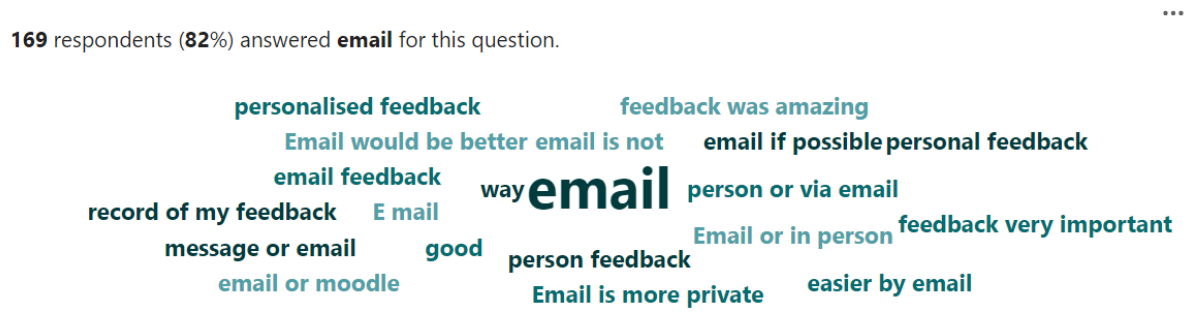

Figure 14: Word Cloud showing feedback method preference.

There were some interesting comments from qualitative data coming through the students on feedback preference as shown in Figure 15:

144	[redacted]	By email, you can look at it in your own time and its less intimidating.
119	[redacted] IY	I think the email is detailed enough for an objective topic like maths, but if we had more subjective assignments/exams like essays, I feel like in person feedback could be more constructive.

Figure 15: Random Student comments on feedback preference

Conclusion

This research highlights the potential of using power tools suite to automate and scale personalized feedback to learners. It also shows that leveraging technology to provide this feedback is welcomed by students who find it useful receiving feedback. This system also makes it a lot easier for educators to send customizable and personalized feedback to large student cohort in much shorter time than they would have used if they were to do it manually.

Acknowledgements

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Social Factors that Facilitate the Online Collaborative Activities of Global Distributed Teams

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Abstract
With the ever-growing presence of online collaborative learning spaces, research on how to develop international global environments to facilitate learning has become increasingly important. Unfortunately, quantitative research is somewhat limited in exploring which specific factors contribute to student satisfaction with international collaboration online learning activities (ICOLAs). The issues of this gap in the literature are a lack of clarity on how students engage with ICOLAs and which specific factors predict student satisfaction outcomes. This study explores the relationships between common constructs identified from prior research and satisfaction with ICOLAs. Trust, cohesion, commitment, and social presence measures were completed by 35 students in separate educational technology courses facilitated by two separate universities located in different countries—collection occurred over the span of three semesters. Results of a Bayesian multiple regression analysis revealed that about 66% of the student variability in satisfaction with online learning environments is accounted for by the trust, cohesion, commitment, and social presence variables along with age and gender. Cohesion and commitment both increased satisfaction with ICOLAs with a posterior probability greater than 97.5%. These findings illuminate the importance of building trust between interaction partners in ICOLAs, which suggests that international program partnerships should focus on creating friendships, increasing immediacy in online interactions, and building social presence.

Keywords: Online International Collaboration, Global Distributed Teams, Online Learning, Trust, Cohesion, Commitment, Social Presence, Satisfaction

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Introduction

Today's universities operate in extended ecosystems that are no longer constrained to the on-campus physical landscape. Instead, university administrative services, instructions, courses, and entire programs, are increasingly located in the internet cloud. Given this, students and faculty are becoming more experienced with collaborative work, and scholarship increasingly relies on worldwide access to knowledge. Consequently, the success of university students is increasingly dependent on their ability to navigate, access, evaluate and analyze the internet's information landscape.

As higher education becomes increasingly immersed in cloud-based information and learning, new opportunities are emerging for understanding and benefiting from national and international perspectives. Educators are also looking at ways eLearning (a term used for online learning practices) can advance student's cultural understanding and global perspective. In describing strategies for developing a new generation of world class learners with these attributes, Yong Zhao (2010) identifies four primary challenges for educators: 1) understanding and harnessing entrepreneurial spirit, 2) fostering student autonomy and leadership, 3) championing inventive learners, and 4) developing global partnership and resources. The social-psychological factors within these challenges are where much research needs to focus for further development.

The current investigation addresses Zhao's fourth challenge for developing international partnerships and resources. More specifically, we seek to understand students' experiences with online collaboration international learning activities, as well as to understand the social factors that contribute to students' satisfaction with successful online collaborations between international educational institutions. We draw on a review of relevant literature on what factors make successful face-to-face collaborations as well as personal experience in applying information technologies to international collaborative activities with students.

While the evolving technologies provide increasing flexibility and affordances, we have found that the underlying factors that contribute most to the success of the collaborations are social, psychological, and pedagogical. Amongst these factors, which are explicated further below, are trust, commitment, cohesion, and social presence. The current analysis seeks to explore the unique contributions of these factors to student's experiences with international collaboration online learning activities, with the goal that the findings will illuminate guidelines for institutions on where to focus their program development efforts.

The General Development and Importance of Institutional Partnerships

One of the first considerations in developing an international collaboration among students within similar courses is to establish effective institutional collaborations (Campana et al., 2019; Crites et al., 2022). In an investigation of successful international partnerships and relationships, Heffernan and Poole (2005) found that the most critical success factors are 1) the development of effective communication structures, 2) building mutual trust and encouragement, and 3) a demonstrated commitment by the partners—these findings are substantiated by more recent research as well (see Cerver Romero et al., 2021). Further practices that contribute to successful partnerships were identified in a report by the American Council on Education (2015) as: 1) establishing transparency and accountability, 2) encouraging faculty engagement, and 3) maintaining quality and institutional leadership and support.

Leveraging and expanding international relationships has been mandatory for higher education institutions—in order to compete in the global arena, institutions must have the capacity for international collaboration. In the United States and globally, institutional higher education partnerships have been the focus of several pioneer organizations, such as the American Council on Education (Insights, 2015). Researchers such as Altbach and Knight (2007) and Berchin et al. (2021) state that internationalization, the expansion of institutions toward international outreach, is a "central force" of higher education institutions. Moreover, several higher education institutions have set forth efforts to increase and expand the diversity of their student population and increase international popularity —using strategic planning which involves a greater focus on international marketing and partnerships with private education companies, institutions have sought to increase the number of international students (Alanazi, 2016a; Bruhn-Zass, 2022). The growth of advanced technology and collaborative strategies is impacting educational institutions and, internationalization is being positively affected by human and relational capital (Hitt et al., 2006; Huang et al., 2022).

As a final note on the general approach of international collaboration, it is important to consider that structural barriers may play a role in preempting beneficial international collaboration in educational settings. For example, international collaborations are especially influenced by temporal communication affordances because participants are often in different time zones and on different schedules, requiring adjustments in reference to using synchronous or asynchronous communication. Although learning in a synchronous environment has several advantages, the time zone disadvantage is frequently noted in this area (Vutborg et al., 2011). While asynchronous communication allows learners with different native languages and cultures to be more reflective (Ellis, 2001) and generate responses at their own pace (Holmberg et al., 2005), yet Mackay (1988) and Soucek and Moser (2010) argue that asynchronous communications can often result in "information overload," creating its own set of issues. Finally, given the shift in technology usage over the past twenty years, one must consider that access to media rich technologies can dramatically enhance the international collaboration format. Learners can create and analyze imagery much faster than words (Galloway, 2017), so development of image-based social media, such as WhatsApp, can encourage image-based learning in international collaborative activities.

Social Learning Theory: The Value of Study Groups

Upon the development of international collaboration between institutions, if technological and structural barriers are surpassed, it becomes critical to understand what unifies students at the course level. Broadly speaking, Thomas and Brown (2011) claim that educational theories have long been limited by remnants of a Cartesian view of learning where "higher authority" teachers pour knowledge into the minds of "lower authority" students. These direct instruction approaches are beginning to give way to more constructivist views of learning, although some "flipped classroom" designs still utilize a teacher-centric model where knowledge is "poured" into student through videotape lectures (Akçayır & Akçayır, 2018; Divjak et al., 2022; Senali et al, 2022; Sointu et al., 2023). In essence, constructivist theories describe learning as an interactive process with students gathering information from a wide range of sources, organizing, analyzing and formulating hypotheses throughout the process. Bandura's Social Learning Theory (Bandura, 2015) and Vgotsky's Social Development Theory (Vygotsky, 1978) extend constructivist notions by including other individuals in the social environment in the active learning process (Alanazi, 2016b). Thus, learning, under constructivist models, is facilitated when a group collaborates via observation, imitation, and modeling, allowing learners to collaborate in the co-construction of meaning (Roschelle,

1992). With advances in technology, constructivist approaches use a similar approach, albeit through different technological means. For example, as a means to the co-constructed meaning, constructivists have suggested that modern learners engage in Digital Storytelling activities (Stargatt et al., 2022). During Digital Storytelling, the learners create knowledge artifacts that can be expressed using a variety of digital multimedia, such as images, audio, and video educational tools (Addone et al., 2022). These artifacts serve as culminating reflections on what all group members have learned.

Brown and Adler (2008) point out that the idea of forming effective study groups is critical to academic success. They draw on the seminal work of Richard Light (2004) who, after 10 years of investigating the factors that contributed to success in Harvard university students, found that one of the strongest determinants for success in higher education was the students' ability to "form and participate in small study groups." Light found that students who study in groups are happier, learn more efficiently and perform better than students who study alone. In addition to facilitating learning, a vast majority of the Harvard undergraduates saw diversity as a positive benefit of learning groups. Whether the diversity was geographic, ethnic, political, religious, or economic, it was noted that this had a highly positive effect on their university experience. Although some researchers found that diversity could interfere with communication and coordination (Gibson & Gibbs, 2006; Krumm et al., 2013), diversity is often portrayed as having a positive influence on such factors as group effectiveness, team performance, and decision making (Gibson & Gibbs, 2006; Shachaf, 2008; Staples & Zhao, 2006; Krumm et al., 2013; Han & Beyerlein, 2016).

Social-Psychological Factors that Influence Positive Team Building

Group Cohesiveness. In understanding the factors which contribute to positive team building, one of the first considerations will be the cohesiveness of the group of interest. Mello and Delise (2015) measure group cohesion by the degree to which group members identify with one another and with their group as a whole (Carron et al., 1985; Lin et al., 2008). The more cohesive the group is, the greater the degree of knowledge sharing (Aubke et al., 2014; George & Bettenhausen, 1990; Wojciechowska-Dzięcielak, 2020). We can expect cohesive groups to demonstrate a higher degree of communication, interpersonal understanding, and creativity, which may be disrupted if group sizes are too large for facilitating effective interaction (Valacich et al., 1992). In cohesive groups, participants establish positive support networks, they negotiate meaning, identify complementary skills, learn to lead and follow, and are supportive of all members (Housel, 2002).

Cohesion may be strongly influenced by the extent to which members feel their goals and ideas overlap. In fact, collaborative partnerships are more effective when team members agree on the communication strategies, goals, and purpose of their collaboration. Groups often begin by deciding how often and how long they will communicate and the primary forms of communication that they will use. Team members often determine how often they will communicate (e.g., twice a week) by their individual schedule or time zone differences. How long the groups communicate (e.g., 3-4 months) is more likely to be determined by institutional policy and administrative schedules. For example, Latin universities often end their semester in March whereas university semesters in the U.S. often end in June. The success of collaborative partnerships is influenced by the team's ability to focus on common goals and their clear purpose (Tarricone & Luca, 2002). Suchan and Hayzak (2001) and Powell et al. (2004) state that designing and setting goals, assigning responsibility to team members, and clearly articulating goals help advance team performance and effectiveness.

Kayworth and Leidner (2000) report that effective project leaders of online teams were perceived as more effective than their counterparts who did not articulate goals or assign and plan the team tasks in advance.

Establishing Trust. Trust can play an important role in online learning environments (Shea et al., 2022), especially when constructing agreements, developing friendships, and assigning tasks in collaborative groups (Han & Beyerlein, 2016). In face-to-face communications, group members develop trust primarily through social presence and emotional processes. In online communication trust is also influenced by the communication media (Bradley & Vozikis, 2004; Coutu, 1998; De Vries et al., 2018; Han, & Beyerlein, 2016). While trust is more easily fostered in face-to-face settings (Oertig & Buegri, 2006) trust can also be established in online environments through regular communication, increasing immediacy, intimacy and interacting on a consistent basis. Whether developed in face-to-face or online settings, trust is often fragile and temporary (Armstrong et al., 2022; Abruzzo et al., 2019; Jarvenpaa & Leidner, 1998; Maznevski & Chudoba, 2000).

Group Commitment. The group members' commitment to teams' goals contributes to overall satisfaction in online teams (Lin et al., 2008). Commitment is considered as one of the components of the satisfaction construct in online teams (Lin et al., 2008) and is one of the critical factors for collaboration in learning environments (Brandon & Hollingshead, 1999). It is also one of the main two necessary characteristics for a collaborative group when building a sense of community (Dholakia et al., 2004). Group members need to be committed to their individual tasks to accomplish the group goals and objectives. It is expected that higher commitment among group members leads to higher performance and satisfaction throughout the collaboration process, as performance and satisfaction are positively associated elements in online learning environments (Alanazi et al., 2020). Commitment is established when a group of learners divide their work and assign tasks to each individual in order to achieve project goals. Even though online teams have a variety of challenges to enhance their performance, commitment is required by all team members to navigate through difficulties successfully (Heller et al., 2010). Commitment is also a necessary characteristic in building a sense of community (Dholakia et al., 2004) and is critical to success in collaborative groups (Brandon & Hollingshead, 1999). Commitment is more likely to occur when a group of learners divides their work and assigns specific tasks to each individual. Online teams will face a variety of challenges in reaching their goals and the commitment of all team members to their specific tasks will greatly increase their likelihood of success (Heller et al., 2010).

Social Presence in Online Groups. Short et al. (1976) originated the term *social presence* in the context of higher education, which they defined as "the degree of salience of the other person in the interaction and the consequent salience of interpersonal relationships." With the advent of computer mediated communications, social presence has become a pivotal concept in advancing online learning collaborations (Alanazi, 2019; Whiteside et al., 2017). Picciano (2002) believes that online collaborative learning environments should incorporate solutions that give learners a sense of belonging to their distributed groups. Other investigators (Oztok et al., 2015; Tsiotakis & Jimoyiannis, 2016; Morueta et al., 2016; Thomas et al., 2017) have identified several technologies and strategies for advancing social presence in collaborative eLearning: these include teleconferencing and sharing some personal information with participating members. While these approaches are useful in online settings in general, social presence is particularly critical in international settings for a few reasons. International collaboration often includes vast differences in cultural and language background between those communicating. Since social presence is especially critical in international settings

because of the cultural and language differences, it is harder to get to really know other members of the group when their customs, holidays, food, values, and language are vastly different. Given this, effective and comprehensive development of social presence becomes critical.

Research Questions:

1. Is there a relationship between the trust in an international collaborative team and satisfaction with the activity?
2. Is there a relationship between the cohesion of an international collaborative team and satisfaction with the activity?
3. Is there a relationship between commitment to an international collaborative team and the satisfaction with the activity?
4. Is there a relationship between social presence and the satisfaction with the activity?
5. Are there associations between trust, group cohesion, commitment, social presence, and with satisfaction?

Methods

Participants

The sample for this study comprised students enrolled in two different face-to-face educational technology courses facilitated through a partnership between two universities. A combined total of 47 students completed the courses, 35 (74.5%) of whom responded to the questionnaire. Of the 35 participants, 29 (82.85%) were females and six were males (17.14%). Most of these participants were undergraduate students, most of whom were pre-service teachers. The mean age of the participants was 21.19 years (SD = 3.781). Table 1 details the students' gender as well as academic affiliation.

Table 1. Participants' Demographic data.

Dichotomous Variable Descriptive		
Gender	**Frequency**	**Percent**
Male	5	14.3%
Female	27	77.1%
Total	35	100.0%
Name of Institution	**Frequency**	**Percent**
U.S. University	18	51.42%
Latin University	17	48.57%
Total	35	100.0%

Instrumentation

To collect data for our study, a questionnaire was distributed on the final day of the classes via e-mail to each student using the Qualtrics platform. The survey responses were Qualtrics then imported to R for statistical analysis. The scales measured responses using a five-point Likert scale with 20 items that ranged from one (1 - Strongly Disagree) to five (5 - Strongly Agree).

Findings

Reliability Estimates for Subscales

The survey was designed to measure five constructs: four items each for trust, commitment, and social presence, three items for cohesion; and five items for satisfaction. This scale was found to be reliable and internally consistent with a Cronbach's coefficient alpha value at .934, based on the sample described earlier. Using the Pearson correlation, reliability was estimated as follows for each variable: Trust α= .840, Cohesion α= .844, Commitment α= .929, Social Presence α= .721, and Satisfaction α= .837. Table 2 shows satisfactory alpha estimate coefficients obtained on all five scales. The overall reliability estimate (0.934) for the whole instrument indicates a strong internal consistency. This reliability coefficient indicates that the scale developed in this study is reliable to measure students' satisfaction with international collaborative online learning activities (ICOLAs), *see Table 2 below*.

Table 2. Reliability Estimates for the Scales

Construct Scales	α	Number of Items
Trust	.840	4
Cohesion	.844	3
Commitment	.929	4
Social Presence	.721	4
Satisfaction	.837	5

Correlation Analysis Results

Pearson's correlation coefficients were calculated to examine relationships among all four predictors (trust, cohesion, commitment, social presence) and students' satisfaction with ICOLAs. For the correlation analyses, the author found that there is a positive moderate-to-strong correlation between satisfaction with ICOLAs and: trust, cohesion, commitment as well as social presence with values of ($r(33) = .568$, $p < .01$; $r(33) = .724$, $p < .01$; $r(33) = .735$, $p < .01$; $r(33) = .553$, $p < .01$), respectively. In addition, trust, cohesion, and social presence are moderate-to-strongly positively and significantly ($p < .01$) correlated with each other. *See the correlation matrix in Table 3 below for full details.*

Table 3. Pearson Correlations among Variables

	Satisfaction	Trust	Cohesion	Commitment	Social Presence
Satisfaction	-				
Trust	.568**	-			
Cohesion	.724**	.645**	-		
Commitment	.735**	.600**	.814**	-	
Social Presence	.553**	.543**	.442**	.667**	-

** $p < 0.01$.

Data Analysis

A Bayesian Markov chain Monte Carlo model (MCMC) was developed using the function *brm* from the R package brms (Bürkner, 2021) to estimate how the linear variables of trust, cohesion, commitment, social presence, age and a dummy variable for female gender would impact satisfaction. A normal distribution with mean of 0 and a standard deviation of 0.5 was

used as the prior on all coefficient estimates to model the starting views of a conservative observer. Satisfaction was modeled using a Student's t-distribution with the degrees of freedom v given a starting prior of the gamma distribution ($k = 2,\ \theta = 0.1$) to account for possible outliers in the data. The model was run for 3,000 iterations on four chains using the default NUTS sampler from the Stan statistical programming language, and the last 2,000 iterations from each chain were obtained as the model fit. Using a Bayesian model here provides several benefits including results that are more easily interpretable as posterior beliefs about the impact of coefficients on satisfaction, easy implementation of shrinkage towards zero on coefficient estimates which should provide better performance on out of sample data, and handling of outliers with the T distribution on the response.

Results

The table below shows the resulting parameter estimates of the model along with their standard errors and 95% credible intervals. A credible interval is the Bayesian analogue of a frequentist 95% confidence interval and is defined as the interval such that there is a 2.5% chance the true parameter estimate is below it and a 2.5% chance the true parameter estimate is above it. Cohesion and Commitment both show strong evidence of positively impacting satisfaction with credible intervals entirely at or above zero and estimates of 0.40 and 0.31 respectively. Social presence also shows some weak evidence of positively impacting satisfaction, with the same 0.31 coefficient estimate as for commitment, but a wider credible interval that does not provide much certainty, *See Table 4 below.*

Table 4. Results of the Bayesian model.

Parameter	Estimate	Standard Error	95% Credible Interval Lower	95% Credible Interval Upper
Intercept	0.22	1.02	-1.77	2.26
Trust	-0.00	0.19	-0.37	0.37
Cohesion	0.40	0.18	0.06	0.75
Commitment	0.31	0.16	0.00	0.62
Social Presence	0.31	0.19	-0.08	0.68
Age	-0.02	0.03	-0.08	0.03
Female	0.21	0.24	-0.27	0.69

Traceplots for these estimates showing good mixing and convergence of the model. The R^2 for this model, which is the proportion of variation in satisfaction explained by these variables, had a mean estimate of 0.66 with a 95% credible interval between 0.51 and 0.74. Bayesian models produce a lower R^2 than frequentist as coefficient estimates are shrunk towards zero and are not the least squares minimizing fit, but should be more accurate for predicting future test data.

Discussion and Conclusion

Prior research has suggested the importance of developing particular social-psychological factors in the context of ICOLAs. However, little research has been done which empirically assesses the important factors which uniquely contribute to ICOLA satisfaction. The current research tested if certain widely discussed factors in the online education literature (trust, cohesion, commitment, and social presence) might contribute to ICOLA satisfaction. Cronbach's alpha values indicate that these variables should have good reliability, and the correlation values show that these variables also indicate good correlation estimates. Results

from Bayesian multiple regression analyses showed that cohesion and commitment served as unique predictors of satisfaction, while social presence may also increase satisfaction but was not statistically significant within this dataset. These findings suggest that developing a sense of cohesion with the group and garnering a level of commitment may be critical to the ICOLA forum.

One of the implications of these findings is that, to increase students' satisfaction with ICOLAs, instructors may need to focus on the factors that foster the group cohesion of the learners, the more rigid the cohesion of the group members, and the more salient the individuals of the group members are, the greater the satisfaction the learners will derive from their participation in ICOLAs. As noted by Bravo et al. (2019), some ways to improve cohesion within the group are to establish collaborative work tasks, while also minimizing the heavy workload in the group setting. In the ICOLA context, this may mean establishing smaller, easy-to-achieve goals such as weekly collaborative write-ups that require a collaborative approach to the relationship. Considering the possibility that social presence factors may help feed into group cohesion and commitment, it is possible that considerable variability is captured by the cohesion and commitment measures, which could explain the lack of statistical significance of the social presence variable in the current research.

Commitment was also a primary predictor of satisfaction in ICOLAs. Although commitment likely leads to greater cohesion, it is important to note that commitment is a separate construct from that of cohesion. As noted by Li (2022), commitment is significantly correlated with motivation and performance factors. It also may be best facilitated in this context by not only assigning collaborative goals, but also ensuring clear communication between team members. With ICOLAs, the importance of commitment can often be undermined by schedule differences, time zones, and other structural barriers which prevent synchronous/effective communication. Therefore, although a separate issue often viewed as distinct from the social-psychological factors contributing to satisfaction, structural barriers may actually be a necessary first step to ensuring communication and, subsequently, commitment in ICOLA contexts. Although setting deadlines may increase submitting assignments on time and increase completion rate, other studies have found that commitment does not increase completion rate (Bisin & Hyndman, 2020), Thus, future research may focus on the factors that indirectly affect commitment and satisfaction.

Contrary to some studies stated in the literature, trust was not a significant predictor of student satisfaction in online collaborative environments. However, as noted by Cheng et al. (2013), trust is a complex construct which is often difficult to conceptualize—in their work, trust was developed differently by each of the teams investigated, which suggests that there is no one uniform way to approach trust development. In the context of ICOLAs, it may not be that trust is unimportant, but rather that individuals have a more transient conception of what trust looks like in online groups. It may also be that only very low levels of trust lead to reduced satisfaction, no subjects in this study had a trust value below 2.5. Future work should consider a broader investigation into how trust can be accurately conceptualized across various learning contexts.

One clear limitation of the current work is that findings are limited to a relatively small sample size. Although the naturally occurring nature of ICOLAs often only allow researchers to access small populations, future work should seek to validate and replicate the current study's findings. Furthermore, these findings are situated in a U.S.-Latin relationship context. One might consider if these factors would fluctuate in their importance, or if new factors

would emerge altogether, in distinct contexts, such as U.S.-Asian relationships, or Latin-Middle Eastern relationships, for example. This, once again, creates a need for replication of the current study's findings in different research contexts.

Overall, we feel the current research provides a necessary first step into quantifying the experiences of those in ICOLA contexts. More specifically, these findings help to illuminate the need for efforts of teachers and program coordinators to develop cohesion, commitment, and perhaps social presence, in order to increase satisfaction in these settings. If done effectively, ICOLAs can become a more commonplace and fruitful education context in the ever-expanding world of online education and learning systems.

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Teaching Goal-Setting in English Learning

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Abstract
Effective goal-setting is essential in language learning strategies for becoming autonomous learners. However, in countries where English is a foreign language, required practical English skills are not self-evident. In addition, being surrounded by many extrinsic motivators such as English test scores, it is not simple for learners to find realistic and meaningful goals of their own. This study examined goal-setting practice integrated into English courses in students' first language (Japanese). The students practiced goal-setting three times over three weeks. After students' reflections and discussions with peers in the classroom, we observed both improvements and difficulties. Although it seemed challenging to influence large-scale goals for future time, the long-term goals of more than half the students became more concrete. The implication of this study is that the significance of teaching goal-setting needs to be recognized as that of English skills.

Keywords: Autonomous Learners, English Learning, Goal-Setting, Self-Directed Learning

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Introduction

The significance of mastering English is emphasized in a globalizing society. However, among the countries comprising the Expanding Circle, where English is not used in daily life and is learned as a foreign language, the nature of the reasons for learning English is distinguished by the fact that English learning is not usually the learner's real choice but induced by external factors. It is also a characteristic among the countries comprising the Expanding Circle that the real need for learning English cannot be presented as a collective interest but as an individual one that varies from user to user.

In Japanese universities, most students would have studied English for six years in secondary school prior to entering university.[1] English is usually one of the subjects in paper-based university entrance examinations in Japan. Before entrance into university, the purpose of studying English was presented to them as a requirement for passing university entrance examinations. Most students study English exclusively for this purpose. Up to this stage, the objective of studying English was something imposed on them, and they did not have the opportunity to deeply reflect on the purpose of their language instruction. In addition, there is also strong societal pressure for university graduates to acquire English skills.

The university period is the first occasion in which many students are confronted with the question and must think deeply and seriously about the purpose of studying English. To some extent, English remains a compulsory subject on the undergraduate curriculum for first-year students of all disciplines in Japanese universities. Most universities encourage students to improve English test scores, such as the TOEFL and TOEIC.

In the context where English is not used daily, finding meaningful goals for studying English will be essential for maintaining the motivation to successfully continue English learning for a defined period. However, how can students define meaningful goals for themselves?

This study explores this issue based on the empirical research conducted in English courses for first-year students taught in Japanese. The underlying concept of the course is learner autonomy in English learning, aiming to guide students towards independent and self-directed learning. The course offers much different teaching style from general courses on English skills. This study also aims to prove the importance of including such explicit interventions, using the students' first language in the English curriculum.

The Perceptions of English Learning of First-Year Students

The author conducted this study in one of the largest state universities in Japan with 12 academic schools (letters, education, law, economics, science, medical science, dental medicine, pharmaceutical science, engineering, agriculture, veterinary science and fisheries). In 2021, the university had 18, 171 students, including postgraduate and 2,826 Japanese first-year students in the undergraduate degree programmes (Hokkaido University, 2021). English courses are compulsory for all first-year students who must take four English courses during their first year of the curriculum.

Before conducting the main empirical study, the author administered a simple survey questionnaire in Japanese to first-year students selected randomly. The survey asked one

[1] In Japan, foreign language education was officially introduced in primary education in 2020.

open-ended question, 'Do you have any difficulty or concerns in your English study? If yes, what are they?' The students were able to answer more than one item. The author collected 85 complete responses. There were primarily two groups of respondents: humanities/social sciences major (n=33) and science major (n=52). Table 1 summarizes the answers.

		Humanities, Social Sciences (n=33)		Sciences (n=52)	
	Difficulties/concerns	n	%	n	%
1	Lack of purpose	8	28	8	15
2	Lack of occasions to use English	3	10	15	29
3	English skills declining	2	7	2	4
4	Lack of speaking skill	10	24	13	25
5	Lack of listening skill	8	17	10	19
6	Lack of vocabulary	4	14	8	15

Table 1: Difficulties/concerns in English study of first-year students

The result confirmed the author's intuition that many students are engaged in English learning without being fully aware of the purposes, even after entry into university. The awareness of 'lack of purpose in studying English' and 'lack of occasions to use English' are assumed to be familiar in Expanding Circle countries. The author pays more attention to 'lack of purpose' than skill issues. It seems that after achieving their previous purpose, the university entrance examination, students then started wondering about the meaning of English learning. Researchers and universities should not ignore this issue because the lack of purpose can also be related to the lack of motivation. As per Oxford (1990), 'students without aims are like boats without rudders; they do not know where they are going, so they might never get there!' (p. 157): without setting goals, students do not know what English proficiency and skills to be enhanced.

Instead of significant common goals such as examinations, students need to find their personal meaning for studying English during university to become successful learners. According to Table 1, there is an implication that quite a few students tend to struggle with finding their purpose in studying English. The tendency is more salient in humanities and social science majors. Many students do not need to question why they need to master English in science majors. Approximately 75% of students in science majors (Hokkaido University, 2021) go to graduate school and engage in research activities in science, which is usually conducted in English.

In other career paths, schools require testing English ability through English tests or as a subject of examinations. For example, in job-hunting activities for business companies, candidates must present their English skills, typically by English test scores such as the TOEFL and TOEIC, whether in humanities or sciences. In addition, English is one of the subjects for civil service examination and teacher employment examination for schools. English is also a subject for graduate school entrance examinations in humanities and social sciences.

Students perceive the lack of English practical skills, particularly in listening and speaking on the one hand. However, their immediate need for English seems to be the scores of English examinations on the other. The former is the issue of proficiency and practical skills to use a

language, while the latter is the issue of techniques for assessments. The current situation may confuse the students. External factors likely induce the purposes of English learning, and there is a concern that it would become a barrier for autonomous learning. Hawkins (2018) points out that 'successful students described high motivation coming from intrinsic factors', 'while unsuccessful students only discussed extrinsic motivators (p. 460).

Another phase of this matter is that students would not sincerely enjoy English learning without meaningful purposes of learning, affecting their motivation to commit to long-term spontaneous English learning. This point implies that students need explicit guidance to help them find individual goals in English learning.

Goal-Setting in Language Learning Strategies

Oxford (2011, p.79) states 'L2 learners benefit from knowing more about how to set goals.' She advocates the following three elements of goals for effective self-regulated learning: specificity, proximity (the combination of long-term goals and short-term goals), and difficulty (modest level of feasibility) based on Shunk (2001). Since in 1990, she has argued the importance of goal-setting in language learning strategies. She emphasizes the importance of fixing the terms for each goal and differentiates between long-term 'goals' and short-term 'objectives'. The former is for planning for relatively longer periods from months to years, while the latter is from hours to weeks (Oxford, 1990). Besides combining of different goals, Shunk (2001) further adds the need to monitor progress and assess capabilities to adjust the strategy and goals as needed.

Oxford (2011) also points out the importance of 'future time perspective' for setting appropriate long-term goals via 'the planning' strategy. Hence, the author recognizes three stages of goals, including the one with future perspective posed above long-term 'goals' and short-term 'objectives' and considered integrating this viewpoint into the practice of empirical study described later.

There are discussions on the teachability of strategies (Griffith, 2015; Hawkins, 2018). However, if we focus on goal-setting only, it is hard to assume that many although not all, students can naturally set effective goals in the current situation without proper instruction. Without educational intervention, many students would first set non-specific goals, as other studies show (Cotterall, 2000; Horai and Wright, 2016; Kanazawa, 2020). Cotterall (2000) argues the importance of raising students' awareness of goals in classroom-based courses to foster learner autonomy. Therefore, the current empirical study examined the following research question:

RQ: How goal-setting practice influence students' goals?

Context

The author planned this empirical study in her English courses which are offered as elective compulsory subjects to first-year students. The underlying concept of this course is establishing one's suitable English learning method, and it aims to guide the students towards autonomous and self-directed learning. It is a different teaching style from other general English classes, which mainly teach English language skills. In this course, the students used Japanese as a medium language for all activities. Therefore the instructor expected students to discuss in Japanese the issues such as 'English learning at secondary school', 'learning

strategies', and 'International English/English as a Lingua Franca', etc. The course content is in Appendix 1.

The course consisted of 15 sessions of 90 minutes once per week. The students submitted two essays for assessment, keeping reflection notes at the end of each session. The maximum enrolment was 25 students per class. The author conducted the empirical study in four classes with approximately 100 first-year students over two academic years from 2020 to 2022. The study followed ethical considerations. The author informed the students of the purpose of the research, confidentiality, anonymity and promised no influence on academic activities.

The Findings of Goal-Setting Practice

The study integrated goal-setting practice into the above English course. Every three weeks, the instructor asked students to set three different goals: (a): The ultimate goal: what they wish to achieve using English in the future (more than a year later), (b): What kind and level of English skills they wish to acquire within a year, and (c): Action plan of the next three weeks under the directions of goal (a) and goal (b). Goal (b) corresponds to 'long-term goals' and goal (c) to 'short-term objectives' defined by Oxford (1990). Goal (a) corresponds to the 'future time perspective' stated in Oxford (2011). The reason the author added goal (a), ultimate goal, was that she considered that goals (b) and (c) were not enough to gear the students' perspectives from 'extrinsic' to 'intrinsic'.

The students repeated setting goals three times over nine weeks. The instructor asked the students to reflect on their previous goals in the second and third practices and set the next goals based on the reflections. In the classroom, students also had occasions to introduce and discuss their goals with each other in a group of several students. The flow of setting goals, reflection and adjustment tended to become individual work. However, the interactions utilizing the contexts with peers would contribute in the adjustment of goals. In fact, 'learner autonomy is a matter of developing and exercising a capacity for independent learning behaviour in interaction with other learners (Little, 2000, p.26)'. The author as a teacher avoided individual advising on the goals students described to encourage students' self-adjustment.

Out of approximately 100 first-year students enrolled in the four courses, 81 students completed the three sets of goal sheets with reflections, which the author analyzed. The author/instructor explained that there was no penalty for not achieving their action plans, the students were free to alter their previously set goals (a) and (b) in the subsequent goal-setting periods. The author regarded these reflection activities as monitoring progress and assessing capabilities which Shunk (2001) suggests, as previously mentioned.

This study focuses on how goal (a) and goal (b) altered from the first period to the third period. Goal (c) was not the analysis target in this study due to the capacity and action plans' nature that the action plans' achievement is self-assessed by students.

Goal (a): The Ultimate Goals: What They Wish to Achieve Using English in the Future (More Than a Year Later)

If students continue studying English without these goals, English learning remains solely an academic subject for study. After release from compulsory English subjects assigned in their

first year, students would find it difficult to continue studying English by themselves. In a sense, the determined future goals would sustain their long-term English learning.

After reflections of the two periods, the author divided the students' goals in the third period into the categories in Table 2.

	Goals	n	%
1	Study abroad	9	11
2	Reading research articles	9	11
3	Personal interests, hobbies	10	12
4	Vocational interest (concrete)	18	22
5	Job hunting（incl. English test score)	11	14
6	Fluent communication	34	42

Table 2: The ultimate goals of English learning set in the third period

In Table 2, the characteristics of the first four categories are different from the two categories at the bottom. If they plan to study abroad, it is natural to aim at 'study abroad.' Most students stated 'reading research articles' were in a science major where they need to do research in English in the future. Examples of the third category are 'to enjoy premier league football live coverage' and 'to enjoy mystery novels in English.' An example of the fourth category is 'My dream is to become a curator of a museum in another country to introduce Japanese art. To acquire English skills to explain Japanese art is my goal.' A characteristic of this category is that their future direction is concrete. They stated their future professional aims with other examples, including 'international lawyer' and 'international nurse', etc. There was a distinguished lack of concreteness in '5 Job hunting.' In the fifth category, students have not decided what they wish to become and tended to state, 'English skill will be an advantage in job hunting,' or 'Good English test scores will be needed for getting a good job.' In addition, the large difference between the fifth and fourth categories is that the description is still vague.

Examples of the sixth category are 'natural communication with people all over the world is my goal,' and 'to gain fluent English-speaking skills like my mother tongue, Japanese, is my goal.' In several cases, 'to become a native speaker-level English speaker' is set as a goal. These descriptions are more suitable to goal (b), but the vagueness was prominent. There was an association between the fifth and sixth categories and the result of the first questionnaire (Table 1), where students indicated they had not found the purposes of studying English, yet. The responses indicate that many students are still searching for their future directions, including vocational interests and could not decide the type of English users they wish to become. Hence, the author assumes that students lack clarity in required English skills and levels.

Unlike the following section, the goals they described for the first period rarely changed in the third period. Only eight out of 81 students revised their initial goals in the third period. It is somewhat unexpected, as the author assumed more students to clarify their future directions after the goal-setting exercises. The author realized it was a little early to ask them these goals as they are still following compulsory English courses in their first year. The future direction is often closely related to vocational interest, but many first-year students are unsure.

Goal (b): What Kind and Level of English Skills Do They Wish to Acquire Within a Year

The author also set one year to achieve this goal, as it will take a certain period to acquire specific skills. In this category, the students' descriptions varied, with some stating more than two goals of different skills. Therefore, the attempt at categorization was not realistic, and the author decided not to categorize them. In this goal, the author found many refinements in the third period compared with those in the first period. Out of 81 students, 43 revised their stated goals to be more concrete. In the first period, the author discerned vague and abstract descriptions such as 'to be able to understand in English well.' There were also quite a few unrealistic goals such as 'to be able to speak English like a native speaker'. Many also focused on the English test scores rather than using English, such as 'to keep attaining TOEFL score XX or above.' In the goal-setting practice of the third period, however, more specific descriptions increased such as 'to be able to output in daily level communication using basic English grammar' and 'to be able to understand the texts of extensive reading materials.' In addition, a few students mentioned CEFR can-do statements that the author introduced during class.

It is also interesting that students mentioned English-medium classes by English native speaker-teachers as criteria, such as 'to be able to properly participate in the activities in all English-classes' and 'not to hesitate in English activities in all English-classes,' etc. The author assumes that English-medium classes are psychological challenges for the students, and some may struggle with them. A few students also mentioned finding goals or motivation of learning English itself, such as 'to find my personal motivation to learn English.' This finding is also associated with the first questionnaire survey result (Table 1) that many students cannot find the purpose of English learning.

The difference between goal (a) and goal (b) was sometimes unclear. For example, one student stated, 'to be able to understand Disney animation films without Japanese subtitles.' in goal (b). It is detailed but this would be more suitable to goal (a) as it would require a high level of multiple skills.

Students revised and refined their goals through the goal-setting practice with reflections over the three periods and discussions with classmates. As a result, more than half of the students improved their initial statements, although the goals of two students did not change as they were concrete from the beginning.

Conclusion

The effect of goal-setting practice became evident to some extent. But as the author found a limitation in goal (a), the future time perspective, how to expand students' interest in English use beyond English learning, will be one for the next plan. In Oxford (2011), although the researcher recognised the effect of future time perspective, she does not define it to be essential. She suggests that leaners without a future time perspective can also use tactics associated with 'the Planning strategy.' In a sense, it is an issue beyond English language education, but one that we cannot ignore. Commit to goal (a) might have been early for first year students, but the earlier they set up goal (a), the earlier they will start becoming autonomous. For example, students who established a concrete goal (a) also described concrete goal (b).

English classes incline toward input of skills. However, as this study shows, many students probably need help setting up practical goals. There should be more room for educational intervention in this direction.

Regardless, this study has limitations. The study only focused on goal-setting practice. Future research should also examine the aspect of goal achievement and together with the result, illustrate the role of goals in learning strategies. In addition, it is unexplored how course content influence students' development of goals. The topic will be one on a future research agenda.

Appendix 1

Week	Content
1	Why learn English?
2	Analyzing your learning style
3	English language teaching in school education
4	Setting goals and how to achieve them
5	Analyzing self-study materials
6	Learning English vs using English
7	International English（1）
8	International English（2）
9	Proven methods in Second Language Acquisition Research（1）
10	Proven methods in Second Language Acquisition Research（2）
11	Learning from the experience of a non-native speaker with a high level of Japanese proficiency (guest speaker session)
12	Learning strategies
13	Evaluation of goal setting and achievement
14	Wrap-up, after this course
15	Individual consultations

Course Contents of English Course

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The Place of French in Botswana's Language in Education Policy: Contradictions and Paradoxes?

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Abstract
Society prospers on education to shape the individual; formal or informal. In modern times where governments are responsible for the organization of society, education serves as a developmental tool for the citizenry. The choices that a country makes towards developing its nation are very important, Botswana is a case in point with her Vision 2036 which stipulates her aspirations under the pillar of Human and Social Development. As Harworth Robert H. (2012) postulates, Education is political and as such, the decision to introduce a subject in the school system is always a political one guided by socio-economic factors. In Botswana's Education environment a monolithic and monoethnic political perspective has prevailed in the Education system where only two (2) languages: Setswana and English, have been taught as subjects and were equally used as languages of instruction. French disrupted this status quo when it was introduced in public schools in 2000.

Keywords: French in Botswana, Language Policy, Foreign Language Education, Language-in-Education Policy – Didactics of French

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Introduction - Purpose of the Study

With its introduction in 2000, disrupting therefore the status quo and being a third and foreign language to be taught in schools, French naturally brought in a different dimension to the Education system of Botswana. This would have called for a modification in the policy pertaining to language education as well as in designing instruction and in the implementation of rolling out instruction of this new language. This article therefore seeks to bring to light the paradox emanating from the intent of teaching French in Botswana as an economic and political will and the reality of implementation which must be guided by national policy documents. Through desktop reviews and questionnaires, we investigated whether the requirements for a multi-layered approach in language policy were met. In conclusion, the paper will make suggestions on how to successfully implement an education policy which would be best suited to address the situation.

Research Question

This research paper comes in the backdrop of low pass rates in French Junior certificate examinations, giving way to:

- Dwindling numbers of students taking French in secondary schools;
- Some school heads decommissioning the teaching and learning of French in their schools;
- Threats to job security for teachers of French in these affected schools.

Hypothesis

A closer examination of why certain school heads would decommission a subject that has been earmarked for teaching in schools leaves suspicions of an irregular implementation of the pedagogy of the language as well as pointing to a big loophole in policy direction: that is, there is no policy to give direction to the integration of French in Botswana's education system.

- Question: Could this be a deliberate move by the government not to commit?

As postulated by Obene B. Bojosi, Boingotlo W. Kaome and Rodah Sechele-Nthapelelang (2022), it would seem like implementers are left to themselves and endure the most of manoeuvering a space which has little to no support in terms of policy back-up and material support. Implementers can therefore decide to rescind the offering of French in their schools. Teachers of French and students become *sacrificial lambs* in the process. This paper therefore seeks to respond to the question of how the Language in Education Policy of Botswana provides for the teaching of French in Botswana? Why was French introduced in Botswana: on a social, political, and economic level, what is the import of the French language to Botswana?

This study wanted to unravel the impasse that seems to prevail within the teaching of French in Botswana public secondary schools. A qualitative approach seemed the most appropriate since it allowed to carry out an environmental scan of the teaching of French as well as to get first-hand information from the people on the ground being the teachers who are involved in a triad of learning: learners on one side and policy makers on the other.

Data was collected using two tools:

- Open-ended questions in an administered questionnaire. Data was collected from a sample of secondary school teachers.
- Desktop reviews were used to guide understanding and analysis of policy documents.

In interrogating the participants, we sought to know:

- How long they had been teaching French and when their schools introduced French.
- Their opinions on the value and future of French.
- Challenges and successes in policy implementation.
- If in-service training was adequate.
- If there were any mechanisms put in place for support.

This is aimed at linking planning and implementation.

Background

This study is limited to the Botswana context of teaching French and the policy environment that is expected to favour such an endeavour. Botswana has been chosen as the centre of focus primarily because being a practitioner in the field of teaching French as a Foreign Language, one is systematically brought to appreciate the context, its needs and intervention measures to alleviate the situation. The high failure rate in schools especially for the subject French, the decommissioning of French in some schools by school heads, the incessant lack of mutual understanding between policy makers and teachers of French became an eyesore that needed to be investigated. The geo-socio-political and economic context of Botswana is equally worth mentioning in a bid to put this study into perspective. Botswana is an Anglo-Saxon country, situated in Southern Africa boasting a small population of 2,346,179 (Statistics Botswana 2022). The cultural and linguistic diversity of this country puts it at about 28 languages spoken in the country but only two languages being officially recognized (Batibo, 2005): Setswana is used as a national language while English is used as the official language. French has been the only foreign language taught in public schools since 2000.

In Botswana, French is taught as a foreign language both in private and public schools since an undocumented period for the first and the year 2000 for the latter. According to an unpublished report of the Ministry of Basic Education on school performances in the 2019 Junior Certificate Examinations, 39 public junior schools and 7 senior secondary schools teach French currently (Maplanka, 2019). The teaching began in the 1980s in two public schools, which benefitted from exchange programmes with cognate institutions without any policy orientation. According to Obene B. Bojosi, Boingotlo W. Kaome and Rodah Sechele-Nthapelelang, 2022, the serious uptake of French in public schools and the institutionalization of such within the Education Policy of Botswana has been through a number of factors, some emanating from personal experiences by decision makers who saw the need for the country to adopt a political positioning within the world. The global move towards integration of economies has seen the SADC (Southern African Development Community) region as well as the Continent putting in place measures to ensure smooth integration, amongst which was a move to reduce the linguistic and cultural divide within the continent. Subsequently, the Ministry of Education implemented a pilot programme on the teaching of French in 15 secondary schools throughout the country, commencing in 1999. This followed a recommendation made in 1994 through the Revised National Policy on Education, Government Paper No 2 for the introduction of a third language in the school system and this gave way to the roll-out of French teaching and learning in public schools. We can safely say

that the choices made for the pedagogy of the country, programme prioritisation as well as course content and learning outcomes are guided by both the political and economic drivers. Following the success of the first phase of piloting French language in schools, the then Ministry of Education, currently Ministry of Education and Skills Development resolved to roll-out the teaching of French to all public schools in a phased approach depending on the availability of resources and the implementation thereof was left to the discretion of the regions and the schools. Further after rolling out the teaching of French to public schools, the government of Botswana took a step and signed a cooperation agreement with the Government of France for the introduction of French in public schools in 2008, followed by a more comprehensive cooperation agreement in 2015 between the governments of Botswana and France (Sénat & Australe, 2016). Given this background, it is therefore evident that the teaching of French has evolved in a context where it was preceded by structures put in place for English and Setswana. The underlying question to this situation is how prepared was the political atmosphere to accept French teaching into Botswana knowing that a learned language is a vehicle of the linguistic structures as well as its cultural imprints? How prepared was the country to put in the rightful structures for implementation of the teaching of French starting with syllabus design to allow for a smooth planning for teaching and learning of such a language?

French Teaching in Public Schools in Botswana

French was from a long time back initially taught in private schools and mission schools. However, a deliberate roll-out of the teaching of French in public schools follows the following timeline which echoes the timeline established by Kewagamang and Kaome, 2020:

- **1999:** 18 recently graduated BA holders sent to France to be trained as teachers of French in preparation for the introduction of French in government schools as a pilot project.
- **2000**: Introduction of French as a foreign language in 15 Junior secondary schools as a pilot project.
- **2008**: Signature of a Cooperation Agreement on Education and French Language between the French and Botswana governments. The Botswana government creates the posts of Principal Education Officer training for French, French officer at curriculum and the Botswana Examinations council (Kewagamang and Kaome, 2020).
- **2015**: Renewal of commitments of the Cooperation Agreement between the governments of France and Botswana (Senat & Australe 2016).
- Currently 39 public junior schools and 7 senior secondary schools teach French (Bojosi et al, 2022).

Factors Justifying the Introduction of French to Botswana

Botswana's participation in the global economy would benefit from training her citizenry in foreign language skills and competencies since then the country would be able to export labour, goods, and knowledge. In her national plans and her Vision, on an overarching national prioritisation level, the country had envisioned within the Human and Capital development pillar to broaden and strengthen of our external partnerships as well as actively participate in global governance and international trade. (Vision 2036). This gels well with the commitments that the country has entered amongst which there is the hosting of the SADC Secretariat in Botswana since 2000 which systematically implied the opening of job opportunities as well as investment opportunities associated with the working languages of

SADC. The bilateral agreements between France and Botswana of 2008 and 2015 aiming at promoting the Teaching of French in Botswana, France-Botswana (2008, 2015) further intensified areas of collaboration between the two countries to cover vast areas such as teaching, agriculture, animal and human health and many others. Within the same vein of being a regional, continental, and global player, the country recently ratified the African Continental Free Trade Area (AfCFTA) agreement in February 2023 which also places the country at a certain level of integration with regional and continental economies.

These developments, though not related to the teaching of French in Botswana, did attune the teaching of French in Botswana to what it has become today because every development of the economy must have its matching value in human and skills development and language is a tool through which humans communicate, regardless of the professional orientation. Based on the above imperatives of the year 2000 and beyond, there is proof that the country saw some value in introducing French in schools based on the above.

Discussion: Language Policy

Language Policy defined:

A language in education policy must be anchored within a country's broader language policy. Language policy has been defined as a body of ideas, laws, regulations, rules, and practices intended to achieve the planned language change in societies, groups, or in a system. (Kaplan and Baldauf 1997: xi). Further understood in the current usage as official government decisions regarding the use of language in the public domain, including courts, schools, government offices and health services. The emphasis on government's decision is equally echoed by Djite in the following terms:

"The deliberate choices made by governments or other authorities with regard to the relationship between language and social life" (Djité, 1994: 63).

McCarty (2011), on the other hand defines a language policy as:

> a complex sociocultural process [and as] modes of human interaction, negotiation, and production mediated by relations of power. The 'policy' in these processes resides in their language-regulating power; that is, the ways in which they express normative claims about legitimate and illegitimate language forms and uses, thereby governing language statuses and uses. (page 8)

Theorists seems to converge around a similar postulate of language policy as the mechanisms or a decision through which a government uses to regulate how languages interrelate in terms of power relations, development, promotion and resourcing of the concerned languages.

The Botswana language policy has accorded the status of official language to English while Setswana is accorded the status of a national language. Setswana stands out as a national language because its varieties are spoken by 80% of the population. Apart from these two languages, there are 27 other minority languages spoken in the country (Nyati-Ramahobo, 2000). The languages of instruction in the educational system of Botswana are English and Setswana. The National Education Plan advocates for the use of Setswana in the first year of primary school. As early as the second year, English becomes the language of instruction, and it is recommended that Setswana be a compulsory subject for all Batswana until high school.

Given that Botswana is a multilingual country, a move towards including the so-called minority languages is captured in the Revised National Education Policy of 1994 which recommends the introduction of a third language in the educational system. This was done for students whose mother language is not Setswana but what is remarkable is that French was recommended as the third language (Republic of Botswana, 1994). Botswana's policy on education is guided by the Report of the National Commission on Education of 1977, the Revised National Policy on Education (RNPE) Government Paper No 2 of April 1994, NDP9, Vision 2016 as well as the 2001-2006 Strategic Plan of the Ministry of Education and Skills Development. Having been adopted from the pre-independence era Botswana's education system came to a more domesticated approach with the setting up of a National Commission on Education of 1977 which was mandated to carry out a review of the education system. This Commission proposed that the starting point in the educational review should be the national principles of democracy, development, unity, and self-reliance. Needless to say, this was an era of nation building and as such, other actors equally participated in shaping the education system in Botswana. There has been numerous of them from state actors to non-state actors with one important stakeholder, the voice of the teachers coming through the Botswana Teachers Union (subsequently referred to as BTU) Policy on Education. According to the BTU Policy on Education "The Revised National Policy on Education Government Paper No 2 of April 1994 has guided the programme activities of the Ministry of Education and Skills Development in terms of curriculum reforms and ongoing improvements since NDP8. The RNPE was intended to cover a timeframe of 25 years given that its recommendations were to be implemented in the short, medium, and long term" (Bojosi et al., Botswana Federation of Trade Unions, 2007, p. 2). Regarding the recommendation of a third language in the school systems, as mentioned earlier, this third language became French at a later stage.

Language in Education Policy

Language in Education policy on the other hand has been defined as "a set of principles agreed on by stakeholders, enabling decision-making about language and literacy issues in the formal education system at all levels: early childhood, primary, secondary, and the teacher education segment of the tertiary level". (Jamaica Ministry Of Education, Youth & Culture Language Education Policy,2001). Studies on language policy in Africa have concluded that the choice of a medium of instruction in multilingual states in Africa has always been a major component of state language policy and Botswana is no exception. The choices made are often more informed by political, economic, and ideological considerations than being strictly educational ones, and are deeply controversial with issues of feasibility, popular aspiration, cultural identities, globalisation and development featuring prominently in the discussion, though these often pull policy in different directions. (Ferguson 2013,1).

"Even though it is common belief that English is Botswana's official language and Setswana is the national language, such a declaration does not exist in the Botswana Constitution (Anderson and Janson 1997; Nyati-Ramahobo, 2008). Botswana does not have a national language policy, it seems English and Setswana acquired their roles as official and national languages respectively mostly out of practice instead of legislation.

The Revised National Policy on Education (RNPE) of 1994 is almost 30 years old and was unveiled before French was introduced in Botswana schools, therefore the teaching and learning of French is not covered in the policy. Apart from the bilateral cooperation

agreements (France-Botswana) of 2008 and 2015, no national policy guides the teaching of French in Botswana.

Findings

Having interrogated the context into which French teaching was introduced in Public Schools, we then administered questionnaires and analysed them to gather opinions of teachers and understand them better. The results have been analysed as follows:

Experience

The participants' experience ranges from 5 to 16 years in the teaching of French Foreign language.

Introduction of French in the School

French has been taught in the schools investigated from as early as 2000 (the pilot schools) to 2022 latest.

Stakeholder Engagement or Lack Thereof

Disengagement of learners which translates into lack of interest for the language as well as low completion rates. In their own words, the teachers said:

> It is frustrating because learners lack interest in French lessons, lack of parental support for students learning. Also, where I teach leaners drop out of school before they complete their term of study or perform badly in their final examinations.

This could be an indication that little to no consultation with parents and communities on the introduction of French in Botswana. It could also mean the parents and students do not know/see the importance of the French language.

Incoherent Planning and Implementation of Policies

While the government currently advocates for the use of mother tongue in lower primary as a medium of instruction, students continue to be taught in the dominant Setswana language. There is therefore a disconnect between what is being preached and the reality on the ground: implementation and commitment of resources. This could make it difficult for the learners to embrace foreign language learning. Teachers' point of view was that:

> "Also, there is a language barrier as the majority learners here are from the Basarwa tribe and French is their fourth language so, this makes it difficult for them to comprehend the content."

Low Performance Continues on a Downward Trend

Under this analysis point, teachers submitted the following:

> "Learners' performance has been drastically deteriorating over the years."
> "I feel frustrated the learners do not perform well."

Teachers Decried Lack of Support

Lack of support for the teaching of French in Botswana teachers of French from their supervisors (at school level or at national level).

School Heads

> “There's very little support from the supervisors in school.”

I feel frustrated at times just to see that even after so many years of teaching of French in schools, the school managers are not conversant with the subject: they do not appreciate it also some teachers still tell learners that it (French) is not important.

National Officers

> “Less is done in supporting the teaching and learning of the French language in Botswana and this affects us teachers in a negative way.”
>
> “At national level the ministry of education makes effort by organizing training workshops every now and then.”
>
> “None at school level but at national level there's a WhatsApp group whereby teachers can share knowledge.”
>
> “Not even, there’s a lot of negativities surrounding the teaching and learning of French from internal leadership to national.”

At school and regional level there is minimal or no support for the subject but nationally we do get support from in-service principal education officer and from Curriculum development office.

Successes

> “In senior schools policy implementation seems to be going well since learners are performing well.”
>
> "As for my School we have always performed very well, being in the top 3 year in year out."
>
> "Change in Junior Certificate syllabus and assessment to actionelle method."

Implementation Challenges

All the participants from junior schools answered that the way the teaching of French is being rolled out is not effective. We have classified their opinions in the following categories:

Inadequate Resources

It came out clearly in the responses by teachers that the teaching of French in Botswana public schools has not been adequately resourced in terms of capacity building of teachers.

The desired intervention would be that there be In-service training every 2 years. It was observed that French was not accorded the same treatment as other subjects since for other subjects, teachers are sponsored for master's degrees by the government while for French the same is not accorded.

All these point to some inconsistencies between aspirations and realities of implementation and this translates into little value given to French and subsequently lack of motivation.

Conclusions

The aspiration of introducing French to Botswana schools seems to have been founded on a good political, socio-economic, developmental, and cultural rationale. Planning for such an introduction started off reasonably well with training of teachers, signing of memoranda of agreements and piloting the project. However, full implementation was not backed with policy commitments:

> Following the success of the first phase of piloting French language in schools, the Ministry adopted for a position to roll-out the teaching of the language to all public schools and the implementation thereof was left to the discretion of the regions and the schools. (Bojosi et al., 2022)

We have observed that even at a general overarching national level, even a language policy is not clearly enunciated and the language in education policy does not exist.

Consequently, resource commitments also lagged depicting contradictions between what the agreements signed entailed and practice. Another aspect that sends a strong message of lack of commitment on the Botswana side is A lack of re-commitment since last cooperation agreement (2016), The question remains: what really is the place of French when in some cases continuity from JC to Senior School is not possible? (39 Junior schools vs 7 senior schools).

Recommendations

It is therefore recommended that the country needs to have clear policies to guide language developments in orthography and teaching: (a national language policy, a language-in-education policy, a foreign language policy). That there must be coherent linkages among policy, agreements signed and practice.

Another recommendation centres around the need to have a comprehensive approach to Education in full knowledge that Primary schools form the basis from which feeds Junior Secondary schools and the same applied for Junior Secondary schools being feeder institutions to one and the other. In that sense there needs to be a smooth transition in syllabi from Junior to Senior school and to tertiary.

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Cracking the Code: A Framework for Ensuring Reliable TIMSS Test Scores for South African Learners

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Abstract
In many countries, including South Africa, the Trends in International Mathematics and Science Study (TIMSS) serves as a prominent assessment tool for evaluating students' achievements in mathematics and science. It's noteworthy, however, that the extent of the reliability of TIMSS test scores in South Africa has not been extensively investigated within the existing literature. This research employs generalizability theory to assess the reliability of 2019 TIMSS test scores among South African students. The primary objective is to gauge various forms of errors linked to test scores, encompassing factors such as tester and item effects. To achieve this, a single facet crossed design was adopted alongside a systematic sampling approach to gather item responses from 150 fourth-grade learners in response to 35 mathematics items drawn from an IEA IDB Analyzer Merge module. For data analysis, the *gtheory* package within the R language and statistical computing environment was employed. The assessment encompassed the computation of the generalizability (g) coefficient, the phi (Φ) coefficient, and the decision (d) study. The results divulged a g-coefficient of 0.989 and a Φ-coefficient of 0.981, indicating a notable level of reliability. These findings emphasize that TIMSS test scores remain unaffected by diverse sources of error, including those stemming from tester and item effects. This robust level of generalizability and reliability in the scores is thus validated. In the context of South Africa, these outcomes can potentially furnish policymakers and educators with more comprehensive insights for making informed decisions concerning the utilization and interpretation of TIMSS test scores.

Keywords: Generalizability Theory, Reliability, TIMSS, Test Scores, Mathematics Achievement, South Africa

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1. Introduction

The Trends in International Mathematics and Science Study (TIMSS) program, conducted by the International Association for the Evaluation of Educational Achievement (IEA), is a significant global assessment initiative that evaluates students' performance in mathematics and science across various countries. It has had a profound impact on education policies and practices worldwide. Participating countries like South Africa learn from each other's experiences to improve their education systems (Fishbein et al., 2021). South Africa selects diverse schools and students to ensure a representative sample reflecting socioeconomic, geographic, and urban-rural diversity. The TIMSS assessment targets two grade levels: Grade 4 and Grade 8. Grade 4 covers fundamental mathematics and science concepts, while Grade 8 delves into more advanced topics. Mathematics assessment topics span algebra, geometry, number theory, and data analysis, while the science assessment encompasses biology, chemistry, physics, earth science, and environmental science. To gauge students' comprehension, TIMSS focuses on three cognitive domains. It gauges students' understanding through "Knowing," "Applying," and "Reasoning" cognitive domains, assessing recall, problem-solving, and deeper comprehension (Martin et al.,2020). The program generates achievement benchmark scores (elementary level (400-474), average level (475-549, high level (550-624), and advanced level (625 or more points)) categorizing countries based on performance levels (Martin et al.,2020). However, these plausible scores are likely to be affected by measurement errors, which are variations under consistent conditions. This error arises due to differences between observed scores (X) and true scores (T). The psychometric analysis aims to estimate and reduce error variance for accurate assessments (Ayanwale, 2019; Crocker & Algina, 2008). Classical test theory (CTT) treats scores as a combination of true and random error components but can't identify specific error sources (Ayanwale et al. 2018:2019a; Brennan, 2001; Johnson & Johnson, 2009). Recognizing CTT's limitations, generalizability theory (g-theory) was developed to disentangle and estimate various sources of measurement error (Brennan, 2001; Shavelson & Webb, 1991). This theory goes beyond CTT, offering a broader framework to pinpoint, differentiate, and estimate errors for improved reliability in assessments. Unreliable scores can lead to unfair educational policies and inaccurate evaluations of students, teachers, and schools. This underscores the importance of assessing the reliability of TIMSS scores specifically for South African learners. Employing generalizability theory allows us to uncover various factors contributing to score inconsistency, like learner differences, rater variations, and task-related variability. This insight becomes instrumental in refining the testing procedures, guaranteeing precise and dependable outcomes. Ultimately, these efforts will have a positive impact on individual learners and contribute to enhancing the entire education system.

Generalizability Theory (G-theory) is a statistical framework employed to assess the reliability of test scores (de Vet et al. (2011); Thompson (2003)) like those from the TIMSS assessment. It accounts for various factors that can influence scores, such as different raters, learners, and tasks. G-theory helps identify and quantify these factors to understand score reliability better. In this context, G-theory examines multiple facets like learners, raters, and tasks (Brennan, 2001). When the same test is given to different learner groups, score variation can occur due to their abilities. High learner variability can hinder accurate ability measurement, while high rater variability makes consistent evaluation challenging. Similarly, different raters grading the same test might have varying scoring criteria. Additionally, using different tasks to measure the same skill can lead to score variation due to task difficulty, not suited for all learners. To ensure reliable TIMSS scores, each facet's impact on reliability

must be considered. G-theory helps identify which facets affect reliability the most, aiding in adjustments. This enhances score accuracy, ensuring valid measures of learner abilities. The conditions of G-theory encompass variables impacting TIMSS score reliability, including learner, rater, and task numbers. Limited learners might yield non-representative results for a larger learner population. A small rater group could introduce significant bias into score reliability. Likewise, a few tasks might not comprehensively reflect learner skills. All these conditions are vital in evaluating TIMSS score reliability using G-theory.

In G theory, there are two types of coefficients that can be computed: G and Phi. These coefficients serve to distinguish between relative and absolute decision-making within G theory. Specifically, G and Phi coefficients enable the independent assessment of norm-referenced testing and criterion-referenced testing. Coefficients derived from relative error variance are determined by the interactions between different aspects of measurement and the items being measured, and they are referred to as generalizability coefficients (G coefficients). On the other hand, coefficients obtained from absolute error variance are based on the main effects of all factors involved in measurement, including different facets, and the interactions between these facets and the items being measured are represented by the Phi coefficient (symbolized as Φ). It's crucial to note that in assessing behavioral measurements' reliability, a G-study is crafted. It aims to separate and estimate variations from the measured object and possible measurement error facets. This approach emphasizes practicality and efficiency in examining these facets. Afterward, a D-study (decision study) utilizes insights from the G-study to customize measurement applications for specific purposes. During D-study planning, decision-makers outline the scope of generalization, specifying facets and levels for extending conclusions and the intended interpretation of the measurement (Rentz, 1987; Shavelson & Webb, 1991: 2003).

1.1. The Present Study

In the context of South Africa, where the TIMSS test is commonly utilized, it's crucial to assess the reliability of these test scores to ensure their accuracy and usefulness in educational decision-making. The 2019 Trends in Mathematics and Science Study (TIMSS) results revealed a decline in Grade 4 mathematics achievement in South Africa compared to the 2015 average score of 376 (Mullis et al., 2020). This has sparked a debate among South African educators about the reliability of TIMSS scores in gauging the performance of South African students relative to those in other countries. While TIMSS employed a relevant instrument to assess mathematics skills among South African learners based on the framework and content, there's a lingering question about the reliability of these test scores. However, the literature lacks a comprehensive assessment of the reliability of TIMSS scores in South Africa using a robust statistical framework. Existing research mainly relies on classical test theory, which has limitations in addressing multiple sources of error and various measurement facets. Various studies have explored the reliability of test scores using generalizability theory in different contexts. For instance, Akindahunsi and Afolabi (2021) evaluated the reliability of English Language examination scores in Nigeria and found high-reliability coefficients. Uzun et al. (2018) assessed the score reliability of dentistry students' communication skills and identified issues related to the task component's variance. Nalbantoglu-Yilmaz (2017) examined score reliability from self-, peer-, and teacher-assessments and found acceptable limits of reliability. Gugiu et al. (2012) investigated the reliability of grades assigned to research papers and discovered high interrater reliability. Atilgan (2008) used generalizability theory to assess the score reliability of the special ability selection examinations for music education programs in higher education and concluded that

both the relative severity of raters and the relative difficulty of tasks are reported as the variance component of facets.

However, most of these studies focus on test scores outside of the TIMSS context, particularly those for grade 4 mathematics. Notably, there's no comparable study that examines the reliability of TIMSS test scores using generalizability theory, specifically for South African learners in the 2019 TIMSS mathematics assessment for Grade 4. This study addresses this gap by assessing the reliability of TIMSS test scores for South African learners using the Generalizability Theory. The study's uniqueness lies in its utilization of TIMSS mathematics achievements and scores from the IEA IDB Analyzer Merge module. By applying Generalizability Theory, the study aims to offer a more accurate and detailed understanding of the reliability of TIMSS test scores for South African learners. Consequently, the research seeks to fill the existing gap in the literature by answering the research question: What is the reliability of TIMSS test scores for learners in South Africa, analyzed through the lens of Generalizability Theory?

The next section outlines the methodology, encompassing participant details, used instruments, and conducted statistical analyses. Subsequently, the third section presents the obtained results, and the paper concludes with a discussion section, which includes final remarks and practical implications.

2. Methodology

The study employed a crossed one-facet design where all conditions of one facet are observed alongside all conditions of every other facet. For instance, in this design, denoted as a $p\mathrm{x}i$ design, each individual's measurement is taken for each item, symbolized as X_{pi}. The research utilized mathematics achievement data from the TIMSS 2019 4th-grade assessment in South Africa, accessible from the IEA repository (https://www.iea.nl/data-tools/repository/timss) (IEA, 2021). All 4th-grade students who participated in TIMSS 2019 from South Africa were included in the study. The selection of participants for TIMSS 2019 was meticulously carried out using a systematic random approach to ensure a representative sample of all 4th-grade students in South Africa, encompassing a diverse range of schools. The assessment included 11,891 students, hailing from 298 distinct schools nationwide. The gender distribution in the sample was almost balanced, with 49.4% male, 50.4% female, and a minimal exclusion of 12 data entries (0.2%). Notably, the assessment received a high response rate for all questions, highlighting the comprehensive completion of the evaluation.

The research incorporated data gathered from students who participated in the 2019 TIMSS assessment cycle, responding to a 35-item test that included both multiple-choice and constructed response questions. TIMSS is a global evaluation of math and science skills, conducted every four years since 1995, targeting students in 4th and 8th grades. Notably, it's important to highlight that South Africa joined the TIMSS initiative in 2015. The primary goal is to analyze trends in student achievement alongside contextual data. In TIMSS 2019, 58 countries participated, constructing the assessment based on frameworks established by each country for various curriculum areas and grades. The majority of items are designed to evaluate students' application and reasoning skills (Mullis et al., 2020). In TIMSS, student achievements are represented using five plausible values. For this study, these five plausible values were employed as a measure of mathematics achievement for South African grade 4 students in the 2019 assessment. The values were obtained using IEA IDB Analyzer 4.0.12 (2018) and SPSS software version 26.0. The analysis involved the utilization of various tools,

including the "*gtheory*" package (Moore, 2016), along with functions like *aov(), gstudy(), dstudy(),* and others within the R programming language and statistical computing environment (R Core Team, 2021). These tools were employed to compute parameters such as the g-coefficient, phi coefficient, and the D study. The D study, which identifies the most suitable number of conditions for each aspect to optimize reliability, was deduced from the G study variance components. The specific R code implementations, adapted from Huebner and Lucht (2019), can be found in the appendix.

3. Results

The G-study procedure calculates the variances associated with the measured entities (e.g., students/persons) and the different aspects (e.g., tasks/items), along with variance that cannot be explained. This analysis quantifies the level of error when extending a student's 2019 TIMSS 4th grade mathematics test score to the overall score of the population. An effective way to interpret the estimated variances in a G-study is by determining the proportion of the total variance that each variance component signifies. Table 1 displays the assessed variance corresponding to each of these components.

Source	Effect	df (α)	SS (α)	MS (α)	$\sigma^2(\alpha)$	Percent of variability
person	σ^2_p	149	9372938	62906	1777.14	59.9
Item/task	σ^2_i	34	2487749	73169	483.09	16.3
residual	$\sigma^2_{pi,e}$	5066	3573100	705	705.31	23.8

Note: SS (α) – sum square, MS (α)- mean square, df (α)- degree of freedom, $\sigma^2(\alpha)$ - estimated variance

Table 1. Summary of G-study statistics for the p x i design

Table 1 demonstrates that the variance stemming from students, representing the overall score variability, constitutes 59.9% of the entire variance, which appears notably substantial. Additionally, the variance attributed to items making up 16.3% of the total variance is somewhat smaller compared to the universe score variance, but it is also less than the residual variance amounting to 23.8% of the total variance. This implies that the variation in students' scores comprises a significant portion of the overall variability, possibly suggesting a substantial diversity in the abilities and backgrounds of the students. The variance arising from the individual items contributes a moderate degree of variability, signifying potential differences in item difficulty or clarity. The residual variance, on the other hand, represents unexplained factors that impact scores beyond students and items, highlighting the presence of other sources of variability that the analysis may not have captured. This underlines the complexity of factors affecting test scores that go beyond individual characteristics and item quality. Furthermore, Table 2 illustrates the calculation of the generalizability coefficient employing the following mathematical expression:

$$\mathbf{E}\rho 2 = \frac{\sigma 2(\tau)}{\sigma 2(\tau) + \sigma 2(\delta)} = \frac{1777.142}{1777.142 + 20.151} \approx 0.989 \qquad \text{Eqn.1}$$

Source	Effect	Estimate
Universe score variance	$\sigma^2(\tau)$	1777.142
Relative error variance	$\sigma^2(\delta)$	20.151
Generalizability coefficient	$\mathbf{E}\rho^2$	0.989

Note: $\sigma^2(\tau) = \sigma^2(p)$ due to the consideration that all facets are treated as "random." This signifies that the sample size is significantly smaller than the population.

Table 2. Generalizability coefficient *(N = 35)*

Table 2 provides the essential elements utilized to calculate the generalizability coefficient for the 35-item 2019 TIMSS 4th-grade mathematics test. According to the table, the computed generalizability coefficient for the test stood at 0.989. This high generalizability coefficient value signifies a considerable level of reliability associated with the test. In essence, the test demonstrates a high degree of consistency in measuring the mathematical abilities of 4th-grade students in South Africa. The implication of this high generalizability coefficient is that the test results are dependable and consistent.

Moreover, in order to evaluate the dependability coefficient, a D-study was conducted, utilizing the foundation established by the preceding G-study. This procedure enabled the determination of the reliability of the TIMSS test, as showcased in Table 3. Much like the approach adopted for the generalizability coefficient, the analysis utilized the dstudy () function. The computation of the dependability coefficient follows this mathematical expression:

$$\boldsymbol{\phi} = \frac{\sigma 2(\tau)}{\sigma 2(\tau) + \sigma 2(\Delta abs)} = \frac{1777.14}{1777.14 + 33.95} \approx 0.981 \qquad \text{Eqn.2}$$

Source	Effect	Estimate
Universe score variance	$\sigma^2(\tau)$	1777.14
Absolute error variance	$\sigma^2(\Delta abs)$	33.95
Dependability coefficient	ϕ	0.981

Table 3. Dependability coefficient

Table 3 presents the elements utilized to calculate the dependability coefficient for the 35-item 2019 TIMSS 4th-grade mathematics test in South Africa. The findings reveal that the calculated dependability coefficient for the test amounted to 0.981. This outcome underscores that the test scores were notably reliable and consistent. The implication of this high dependability coefficient is that the test results are dependable and stable, thus reflecting the students' mathematical abilities consistently. This reliability suggests that the test scores can be confidently used to assess students' math skills, guide educational decisions, and monitor progress over time. Consequently, educators and policymakers can place strong trust in the test outcomes as a reliable tool for evaluating students' mathematics proficiency and making informed educational choices.

Additionally, to establish the D-study concerning the test items, the corresponding values for various alternative n values (found in columns three through six of Table 4) can be established using the equations provided in (1) and (2). As an illustration, the variance components *σ2(I)* and *σ2(pI)* for the D-study, corresponding to the case where n=2, are computed by dividing the variance components from the G-study, *σ2(i)* and *σ2(pi)*, by 2. Table 4 provides an overview of the D-study statistics for the design based on *p x i*.

$\sigma^2(\tau)$	$\acute{n}_i$	25	20	15	10
$\sigma^2(p)$ = 1777.14	$\sigma^2(p)$	1777.14	1777.14	1777.14	1777.14
$\sigma^2(i)$ = 483.09	$\sigma^2(I)$	19.32	24.15	32.21	48.31
$\sigma^2(pi)$ = 705.31	$\sigma^2(pI)$	28.21	35.27	47.02	70.53
	$\sigma^2(\delta)$	28.21	35.27	47.02	70.53
	$\sigma^2(\Delta abs)$	1.36	1.69	2.26	3.39
	$\boldsymbol{E}\rho^2$	0.984	0.981	0.974	0.962
	ϕ	0.999	0.999	0.999	0.999

Table 4. Summary of D-study statistics for the p x i design

Table 4 depicts that as the number of items decreases, the proportion of variance that can be explained by the study, denoted as Eρ2, displays a declining pattern. Starting at 0.984 for 25 items, it decreases to 0.981 for 20 items, further drops to 0.974 for 15 items, and finally reaches 0.962 for 10 items. This pattern suggests that with fewer items, the extent to which the study can account for the variability in the measurements diminishes, leading to a gradual reduction in the explained variance. However, on the other hand, the reliability coefficient, represented as ϕ, remains consistently high throughout the reductions in item numbers. It remains at an elevated level of 0.999 regardless of whether the number of items is 25, 20, 15, or 10. This consistently high-reliability coefficient indicates that even with fewer items in the measurement, the results remain dependable and stable.

4. Discussions and Conclusion

The performance of Grade 4 students in South Africa concerning the 2019 TIMSS Mathematics assessment has been scrutinized using generalizability theory through single-facet designs, and the ensuing findings are outlined below. In this framework, items or tasks are considered as the focal measurement object in completely crossed designs. In this particular setup, the estimated variance component associated with items exhibits a notably limited impact in elucidating the overall variance. While conventional wisdom suggests that the measurement object should significantly contribute to explaining total variance, existing literature demonstrates instances where variance percentages of the measurement object are low, particularly when the attributes being measured do not exhibit substantial differentiation. In this study, it has been deduced that the items or tasks within the 2019 TIMSS mathematics test exhibit insignificant disparities in terms of difficulty levels. This observation resonates with the findings of Akindahunsi and Afolabi (2021), Atilgan (2008), and de Vries (2012), which imply that a considerable portion of the error variance in the examination might be attributed to the interplay between individuals and items. Lowering this variance could result in heightened dependability. Furthermore, upon examining individual students, it becomes apparent that the variance associated with the student component is notably significant. This observation suggests that the 2019 TIMSS participants differ in terms of their performance within the context of the assessment. This aligns with previous findings reported by Yılmaz and Gelbal (2011). In conclusion, the G-Study analysis offers a comprehensive panorama of the contributing elements to Grade 4 TIMSS mathematics scores in South Africa. It underscores the significance of students' unique attributes, the quality of test items, and recognizes the existence of unexplained variance. These insights present the opportunity for refining mathematical education strategies, test development, and assessment methodologies, ultimately culminating in more meticulous and insightful evaluations of students' mathematical capabilities.

Furthermore, the outcomes derived from the generalizability coefficient underscore the likelihood that the test results accurately mirror students' mathematical skills and knowledge, unaffected by random or extraneous influences. This conclusion resonates with earlier investigations by Gugiu et al. (2012) and Yilmaz (2017). Additionally, the dependability coefficient (Φ), a metric reflecting the measurement procedure's contribution to the test score's reliability, emerges as highly dependable. This aligns with the assertions of Akindahunsi and Afolabi (2021); Brennan (2003), who posit that values approaching unity (1) indicate the capability to discern scores of interest with notable accuracy, even amidst random measurement fluctuations. Notably, Φ offers the advantage of pinpointing error sources that undermine classification precision and devising strategies for enhancing these classifications. While most authors typically explore variability across facets to identify the most beneficial factor for generalizability, this outcome aligns with the findings by Fosnacht and Gonyea (2018). Additionally, the consistent high-reliability coefficient confirms that even when the measurement employs a reduced number of items, the results maintain their reliability and stability. Yin and Wiley (2015) corroborate this notion by affirming that expanding the number of items reduces error variance while simultaneously elevating both G and phi coefficients. Succinctly, the findings underscore the robustness of the assessment. The generalizability coefficient implies trustworthy reflections of student abilities, supported by previous studies. The dependability coefficient reinforces measurement precision, is consistent with expert opinions. Additionally, the enduring high-reliability coefficient endorses the reliability of results even with fewer items. These observations not only confirm existing research but also contribute to a better understanding of measurement quality and the factors influencing it.

5. Implications

The findings carry significant implications for the realm of educational assessment. To begin with, the reduction in the proportion of explained variance emphasizes a delicate equilibrium between assessment comprehensiveness and practical constraints like time limitations or participant fatigue. It is imperative to carefully navigate this equilibrium, considering the interplay between item count and the extent of measurement precision. Additionally, the enduring high-reliability coefficient signifies that, even in situations where there's a necessity to curtail the number of items, educators and policymakers can still place confidence in the retained items to generate consistent and reliable outcomes. Furthermore, the identification of sources of variability in the scores provides policymakers with valuable insights to make well-informed decisions concerning the enhancement of educational quality within the country. This offers a pathway to strategically address areas that contribute to variance, enabling targeted interventions to uplift educational practices.

Acknowledgments

We acknowledge the International Association for the Evaluation of Educational Achievement (IEA) for providing the Trends in International Mathematics and Science Study (TIMSS) data for this study. Their commitment to making this data available for research purposes is greatly appreciated, as it contributes to the advancement of educational research and our understanding of global educational trends. Thank you, IEA, for your valuable contribution to the academic community.

Appendix- R codes

```
# get working directory

getwd()
# set working directory

setwd("C:/Users/DELL/OneDrive/Download 6/Generalisability theory")

# call package for the generalizability theory analysis

library(gtheory)

# read dataset into R environment

Person <- as.factor(rep(1:150,each = 35))

Item <- as.factor(rep(1:35,times = 150))

Score<-
c(582.69,616.59,570.78,648.9,658.69,682.77,667.15,624.15,611.69,621.51,682.32,671.44,58
5.7,616.21,609.22,673.87,671.28,616.33,607.96,701.09,596.1,660.19,626.15,616.2,699.75,58
9.11,628.68,582.25,628.33,682.67,579.98,623.44,619.26,600.61,657.1,526.63,497.17,561.69,
469.71,548.32,525.4,537.62,582.21,533.37,551.16,500.12,562.58,548.75,519.32,549.18,540.
5....)

Timss_dat <- data.frame(Person,Item,Score)

# to perform analysis of variance

ANOVA<- summary(aov(Score~Person+Item, data  = Timss_dat))

# extracting the ANOVA output

sink()

sink("ANOVA_ANALYSIS.TXT")

ANOVA

sink()

# to perform G-study variance components from ANOVA results

formula1 <- Score ~ (1|Person)+(1|Item)

g_study <- gstudy(data = Timss_dat, formula1)
g_study$components

# extracting the G-study output
```

```
sink()

sink("GSTUDY_ANALYSIS.TXT")

g_study$components

sink()

# to perform D-study component

d_study <- dstudy(g_study,colname.objects="Person",colname.scores="Score",data=
Timss_dat)
d_study$components

# extracting the D-study component output

sink()

sink("DSTUDY_ANALYSIS.TXT")

d_study$components

sink()

# to perform universe score variance

d_study$var.universe

# to perform relative error variance

d_study$var.error.rel

# to perform generalizability coefficient

d_study$generalizability

# to perform dependability coefficient(phi)

d_study$dependability
```

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Brilliant Club Scholar Programme Case Study: Teaching Climate Change With KS2 Pupils

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Abstract
Since the autumn of 2022, I have become a Brilliant Club Scholar Programme tutor, delivering university-style lectures on Climate Change to KS2 pupils with underprivileged background. I appreciate the opportunity to contribute and be part of pupils' progress in their understanding of this subject and try to engage them in a range of learning activities. It is essential for pupils to understand climate change at a young age and grow up to be adults who positively contribute to the zero-carbon future. This paper aimed to introduce the course design process guided by the Brilliant Club and reflect on the delivery of the Climate Change course in primary schools in Wales in 2022/23. Good practices were discussed and concluded.

Keywords: Brilliant Club, Climate Change, University Style Teaching, KS2 Pupils

iafor
The International Academic Forum
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1. Introduction

The Scholars Programme by the Brilliant Club is to link PhD researchers to pupils at age 8 to 18 in schools across the UK. The core purpose of this programme is to inspire and help underprivileged pupils to develop the knowledge, skills and confidence to secure a place at a competitive university. At the same time, PhD researchers are well supported by the Brilliant Club to develop their teaching skill. In 2022/ 2023, 473 tutors supported 17,649 pupils through 1276 placements across the UK. Positive feedback from pupils and tutors were reported (Brilliant Club, 2023).

Based on my experience of delivering the Climate Change course in 11 primary schools in 2022/2023, this paper reflects on how to effectively engage pupils in the learning process. Good practices are discussed and concluded.

2. Course Design

Extensive trainings were provided to all tutors, from safe guarding, to course planning, delivery, assessment and feedback to ensure the tutors are well equipped to deliver the course in classroom.

All courses were designed using Backward Planning (Figure 1), an approach for curriculum design put forward by Wiggins and McTighe in their book 'Understanding by Design'. It is similar to constructive alignment proposed by Biggs and Tang (2011) which also starts with the learning outcome. Backward Planning focuses specifically on what successful fulfilment of the learning outcomes looks like. The main benefit of using this model is to design appropriate assessments to guide students through an effective learning process and achieve the planned learning outcome.

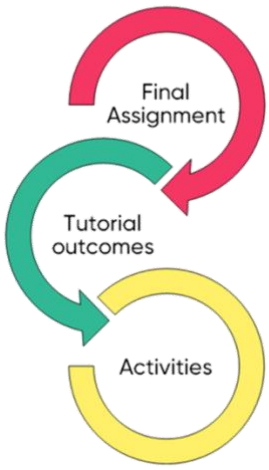


Figure 1: Backward Planning (Brilliant Club, 2022a)

It provided a 3-step process and ensured the course design to achieve the intended learning outcomes:

Step 1: Identify the learning outcomes and design the final assessment

- what the pupils will understand and be able to do after taking the course
- what the success will look like for the pupils
- how to know if the pupils have learnt

Step 2: Plan the learning outcomes for each tutorial

- what the pupils will understand and be able to do after taking this tutorial

Step 3: Design the learning activates for each tutorial

- what learning activities will guide the pupils to the learning outcomes and ways to check

An easy to follow template was provided by the Brilliant Club to further support the design of each tutorial (Appendix A). For each tutorial, following the set of tutorial objectives, a starter activity is designed to hook students' interest or check their learning from the previous session to ensure they are ready for the new session. Then, the main learning activities are designed to deliver key concepts with consideration of how students can demonstrate their learning. Finally, a plenary session is designed to assess pupils' understanding and provide opportunity for them to reflect on their learning.

Brilliant Club also provided further advice on assessment, marking and feedback:

- Assessment: An assessment should not be viewed as to rank, label and category as many studies identified in practice (Ramsden, 2003; Rowntree, 1987). It is important for both tutors and pupils to understand the purpose of an assessment is to ensure and support the quality of teaching and learning (Atkins et al., 1993).
- Feedback: The power of the feedback is to help students close the gap between where they are aiming to be and where they are now (Sadler, 1989). Feedback is no longer a transmissive process and simply passing information from teachers to learners, but an interactive process involving teachers giving, student receiving and taking actions (Black & Wiliam, 1998; Carless & Winstone, 2020; Nash & Winstone, 2017). It is important to overcome characteristics of poor feedback (Huxham, 2017), including 1) ambiguity and opacity, 2) negativity, 3) lateness and 4) uncertainty about criteria and contexts.

A Scholar Programme includes seven tutorials at schools, with one starting event inspiring the participating pupils and one event to celebrate their graduation at well-known universities (Figure 2). The course on a chosen subject is delivered in the first five tutorials. At the end of the fifth tutorial, an assignment is introduced to the pupils to consolidate their learning. Tutorial six is dedicated to give individual feedback on pupils' draft assignment. Then, pupils have two to three weeks to continue working on their assignment before the final submission. Tutorial seven intends to give one to one feedback on the final assignment after the marking and moderation of the assignment. To evaluate the impact of the course, a baseline assignment is set at the end of the first tutorial to capture pupils' knowledge before the scholar programme.

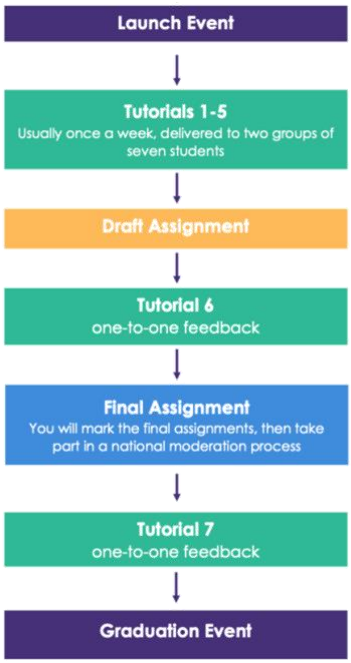


Figure 2: Course structure (Brilliant Club, 2022b)

3. Climate Change Course Design

The Climate Change course was designed in partnership with the Department of Meteorology at the University of Reading and the Met Office.

The course rational is our climate is changing, and all humans need to do take action to protect our planet (The University of Reading & The Met Office, 2022). The academic skills that this course aims to help pupils with are:

- how to use evidence to support arguments
- how to write reports
- how to reason scientifically

The Climate Change course is well designed with a wide range of resources and activities to engage pupils, including discussion, role play, etc**.** It covers what climate change is, what the causes are, what the impacts are and what actions we can take to mitigate and adapt to climate change:

Tutorial 1 – An introduction to climate change + *Baseline Assignment*
Tutorial 2 – The physics of climate change
Tutorial 3 – What are/might be the effects of climate change?
Tutorial 4 – What can we do?
Tutorial 5 – Bringing it all together + *Final Assignment*
Tutorial 6 – Draft assignment feedback and reflection
Tutorial 7 – Final assignment feedback and reflection

A baseline assignment and a final assignment are set to demonstrate pupils' learning:

- Baseline homework: pupils are asked to write a 300-word essay about what climate change is based on the first lesson, learning to use references and captions.
- Final assignment: the pupils will write a 1000-word letter to convince their head teacher that the school should take specific actions to mitigate and adapt to climate

change. The work is assessed in three criteria, including subject knowledge, critical thinking and written communication, with clear rubric set in the workbook.

4. Climate Change Course Delivery

The course delivery was well supported by the programme officer and teachers from schools. Most pupils were well engaged in each tutorial. After the first-round delivery, I reflected on my experience in supporting pupils' learning:

1. Feedback on the baseline homework should be delivered to pupils in an effective way. Pupils did not know how to use their feedback.
2. A more effective way to help pupils remember the last lesson can be explored. Pupils forgot what they learnt a week ago.
3. When setting the final assignment, the criteria used to mark the final assignment should be discussed with the pupil. Their focus was on the typo, punctuation, etc.

According to Haigh (2005) and (Gossman 2008), I adopted the three R (rules, reflection and research) model to assist my teaching development: 1) identify factors affecting teaching and formulate a set of rules, 2) reflect on my practice and refine and develop new rules and 3) conduct research into teaching. In my second-round delivery of the Climate Change course, I updated my tutorials in relation to my reflection and research on effective teaching and support learning:

1. Use an example baseline assignment to show pupils the good part, and the part that can be improved, ask pupils to talk about how they did their homework and ask them to revise their own work. As Sadler (1998) concluded that we should focus on not just the technical structure of the feedback (such as its accuracy, comprehensiveness and appropriateness) but also its accessibility to the learner (as a communication), its catalytic and coaching value, and its ability to inspire confidence and hope. Feedback should be learner-centered and be used by students to achieve their academic goals and build their confidence, instead of being teacher-centered and instructing how to correct an error in a piece of work. It is also an opportunity to reassure the pupils and recognise their efforts.

2a. Have a 5 to 10-minitue quiz at the beginning of each class and ask pupil to write down the answers. Research showed that testing could improve students' memory of the tested information and their ability to remember related information (Brame & Biel, 2015).

2b. Ask pupils to draw a picture in relation to climate change to engage pupils, which is an exciting activity for most of the pupils, and they demonstrated great creativity (Figure 3). According to Hardiman et al. (2019), memories associated with arts are powerful—arts experiences are thought to elicit emotional cognition, employ creative thinking pathways, and recruit cognitive processes that inherently facilitate long-term recall. Alternatives are offered to students do not feel comfortable to draw, such as creative writing, etc.

3. Discuss critical thinking, written communication and subject knowledge with pupils with examples. Ramsden (2003) pointed out that it is important to discuss assessment expectations with students. I found simply sharing the criteria was not effective and students didn't understand these criteria due to cognitive overload or the lack of knowledge and experience. With examples, Pupils can learn from emulation (Sadler, 1989).

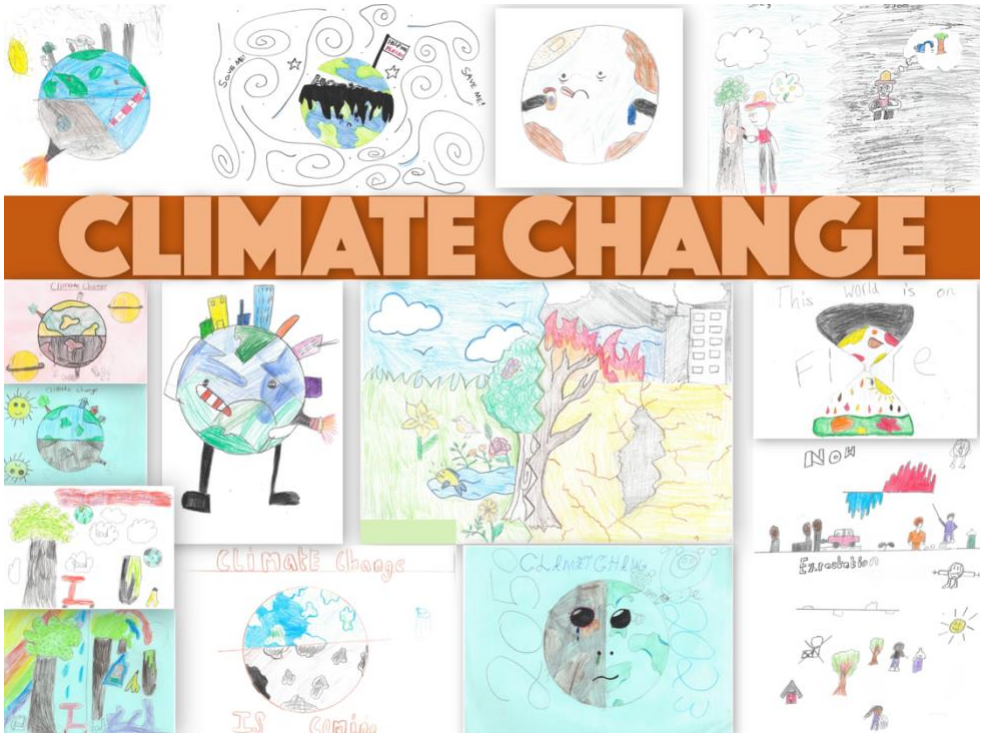


Figure 3: Drawings created by pupils

In addition, two more challenges have been recognised. While communicating with the programme officer, practical and effective advice was provided:

1. How to help the pupils who did not get it?
    - Coming up with a few simple analogies for 'Climate Change'/a few of the trickier concepts
    - Using graphics to support with showing pupils the processes involved in and the effects of Climate Change
2. How to keep pupils motivated throughout each session?
    - Starter ideas (helps to -recap' content of previous session, making sure that pupils are engaged from the beginning)
    - Planary/review ideas (can motivate learners because they feel that they've 'learned something' during that tutorial)

5. Conclusion

After the successful delivery of the Climate Change course in 2022/23, I reflected on the future Scholar Programme course design and delivery:

- Motivate pupils and guide them to deep learning. Pupils have three main learning approaches, i.e., surface learning and deep learning recognised by Marton and Saljo (1976), and strategic approach identified by Entwistle et al. (1979). Comparing to the surface learning approach to do the minimum to meet course requirements and the strategic approach to achieve the highest possible grades, the deep learning approach seeks to understand the meaning of knowledge and engage the task with an appropriate level of cognitive activities. It is the teachers' responsibility to set up a course that encourages students to use the deep learning approach rather than leave it to pupils' choice.
- Consider applying neuroscience for learning and development (Collins, 2023), Brain Targeted Teaching (Hardiman, 2023; Seegers, 2020) to improve learning, including

making topics multisensory, engaging pupils in active review, chunking, using brain friendly learning models and so on.

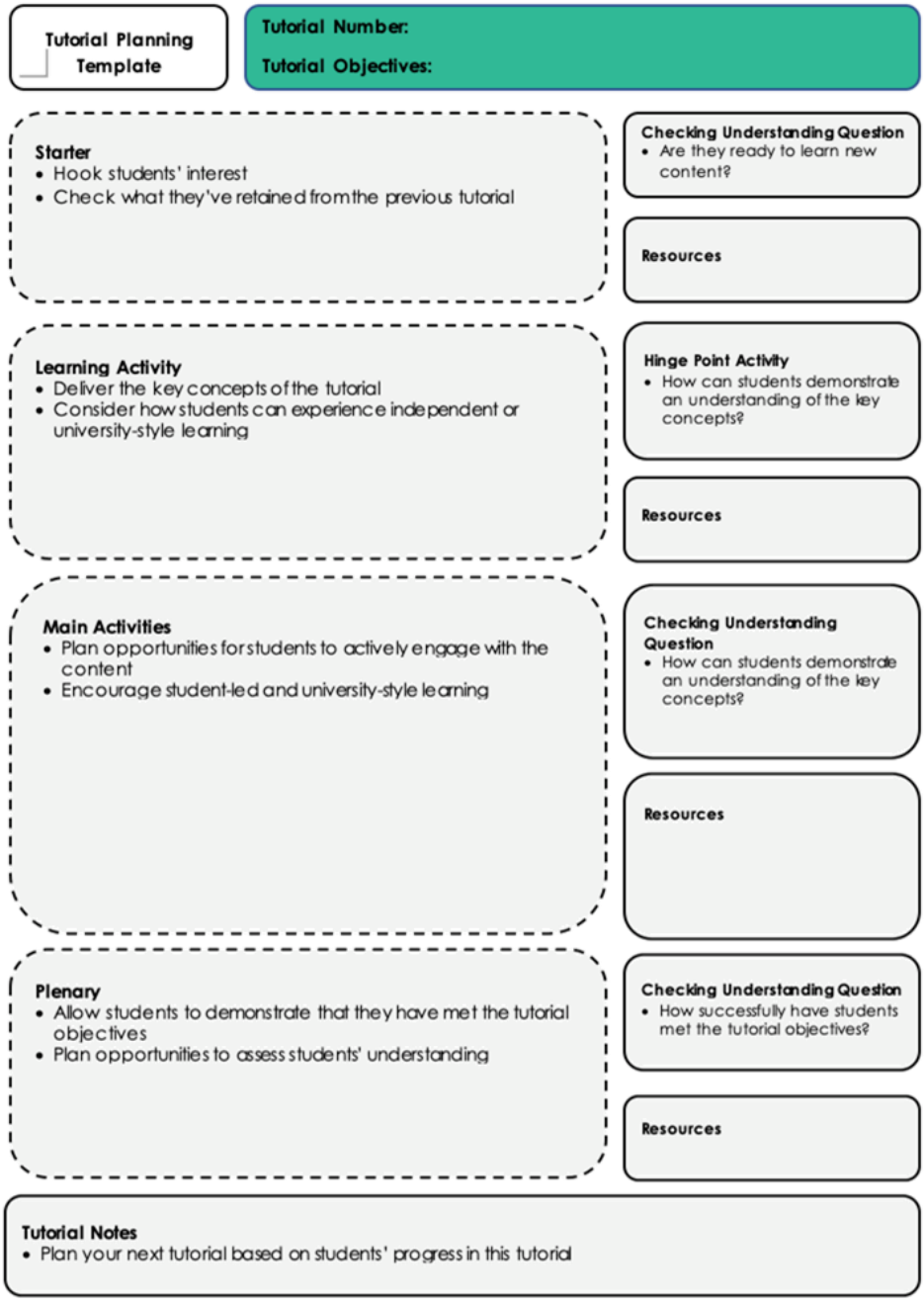
- Consider opportunities to design the course with pupils as patterners. According to Healey et al. (2010), actively engaged in one's own learning is the basic level of engagement. How to engage pupils in the co-creation of learning and teaching, as the role of Consultant identified by Bovill et al. (2016), can be explored further.
- Consider the continuality of Scholar Programme support and resource for participating pupils. The ultimate purpose of the programme is to inspire pupils and guide them to become independent learners. The potential to create learning resources that pupils can have access to after the graduation to continue their learning and development.

Acknowledgements

The climate change course was designed by the University of Reading and the Met Office. Teaching materials, school links and delivery support were provided by the Brilliant Club.

All teachers at schools worked hard to coordinate the course and ensure the programme run smoothly.

Appendix A: Tutorial Planning Template



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Co-designing Curriculum for Rural Education in Indonesia: Promoting Relevance and Engagement for Holistic Education Development

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Official Conference Proceedings

Abstract
This research aims to explain the process and impact of the co-design of curriculum in some rural schools in West Nusa Tenggara, East Nusa Tenggara, North Kalimantan and East Java, Indonesia. The methodology used in this research is descriptive qualitative with data collection techniques through interviews, group discussions and document analysis. This research identifies stakeholders involved in the curriculum co-designing process, namely teachers, students, parents and the community members. The process in four regions begins with the initial exploration stage, consisting of understanding the local context and building stakeholder capacity and capabilities. However, East Java province is exempt from the second phase of initial exploration due to its stakeholders' sufficient capacity and capability. The process continues with the discovery phase to identify the educational needs, the development phase to conceptualize and refine the curriculum, and the delivery phase to implement and revise the current curriculum. There are three main characteristics of this process including inclusiveness, collaboration and iteration which contribute to the development of a curriculum that is adapted to the local context and cultural values. The co-design process is proven to increase active participation from students in the learning process and active contribution from the local community which simultaneously develops holistic education. The research further demonstrates that the process of co-designing curriculum requires the unwavering commitment and cooperation of all parties involved to enhance collaboration and improve capacity building, as well as substantial assistance from government agencies and other pertinent institutions to advocate for holistic education and curriculum evaluation.

Keywords: Co-Design, Curriculum, Holistic Education Development, Rural Area

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Introduction

The provision of education in Indonesia encounters many obstacles in meeting the varied requirements of a vast and heterogeneous population. One of the primary obstacles is the disparity in the availability and caliber of educational opportunities between urban and rural regions. There exist notable gaps in education between urban and rural areas in Indonesia. According to data from UNESCO (2019), school enrollment rates in rural areas of Indonesia are lower than in urban areas, especially in middle and high schools. Moreover, the completion rate of junior secondary school among individuals aged 15 and over in rural Indonesia stood at 37.8%, while urban regions exhibited a higher rate of 60.5% (World Bank, 2020). It is also worth noting that access to early childhood education is comparatively limited in rural areas. Based on the statistics provided, it is evident that the enrollment rate for early childhood education among children aged 3-6 years was 34.3% in rural areas; however, this number accounted for 52.4% in urban areas (World Bank, 2020). The matter at hand holds significant importance, as indicated by statistical data revealing that over 45% of Indonesia's population resides in rural regions (BPS, 2019).

These disparities highlight the obstacles that rural communities experience in gaining access to high-quality education, as well as a pressing need for individualized interventions to address them. To alleviate these tensions, it is also necessary to improve infrastructure, teacher training, and access to technology. However, Indonesia is a culturally diverse nation with more than 300 distinct ethnic groups (BPS, 2020). Meanwhile, curricula that are frequently developed with a top-down approach tend to disregard the local context and the distinctive requirements of rural communities (Suryadarma & Jones, 2013). This condition requires an all-inclusive and diverse educational approach in order to accommodate a variety of requirements (Suryadarma, 2013).

Traditional curriculum design methods frequently take a top-down approach, placing a heavy emphasis on meeting national and international standards without adequately considering the social, cultural, and economic context of students (Schiro, 2013). This approach, while assuring a level of uniformity and standardization, may not effectively meet unique local contexts and needs, frequently resulting in a disconnect between the curriculum and the realities of learners (Bishop & Glynn, 1999; Gay, 2010). As a result, students may experience a sense of alienation from the material being taught, which has the potential to reduce motivation and achievement. In rural and culturally diversified communities, this disconnect can exacerbate educational disparities (Aikman & Rao, 2012).

Understanding the unique challenges and opportunities in this context is essential to designing effective and sustainable education interventions in rural areas. Through this research, education stakeholders will be better equipped to adapt education to local requirements, promote holistic development, and contribute to Indonesia's goals for sustainable development. This study concentrates on the "Co-Designing Curriculum" approach for rural education in Indonesia, with an emphasis on incorporating the local context into the curriculum. This approach acknowledges that effective educational solutions necessitate a comprehensive comprehension of the social, cultural, and economic context of the communities served (Sanders & Stappers, 2008). Therefore, incorporating local stakeholders such as instructors, students, parents, and community members into the curriculum development process can increase educational relevance and participation. A more inclusive and participatory approach will be more effective, especially in rural areas or communities with unique requirements.

This study sought to examine the processes and outcomes of curriculum co-design in Indonesian rural education institutions. This includes evaluating the collaborative role of stakeholders in implementing the joint design of curricula in rural areas and determining how this approach can promote holistic educational development in harmony with the local context. A specific study case will be used to examine the co-designing curriculum in education in Indonesia implemented by the Innovation for Indonesia's School Children (INOVASI) Programme. This programme is a partnership between the Governments of Australia (GoA) and Indonesia (GoI) to identify and support changes to education practises, systems and policies using a bespoke approach: local solutions to local learning challenges in four provinces in Indonesia, including West Nusa Tenggara, East Nusa Tenggara, North Kalimantan, and East Java.

Conceptual Framework

Co-Design in Education Curriculum

Co-design is a collaborative and participatory approach that facilitates the joint involvement of designers and users in the development of the ultimate product or service, with the aim of accommodating the requirements and preferences of the end-users (Sanders & Stappers, 2008). This method is frequently implemented within the business sector when companies strive to fulfil client expectations and meet their demands effectively. The objective of this procedure is to enhance the agency of all individuals involved through the establishment of mechanisms that guarantee the inclusion, acknowledgment, and integration of every perspective within the ultimate framework (Björgvinsson, Ehn, & Hillgren, 2012). The characteristics of participatory design/co-design, as outlined by Sanders and Stappers (2008), Björgvinsson, Ehn, and Hillgren (2012), Simonsen and Robertson (2012), encompass the following aspects:

a) Collaborative: This procedure entails the active and coordinated participation of multiple stakeholders.
b) Empowerment: The co-design approach places a strong emphasis on empowering participants and acknowledging the significance of each individual's voice.
c) Iterative Process: The iterative approach necessitates ongoing evaluations and modifications in order to attain optimal outcomes.
d) Practical Applications: Co-design is centred around addressing practical challenges that are pertinent to the intended recipients.
e) Inclusivity: This methodology places significant emphasis on the active participation of all relevant stakeholders, particularly those who are frequently marginalised or overlooked within conventional design processes.

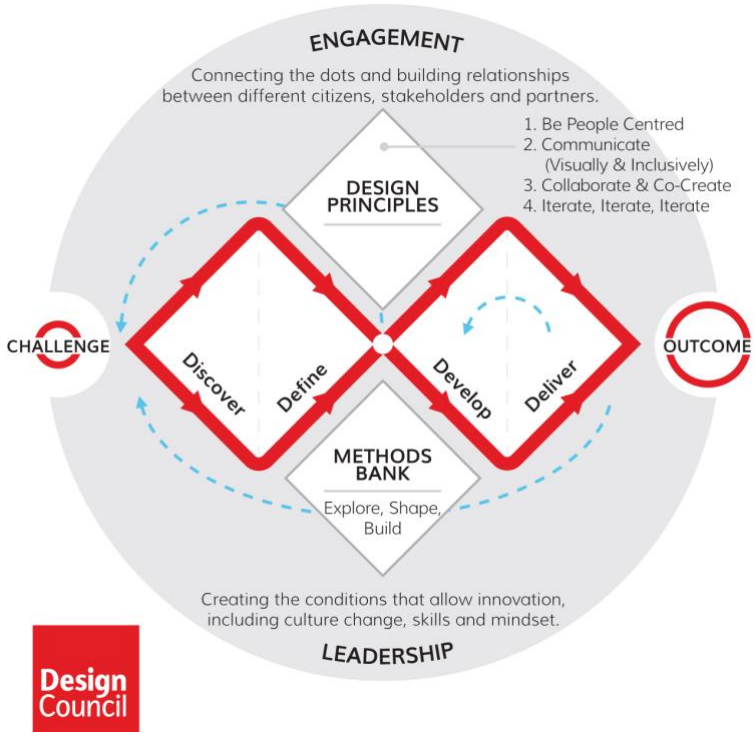

Figure 1. Co-Design Process: The Design Council's Double Diamond
(Retrieved from: Design Council, 2019)

Co-design, within the framework of an educational curriculum, maintains a participatory and comprehensive approach wherein diverse stakeholders, including educators, learners, guardians, and members of the local community, engage in collective efforts to collaborate on the design and advancement of the curriculum. There are some co-design principles in the development of educational curricula. *First*, the collaborative process of co-design in educational curricula places emphasis on the involvement of various stakeholders in order to develop educational solutions that are suitable for the specific local environment (Sanders & Stappers, 2008). *Second*, the concept of learner empowerment involves engaging students in the design process, so enabling them to assume responsibility for their curriculum. This approach has been found to have a positive impact on motivation and active involvement in the learning process (Bavill et al., 2011). *Third*, the utilization of co-design in curriculum development enables the incorporation of local cultural values and social circumstances, hence enhancing the relevance and appeal of education for learners (Bishop & Glynn, 1999). *Last*, the process of iteration and reflection requires continuous adjustment and contemplation to ensure that the curriculum remains adaptable and sensitive to evolving requirements (Brown, 2008).

Holistic Education Development

The objective of a holistic approach to education is to provide comprehensive education to individuals, encompassing various dimensions such as intellectual, social, emotional, physical, and spiritual components (Miller, 2007). The approach aims to offer a comprehensive educational experience that takes into account significant facets of human development. In order to effectively evaluate holistic education, it is imperative to consider and examine each dimension within its respective context.

a) The Cognitive Development Dimension encompasses the cultivation of critical thinking abilities, creativity, problem-solving aptitude, and academic consciousness. The examination of this particular facet of assessment requires careful consideration of how students demonstrate the application of their knowledge and abilities in authentic and practical situations (Paul & Elder, 2006).
b) The physical development dimension encompasses the student's overall physical well-being, motor skills proficiency, and engagement in physical activities. The authors Gallahue and Donnelly (2007) argue that physical health serves as the fundamental basis for achieving successful learning and growth.
c) The Emotional Development Dimension encompasses various aspects such as self-awareness, self-regulation, resilience, and the capacity to cope with stress. The incorporation of emotional intelligence into the curriculum has the potential to facilitate this developmental process (Goleman, 1995).
d) The social development dimension encompasses the capacity of pupils to establish and sustain positive interpersonal connections, demonstrate empathy, and collaborate effectively. The importance of social development in the acquisition of training and interpersonal skills is significant (Zins et al., 2004).
e) The dimensions of moral development encapsulate the student's perception of fairness, adherence to ethical principles, demonstration of respect towards others, and engagement in civic activities. The integration of moral principles into curricula has the potential to promote this developmental process (Lickona, 1996).

Methods

This study employs a qualitative research methodology to gain a comprehensive understanding of the processes and impacts associated with curriculum co-design within the specific context of rural education in Indonesia. This methodology enables researchers to investigate the perspectives, encounters, and interpretations linked to the co-design procedure from diverse stakeholders (Creswell & Poth, 2016). The data was gathered via many methodologies, encompassing in-depth interviews, focus group discussions, and document analysis. According to Krueger and Casey (2014), in-depth interviews are a valuable research method that enables researchers to obtain comprehensive perspectives from individuals. On the other hand, focus group discussions offer valuable insights into social dynamics and collective opinions. Besides, document analysis provides written documentation that serves as evidence of current practises and rules (Bowen, 2009). The utilisation of numerous data sources, methodologies, or theories in the triangulation method serves to establish the credibility and soundness of research findings, resulting in a comprehensive and harmonious representation (Denzin, 1978). The study encompassed informants, consisting of teachers, students, parents, and local community members. These individuals were selected from rural regions in Indonesia, including West Nusa Tenggara, East Nusa Tenggara, North Kalimantan, and East Java. In order to foster a comprehensive and nuanced comprehension of the phenomenon under investigation, it is imperative to include a diverse range of stakeholders, ensuring the inclusion of multiple views in the research process (Flick, 2018).

Findings and Discussions

Co-Design in the Education Curriculum Development Process: Case Studies in Four Provinces Implementing INOVASI Programs in Indonesia

This research successfully delineated the process of co-designing an educational curriculum, encompassing the many stages of co-design and elucidating the respective roles assumed by the stakeholders engaged in this process. The stages exemplify an inclusive and adaptable approach, wherein stakeholders play an active role in every facet of curriculum design, and the design itself demonstrates flexibility and responsiveness to feedback and evolving requirements. The collaborative and iterative approach in this program encompasses multiple stages, which include:

A) Preliminary Investigation

1. Comprehending the Local Context: This phase entails the recognition of the requirements, obstacles, and distinctive attributes of the local community through on-site visits to rural educational institutions, facilitating engagement with students, educators, parents, and community members. It is crucial to comprehend the significance of this concept in order to guarantee the relevance and adaptability of the curriculum being produced, as emphasised by Bjögvinsson, Ehn, and Hillgren (2012).
2. Enhancing the Capacity and Capability of Stakeholders: Workshops are organised with the aim of providing training to educators and parents on the fundamental concepts of collaborative design. Engaging in this activity facilitates the development of the requisite competencies for active involvement in the design process, particularly in the regions of West Nusa Tenggara, East Nusa Tenggara, and North Kalimantan. Surprisingly, the aforementioned step did not transpire in the region of East Java. This observation suggests the presence of variations in the starting capabilities or strategic strategy employed by the respective regions. The process of capacity building plays a crucial role in enabling the empowerment and active engagement of all stakeholders in the design process, as highlighted by Sanders and Stappers (2008).

B) Discovery

1. The identification of educational needs and problems has significant importance in identifying the focal points within the curriculum and effectively addressing the specific obstacles encountered by local communities (Miller, 2010). A series of open dialogues were undertaken with students in order to ascertain their areas of interest in the realm of education, as well as to determine any perceived deficiencies within the existing curriculum.

C) The development and prototyping

1. Brainstorming and Conceptualization of Curriculum: A collaborative session was conducted, involving educators, students, and parents, to generate ideas and conceptualise a novel curriculum that would effectively address the specific requirements of the local community. The involvement of stakeholders in interactive and cooperative dialogues holds significance in the formulation of the preliminary framework of the curriculum (Brown & Wyatt, 2010).
2. Curriculum Refinement: Following multiple iterations of input and modifications, the curriculum concept underwent refinement to verify its alignment with the specific local context, needs, and expectations.

D) Deliver

1. Curriculum Implementation: The implementation of the new curriculum was carried out through a pilot programme, wherein teachers had extensive training and students actively engaged in learning that was more contextualised and stimulating. The

execution of the implementation process is facilitated through the active involvement and collaboration of all relevant parties.

2. Curriculum Revision in Response to Feedback: Following the completion of the testing semester, comprehensive feedback is gathered from all relevant parties, and subsequent modifications are implemented to the curriculum in order to effectively address any identified issues or obstacles. This redesign acknowledges the iterative nature of the design process, wherein the feedback is utilised to facilitate ongoing enhancements (Cresswell, 2014).

Stage	**Sub Stage**	**Location**
Initial Exploration (Discover)	Understanding the local context	All regions
	Building stakeholders capacity and capabilities	West Nusa Tenggara, East Nusa Tenggara, North Kalimantan
Discovery	Identifying educational needs and challenges	All regions
Develop/ Prototyping	Brainstorming and conceptualizing the curriculum	All regions
	Refining the curriculum	All regions
Deliver	Implementing the curriculum	All regions
	Revising the curriculum based on feedback	All regions

Table 1. Co-Design Curriculum Stages in Four Provinces Implementing INOVASI Program

In the West Nusa Tenggara region, there is a significant focus on identifying local educational difficulties. The co-design method yields a curriculum that places emphasis on the acknowledgment of local culture and regional languages, thereby fostering a sense of pride and identity among pupils. In the region of East Nusa Tenggara, the practice of co-design entails active community participation in the identification of economic education requirements. The curriculum that ensues places a strong emphasis on local agricultural practices and the development of commercial acumen, so equipping students with enhanced readiness for the regional labor market. In the context of North Kalimantan, the co-design approach prioritizes the comprehensive comprehension of the environmental context and explores the potential of education in contributing to conservation efforts. The curriculum that has been developed includes modules that focus on the preservation of forests and river ecosystems, aligning with the specific geographical environment of the area. The co-design approach in East Java does not encompass the incorporation of stakeholder capacity and capability development stages. The outcome is a curriculum that is expedited in its development process. The geographical positioning of East Java province on Indonesia's highly populated island, along with its convenient access to a wide range of public services and facilities, potentially influencing variations in the province's capacity and capability to effectively implement co-design strategies.

Characteristics of Co-Design in the Process of Developing the Education Curriculum in Indonesia

The approach of Co-Designing Curriculum for Rural Education in Indonesia is characterised by inclusivity, collaboration, and iteration. This strategy aims to develop a curriculum that is pertinent, influential, and suitable to rural Indonesia's specific circumstances and requirements via a focus on empowerment, involvement, and continuous reflection.

Inclusivity and empowerment are crucial in fostering a more equitable and just society. In order to achieve this, it is important to consider the role of reflexivity and agreement. This procedure promotes active contemplation and consensus-building among participants regarding objectives, approaches, and anticipated outcomes. According to Bjögvinsson, Ehn, and Hillgren (2012), the establishment of a shared understanding and the assurance of equal participation enable the inclusion of all perspectives and ensure that every individual's voice is acknowledged. Codetermination refers to the inclusive practise wherein various stakeholders, such as teachers, students, parents, and community members, are afforded the opportunity to actively engage in the process of decision-making. This practise guarantees that all individuals are actively involved in the process of selecting both the trajectory and substance of the educational programme.

Collaborative development ensures the engagement and participation of all stakeholders, which is integral to curriculum building, facilitating a comprehensive representation of diverse perspectives and requirements (Sanders & Stappers, 2008). The design process incorporates both formal and informal processes to facilitate consensus and agreement, hence promoting equitable representation and collective decision-making.

The iterative process is characterised by the continual participation of all relevant stakeholders, which facilitates the incorporation of changes and adaptations throughout the development process (Scharmer & Kaufer, 2013). A reexamination of developmental phases allows for the possibility of revisiting previous stages, so facilitating the implementation of changes and adjustments informed by feedback and experiential knowledge. Sustained reflection involves the ongoing examination of goals, methods, and outcomes, which facilitates ongoing enhancement and collective knowledge acquisition. This practise ensures that processes remain adaptable to evolving demands and dynamics.

The Impact of Co-Designing Curriculum: Holistic Education Development Evaluation

The findings of the evaluation of co-designing curriculum for rural education in Indonesia demonstrate a noteworthy influence on several facets pertaining to the comprehensive growth of pupils, encompassing:

1. Cognitive Development: The co-design process, characterised by stages of brainstorming and discussion, has been found to facilitate the enhancement of students' critical thinking abilities, creativity, problem-solving skills, and academic performance. This strategy promotes the development of critical thinking and creative problem-solving skills among students, equipping them with the necessary tools to navigate academic and real-world obstacles.
2. Physical development encompasses various aspects of an individual's well-being, including their physical health, motor skills, and engagement in physical activities such as games and ice-breaking exercises during the co-design process. These factors serve as indicators of a favourable impact on students' physical development. This intervention facilitates the development of positive lifestyle behaviours and enhances motor proficiency.
3. Emotional growth is facilitated by the co-design process, as it contributes to the cultivation of self-awareness, self-regulation, resilience, and stress management skills. The significance of this matter lies in the necessity for students to be exposed to a diverse range of perspectives during debates, as this facilitates the development of empathy and a deeper comprehension of others.

4. Social development encompasses the acquisition and refinement of abilities related to the establishment and sustenance of positive interpersonal connections, the demonstration of empathy, and the cultivation of effective collaboration. These proficiencies are further augmented throughout the co-designing stage. Engaging in activities that foster teamwork and social skills can be beneficial for individuals in their everyday lives.
5. Moral development is a multifaceted process that encompasses the cultivation of various qualities such as justice, ethical behaviour, respect for others, and civic involvement. These attributes are fostered through active participation and deliberation within the co-design process. The inclusion of character formation and the cultivation of strong ethical ideals are beneficial aspects of education.

In a general sense, the implementation of the co-design approach within the rural curriculum in Indonesia has yielded favourable outcomes in terms of the pertinence, involvement, communal ties, and comprehensive growth of students. This is a significant stride towards fostering a comprehensive and influential educational system that effectively addresses the requirements and ambitions of all involved parties.

Co-designed curricula possess enhanced relevance since they integrate local context, cultural values, and real-world applications, aligning more closely with students' lives. According to Schwartz and Arena (2013), the use of this approach guarantees that the content being taught aligns with the specific requirements and ambitions of the students, hence facilitating a more profound comprehension and engagement with the subject matter. The co-design approach facilitates sustainable development and the preservation of local culture by including an appreciation for the local context and cultural values.

The act of actively participating in the co-design process has been found to result in a heightened degree of engagement among students. According to Woolner et al. (2015), individuals demonstrate increased engagement in their education and a greater recognition of the practical applicability of their learning in daily life and local communities through their involvement in curriculum development. The co-design method enables students to establish connections and engage with their immediate community, so enhancing their educational experience. According to Sanders and Stappers (2008), this facilitates students' comprehension and admiration of their culture and heritage, while also affording the community avenues to contribute to the field of education.

The holistic development approach places emphasis on the comprehensive growth of students, encompassing not only academic learning but also socio-emotional and cultural learning. According to Miller (2007), this practise contributes to the development of well-rounded persons who acquire the essential skills and attitudes required for achieving success in both personal and professional domains. The process of co-design facilitates the empowerment of various stakeholders, encompassing teachers, students, parents, and members of the local community. According to Bjögvinsson, Ehn, and Hillgren (2012), this phenomenon contributes to the establishment of a collective feeling of ownership and accountability within the realm of education. This strategy fosters innovation in the field of education by creating opportunities for the generation of innovative ideas and the implementation of novel strategies that are tailored to address individual requirements and local attributes.

Conclusion and Recommendation

Conclusion

The co-design of curricula in rural schools in Indonesia is a complex endeavour that involves the active participation and collaboration of multiple stakeholders, such as teachers, students, parents, and members of the local community. By employing this methodology, the research team engages in direct interaction with the individuals who will experience the impact of the curriculum. This facilitates the integration of a profound comprehension of the regional context and cultural principles into the educational programme, yielding subject matter that is both pertinent and captivating to the pupils. Put simply, the curriculum that emerges is not just grounded in theoretical abstractions and concepts but also takes into account the practicalities and genuine requirements of the communities being catered to.

The curriculum that is collaboratively constructed demonstrates efficacy in enhancing educational pertinence for pupils, aligning closely with their specific local circumstances. This phenomenon fosters a heightened sense of affiliation and engaged participation within the immediate vicinity, hence enhancing pupils' sense of belongingness to their cultural heritage and customary practises. Furthermore, this methodology facilitates the comprehensive growth of pupils, encompassing not only their academic progress but also their social, emotional, and moral development. This phenomenon results in an enhanced and more profound educational experience, encompassing not just theoretical knowledge found in textbooks but also the cultivation of personal attributes and practical competencies essential for navigating daily existence.

Policy Recommendations

1. Enhancing Collaboration: The formulation of policies should build a comprehensive structure that fosters and promotes collaborative curriculum development, encompassing the active participation of all relevant parties, particularly in rural regions. By implementing this approach, it can be ensured that the inclusion of diverse perspectives will be prioritised, leading to the delivery of education that is more aligned with the specific requirements and preferences of the local community.
2. Capacity building: This is a crucial aspect of the co-design process since it involves investing in training and development opportunities for teachers and other stakeholders. This investment is necessary to ensure their successful engagement in the process. The acquisition and refinement of the requisite information and abilities for engaging in this collaborative method necessitate systematic instruction and ongoing development.
3. Advocate for Holistic Education: Policies ought to prioritise the comprehensive advancement of pupils, encompassing not alone academic accomplishments but also the cultivation of their holistic development. This comprehensive framework encompasses various dimensions of a student's personal growth, encompassing academic, social, emotional, physical, and moral domains.
4. Curriculum Evaluation: The application of an evaluation framework is crucial in assessing the efficacy of the existing curriculum in facilitating the promotion of relevance, engagement, and holistic development. Continuous assessment will aid in the modification and enhancement of the curriculum to guarantee its alignment with the specific requirements and obstacles of the local context.

Limitations

This research is limited to certain areas in Indonesia, such as West Nusa Tenggara, East Nusa Tenggara, North Kalimantan, and East Java. Therefore, the findings may not be generalizable to all rural areas in Indonesia. This may affect the depth and richness of the data collected. Using a qualitative research design provides an in-depth understanding of processes and outcomes but may lack in producing findings that can be measured and quantified. In addition, the unique nature of the culture and local context of each area studied may influence the interpretation and relevance of the findings in other contexts. Further research is needed to understand in depth how the co-design process can meet the specific needs and challenges of various rural communities in Indonesia.

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Enhance Your Student's Perceived Learning, Attention and Motivation With Immersive Activities and Metaverse – Based Learning

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Abstract
This research was designed to test the effectiveness that immersive tools and activities, specifically metaverse-based activities, has on student learning. For this research, an experiment was designed with a control group and an experimental group in the course EM1009 - Business Model Innovation that is an Online Course lasting 5 weeks and was imparted in the semester of August-December 2022. The experimental group performed certain activities within the metaverse. In the control group, the same activities were carried out, but with a traditional teaching method (without metaverse). Comparisons between both groups were made using parametric and non-parametric hypothesis testing and surveys were also carried out to assess the perception of the learning process of the students who used the metaverse. The results showed that, although in general, there are no significant differences between the amount of learning of both groups, students who work within the metaverse perceive that their learning process has a greater impact in them. They feel more motivated and pay more attention when carrying out innovative activities with state-of-the-art technologies to learn in their classes.

Keywords: Metaverse, Technology, Education, State-of-the-Art

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Introduction

Theoretical Framework

It is important to incorporate cutting-edge technologies in education because they offer unique opportunities and significant benefits for the teaching-learning process. It has the potential to improve the learning experience of students, it guarantees them access to global resources and knowledge, it allows the development of skills and competences that are generally considered useful for the 21st century, it encourages adaptation to work in digital environments allowing the innovation and experimentation of new teaching techniques.

The use of the metaverse and virtual reality in educational environments is addressed, since this technology has the potential to transform learning in education in different ways, which makes it a relevant and powerful tool, as it guarantees students to learn in an interactive and practical environment through immersive experiences. The use of these technologies allows the development of learning activities with a high degree of personalization and adaptability, by guaranteeing access to global resources. Finally, it has been observed that the change of stimuli and the unusual experiences in the classes positively affect the motivation and commitment that students show during the course.

This research focuses specifically on the use of the metaverse and virtual reality, the term of which first appeared in the 1992 science fiction novel "Snow crash" by Neal Stephenson and also appeared in the book and film of "Ready player one" by Ernest Cline. Go et al. (2021) defines the metaverse as a 3D-based virtual reality where daily activities and economic life are carried out through avatars that represent reality itself. It is a universe made up of a network of virtual environments where you have an immersive online experience. Users are represented by avatars and can interact with other people and items that are also in the same environment. It could be said that this term is a new construction, an environment where one can live digitally (Recker et al., 2021).

The use of the metaverse has multiple applications, but in the near future, it could be much more (Donaldson, 2011). Here are some key reasons why using it can significantly improve the learning process:

Immersive Experiences: Virtual reality allows students to immerse themselves in realistic, three-dimensional virtual environments that simulate real-world situations. This provides the opportunity to experience complex or dangerous scenarios in a safe and controlled manner that would otherwise be difficult to reproduce in a traditional learning environment. According to Sattar et al. (2020), virtual reality is a computer-generated interactive experience that takes place in a simulated environment. Users can experience immersive perception and can explore the scenery developing fun and interactive learning. For example, students can explore the human body in 3D, visit historical sites, or participate in hands-on simulations such as spaceflight or science experiments.

Interactive and Hands-On Learning: Instead of just reading or listening, the metaverse and virtual reality allow students to interact directly with the concepts and objects of study. They can manipulate virtual objects, conduct experiments, solve problems, and collaborate with other students, which encourages hands-on, active learning. This hands-on, active participation can improve comprehension and retention of information. Studies have shown

that virtual reality can improve student comprehension, knowledge retention, and engagement as well as student motivation and attention span (Clegg, 2023).

Personalization and Adaptability: Virtual reality and metaverse technology can be tailored to individual student needs and learning styles. Virtual environments can be adjusted to provide instant and personalized feedback, offering specific activities and exercises for each student. This allows for a more personalized approach and greater attention to each student's strengths and weaknesses, which can lead to more effective learning. Immersive learning engages and holds students' attention for longer because it is more engaging. Traditional learning methods can be boring, however, immersive learning makes students feel right at the center of the action (Buljan, 2022).

Access to Global Resources: The metaverse allows students to access a wide range of educational resources from around the world. They can connect with experts, researchers, and professionals from any field, participate in virtual conferences, and access virtual libraries. This expands learning possibilities beyond the physical limits of traditional classrooms and provides students with a global and up-to-date perspective.

Motivation and Engagement: Virtual reality and the metaverse have the potential to make learning more engaging and exciting for students. By providing immersive and engaging experiences, students' intrinsic motivation and engagement in the learning process can be increased. This can lead to greater participation, interest and dedication on the part of students, which, in turn, can improve academic results. One study suggests that students retain more information and are better able to apply what they have learned after participating in virtual reality exercises (Krokos, Plaisant, & Varshney, 2019).

Description of the Innovation and Research Methodology

The objective of this research was to compare different business model alternatives to bring innovation to market using patterns from different industries in an emerging or newly created context to assess whether the use of the metaverse positively influences learning and experience. of the students.

The composition of both groups is described below:

Experimental Group	Control Group
Classes in the metaverse Tec Virtual Campus + training session	Flexible Interactive and Technology-driven (FIT) Classes (Zoom)
Duration: 5 Weeks / 10 Sessions	Duration: 5 Weeks / 10 Sessions
Teacher: Rocío Cortez	Teacher: Rocío Cortez

28 students (Campus Toluca, México City, State of Mexico, Santa Fe, Monterrey, Chihuahua, Guadalajara, Sinaloa, Sonora) 17 male / 11 female Average grade previous to taking the EM1009 course: 85.65 First semester: 5 Second semester: 15 Third semester: 9	30 students (Campus Hidalgo, Puebla, Querétaro, State of México, Santa Fe, Monterrey, Aguascalientes) 13 male/ 17 female Average grade previous to taking the EM1009 course: 92.08 First semester: 5 Second semester: 17 Third semester: 6 Fourth semester: 1 (CPF) Sixth semester: 1 (IIS)

Table 1: Information of the experimental and control groups.

For the experimental group, a series of activities were developed that had to be carried out by the students of the Tec de Monterrey, in the metaverse called Tec Virtual Campus, so that they could meet the skills required to pass the course. They also did a Pre-Test at the beginning of the course and a Post-Test in the last class. This activity allows us to evaluate the knowledge of the student prior to the activities and to compare it against the knowledge of the same student after the activities. They carried out various activities in the Tec Virtual Campus, such as "The blender", "Emerging economies and the 55 business models" and they made an evidence at the end to demonstrate that the students acquired the necessary skills to pass the course. For the control group, the same activities were carried out, but were adapted to be carried out outside of Tec Virtual Campus.

A comparison was also made between the results of the student opinion surveys (ECOA's) regarding the course to check if there were differences between the general opinions of the students in both groups.

The research variables that were used were:

- Grades of the activities: The blender, Emerging economies and final evidence
- Final grades
- Learning gain score (session 1 with pre-test and session 10 with post-test)
- Student satisfaction end of the course poll

Subsequently, the students' results were compared by doing a series of parametric and non-parametric statistical tests and symmetry tests depending on the characteristics and shape of the data distribution. These tests make it possible to compare whether there are statistically significant differences between the results of the control group and the experimental group.

The students of the EM1009 Business Model Innovation course in the FIT modality in the August – December 2022 semester lived an innovative and memorable experience when they connected to their classes in the metaverse of Tecnológico de Monterrey, Tec Virtual Campus. One of the main premises is that the design of the activities to be carried out are appropriate to the virtual and interactive environment where the student becomes an active participant and the teacher is a guide - facilitator in the learning process. It also sought to enhance the learning and engagement of the group through different scenarios such as the Team Suite, Arena, Meeting Room, or having the great opportunity to take the class in the tallest building on the TecVirtual Campus. Students learned to identify and apply methods and tools in business models taking into account the megatrends and technologies of different

industries, as well as develop the Business Model Canvas based on what was learned in the course. At the end, the students presented their evidence in a video pitch that was projected in the Showroom inside the Tec Virtual Campus Gallery, where they selected the best works of their classmates.

The work plan prior to implementation in the experimental group is described below:

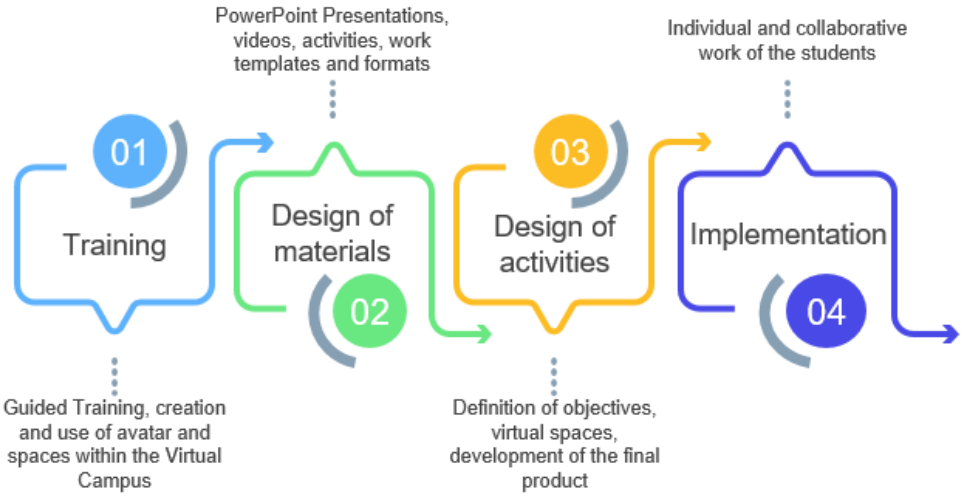

Figure 1: Implementation of the activities in the metaverse.

1. Training was received with the objective of knowing the tool, creation of an avatar, handling it, reactions, use of chat, teleportation to the different scenarios, voice, among others. Likewise, time and space were allocated so that the students also received said 30-minute training with a guided tour.

2. The preparation of materials consists of developing the supports for the class, the templates that the students will use to work, the videos that are used as resources for the class and interactive dynamics to involve the students in the contents.

3. The activities carried out in both the control and experimental groups were the following:

Activity	Objective	Scenario	General Description
The Blender	Identify and apply elements (methods and tools) to take into account in processes of creativity and innovation in Business Models, while making use of megatrends/technologies in different industries.	Meeting Room Arena Team Suite	Selection (in teams) of an industry and type of technology. The students turn on their mental blender to develop a proposal for a new business model, which is reflected upon and presented to the group.

Emerging economies and the 55 business models	Apply the 55 Business Model patterns suggested by the Business Model Navigator Apply and develop the Business Model Canvas and choose 3 of the 55 business models for a selected idea from those generated in the previous class.	Auditorium Roof Hall Team Suite	The results of the "Blender" activity are discussed as a team and an outstanding idea is selected to develop the BMC. At least 2 of the 55 Business Models that could start the idea are selected and describe how its development would be.
Virtual Showroom and Evaluation of the Business Model	Contribute to the development of the following sub-competences and mastery levels: • Business model (B) • Business model (C) • Innovation (A)	Forest Campsite Gallery	Individually, students prepare a Video-Pitch that includes the value proposition and the elements of the business model aligned to it, as well as mentioning what type or mix of business model patterns they are using. Videos are uploaded to Tec Virtual Campus spaces and students review them in the Gallery and vote for their favorite

Table 2: Activities of the EM1009 Business Model Innovation course used f or the investigation.

It should be noted that these activities in the control group were carried out in Zoom, through the breakout rooms tool to start working as a team, and in the experimental group they were carried out in the Tec Virtual Campus metaverse.

1. Regarding the implementation, the classes have a duration of 2 hours, being 100 effective minutes, in which 28 students participated in the experimental group and 30 students in the control group.

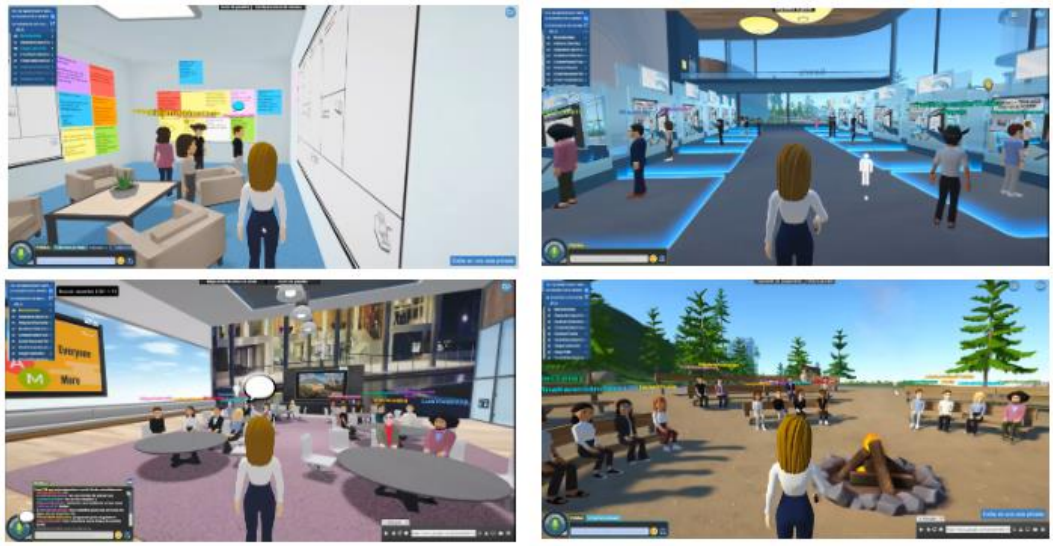

Figure 2: Tec Virtual Campus.

To analyze the data and produce the results, for each sample an exploratory analysis was conducted using Minitab to characterize the sample. A symmetry plot was also generated for each sample to assess the shape and behavior of the data. If the samples showed symmetry, then the T-Student hypothesis test was preferred. If the samples were not symmetrical but had similar distributions a non-parametric Mann-Whitney test was used. If the samples were not symmetrical and did not possess similar distributions, a T-Student test was used, noting that the results might not be 100% reliable.

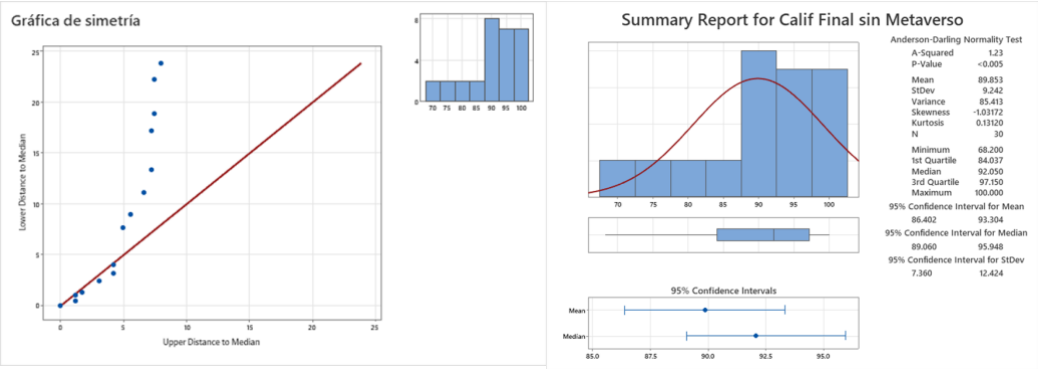

Figure 3: Examples of the Exploratory analysis and Symmetry plots that were used for the investigation.

Results

After an exploratory analysis of the collected data, a Mann-Whitney test was performed to compare the final grades of the control group vs. the experimental group and the grades that the students obtained in the course evidence of both groups.

Comparison	Median (Metaverse)	Median (w/o Metaverse)	Significant difference?	P-Value
Final Grade	92.975	92.050	No	.581
Evidence	92	90	No	.304

Table 3: Results for Final Grade and Final Evidence.

- **Although the average favors the experimental group, there is no significant difference in the activities, final grade or in the final evidence.**

The Pre-test and Post-test of the course were carried out with the Kahoot! within class hours, being a synchronous activity. For the Pre-test, the number of correct answers between both groups was compared and a comparison of the "score" was also made, which, in addition to taking into account whether the question is correct or not, assigns a score depending on the time it takes the student. answer correctly. A T-Student test was performed to compare the averages of the number of correct answers and the score, and the summary of the results is presented below:

Comparison	Average using Metaverse // (std dev)	Average w/o Metaverse // (std dev)	Significant difference?	P-Value
Score	27.71 (10.18)	35.08 (13.63)	Yes	.043
Correct answers	36.7 (14.0)	44.8 (15.6)	No	.061

Table 4: Pre-Test results.

- **There is no significant difference in the knowledge results in the Pre-Test. However, if the time and agility with which they responded (score) is taken into account, there is a difference: the control group arrived better in terms of this item.**

For the Post-test, the number of correct answers between both groups was compared and a score comparison was also made, which, in addition to taking into account whether the question is correct or not, assigns a score depending on the time it took the student to answer. correctly. A T-Student test was performed to compare the averages of the number of correct answers and the score, and the summary of the results is presented below:

Comparison	Average using Metaverse // (std dev)	Average w/o Metaverse // (std dev)	Significant difference?	P-Value
Score	57.93 (9.30)	66.55(13)	Yes	.027
Correct answers	67.0 (11.7)	73.9 (13.8)	No	.109

Table 5: Post-Test Results.

- **There is no significant difference in the knowledge results in the Post-Test, but there is a difference in the score (time and agility) and it favors the control group.**

Finally, A Mann-Whitney and T-Student tests were performed to compare the progress of the students, comparing the pre-test against the post-test and estimating the statistical difference predicted by the model.

Comparison	Pretest Average	Post-test Average	Significant difference?	P-Value
Score with metaverse	27.71 (Average)	57.93 (Average)	Yes (Est. diff 30.22)	0
Score w/o metaverse	33.46 (Median)	69.815 (Median)	Yes (Est. diff 31.35)	0
Correct with metaverse	36.7 (Average)	67.0 (Average)	Yes (Est. diff 30.3)	0
Correct w/o metaverse	44.8 (Average)	73.9 (Average)	Yes (Est. diff 29.09)	0

Table 6: Results for student progress between the Pre-Test and the Post-Test.

- **In the comparison between Pre-Test and Post-Test, there is a significant difference in how much they learned, but the difference in score is greater in the control group. However, in the correct answers, the difference is greater with the experimental group.**

A general summary of relevant data from both groups is shared, which includes the ECOA Survey evaluation, average final grade, pre-test and post-test results, as well as the learning gain score.

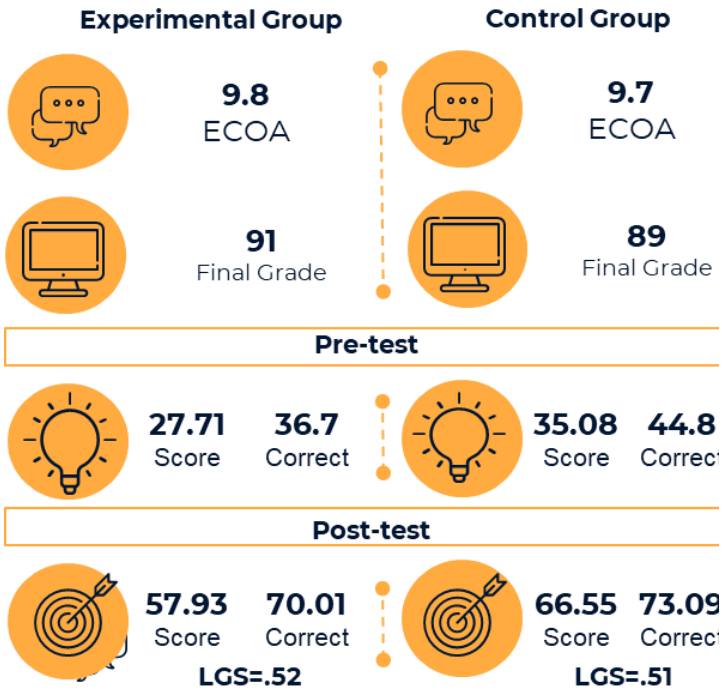

Figure 4: Summary of the results obtained in the comparisons of the activities carried out.

At the end of the course, the students of the experimental group were asked to answer a survey in the Qualtrics tool with the aim of knowing their perception of the metaverse and carrying out activities within this immersive space. The most outstanding results are presented in Figure 4 below.

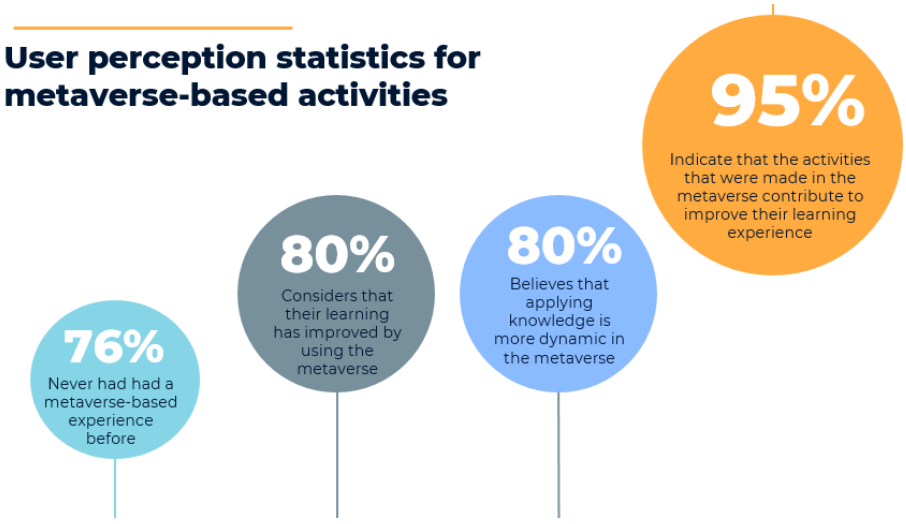

Figure 5: Results on students' perception of their activities within the metaverse.

The results indicate that more than half of the group (76%) had not had any experience in the metaverse, which they had no expectation of and the surprise factor was captive. 80% of the students consider that they deepened their learning and that it is more dynamic to apply what they have learned in the metaverse, therefore, it is perceived as a very effective tool for learning. In addition to this, 95% mention that the metaverse contributes to improving the experience, which can be translated into a greater motivation to learn more about the topics reviewed in class.

Conclusion

By integrating cutting-edge technologies into education, you can improve the quality of learning, promote student engagement, and prepare students for an increasingly digital world. However, it is important to note that these technologies need to be used in a balanced way, with a strong pedagogical approach and adequate support to maximize their benefits and minimize potential challenges.

The metaverse and virtual reality offer advantages in improving students' attitudes towards learning in education. Proper guidance from teachers and careful integration into the curriculum are critical to making the most of their potential and ensuring they are used effectively for the benefit of students.

Although the results of working in the metaverse did not show a significant difference in terms of overall student learning, the impact it had on the perception of their own learning reflects very positive results. The students expressed feeling more motivated, immersed and attentive to what was expected of them during their learning process.

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Collaborative Lessons in a Cross-Border Space: Learning Each Other's Language, Literature and History on the Basis of the CoBLaLT Model

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Abstract
In the paper we propose a new paradigm for teaching literature, language and history in cross-border territories from the point of view of cross-border didactics and cross-curricular collaboration at the higher elementary school level. Based on the CoBLaLT model, we propose interdisciplinar activities for students of two cross-border classes on both sides of the Slovenian-Italian border, who, while studying picture books written in Slovenian, meet via online platforms and live. They get to know each other, learn the languages of other students, experience literature and the art of illustration, and above all experience the complex history of the area where they live.

Keywords: Literature, Language, History, Cross-Border Didactics, CoBLaLT Model, Emotions in the Classroom

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1. Introduction

Researchers interpret the inclusion of literature in the teaching of foreign languages mainly in two different ways, and thus also have different understandings of the importance of literature in teaching foreign languages. On the one hand, there are arguments that understand literature primarily as an example of a more demanding use of language, through which the student can learn more complex language forms (cf. McKay, 1982; McKay, 2001), but at the same time does not deal with sociological, literary and cultural-historical, aesthetic, emotional, etc. dimensions of literary creation, which are emphasized by the second type of understanding of the inclusion of literature in the teaching of other/foreign languages. The second type of understanding takes into account the specifics of literary texts and does not present literature only as an example of language use, but also observes its integration into the wider socio-cultural reality. The didactics of literature in the context of the first language also justifies that students acquire language through literature and thereby strengthen their ability to communicate, but on the other hand they also experience literature and expand their knowledge of literature and culture.[1]

Reading literature introduces the reader to the more demanding uses of language, to the possibilities of organization opened up by language, prepares him for the disciplined use of language required by a predetermined linguistic structure, and leads him to learn about the possibilities of symbolic expression (Grosman, 1989, p. 52), which also applies to learning a foreign language. Among other things, students strengthen their reading fluency and pragmatic and sociolinguistic knowledge, which is emphasized in the *Common European Framework of Reference for Languages* (cf. *SEJO* 2011: 35), while at the same time they learn about spelling and new vocabulary (cf. Khatib et al., 2011). The use of language in literature is complex: here, among other things, we find language games, unconventional uses of language devices, violations of conventions, etc. From the point of view of the *Common European Framework of Reference for Languages*, reading literature requires a wider range and greater control of vocabulary and mastery of grammatical correctness at the B2 level and above, as well as developed phonological control when reading literature aloud.

With the emotional turn in literary science, there is an increasing emphasis on the emotional dimensions of literature, for example the emotional effects of literature on readers. This potential of literature was neglected for a long time in the school system in Slovenia as well as in the wider European area as there was a greater emphasis on intellectual aspects and student's knowledge of literature and culture. The emotional aspects of literature are crucial and without this dimension, the understanding of the literature is simplistic. This is also true for understanding wider culture, history and language, therefore in the paper we show the treatment of two picture books that talk about the horrors of war and offer many possibilities for discussing emotions in the classroom. From the point of view of emotional contents, the students also get to know other topics in the field of literature, history, fine arts and knowledge of a foreign language. Students are therefore emotionally connected to these contents, they understand them more deeply and are motivated for further learning.

The didactics of literature in primary and secondary schools in Slovenia and Italy is mostly rooted in nationally based literary histories, which represents a problem in increasingly

[1] An example is the principles for teaching a foreign language proposed by the Modern Languages Association (MLA) in the document Foreign Languages and Higher Education: New Structures for a Changed World (MLA 2007), which encourage continuous teaching of language, literature and culture and emphasize direct contact students with various texts, including literary ones.

diverse classes with pupils and students from ethnically mixed and immigrant families (Toroš, 2019). This is problematic especially in border areas such is the Slovenian-Italian border, where the European Union has led to the greatest changes in recent decades. In the past, this space was the scene of many horrors of the First and Second World War: from the Soča Front to fascism. In modern times, in this region Slovenians are a minority in Italy and Italians are a minority in Slovenia. We propose an interdisciplinary reading of picture books dealing with the sensitive topic of the First World War exploring the possibilities of teaching literature in connection to (foreign) languages following the model of cross-border teaching CoBLaLT – which represents an innovative methodological framework for primary Neighbouring Language teaching and learning in border regions. The model was forst introduced by Irina Moira Cavaion and is based on social integrative principles and network based language teaching. The paper presents the possibilities of dealing with the problematic topic of war through the medium of picture books, namely from the point of view of cross-border literary didactics, which supports the teaching of literature in cross-border spaces and develops the competences of historical thinking and understanding the context (Toroš, 2022). We propose the picture book by author Lucija Stepančič and illustrator Damijan Stepančič *Anton!*, which describes the shocking and multifaceted experience of interpersonal violence. We show why subjective, complex and realistic representations of war, such as we find in the discussed picture book, are important for the cross-border space.

Based on the didactic model of teaching and learning literature in an area where several languages are in contact, i.e. of the CoBLaLT model (Cavaion, 2020), we present a proposal for the didactic treatment of the mentioned picture books in the classes of the last elementary school triad (age approx. 9-14 years). The model proposes new teaching methods and highlights the importance of making language teaching research a collaborative process between a scientific and professional community (Cavaion, 2022). The connection between the two classes is established at the beginning and at the end of the process via online platforms, and the students also meet in live workshops. The aim is to learn neighboring languages in the community[2] but also to foster cross-curricular collaboration beetween different school subjects that deal with first and second languages, literature, cultere and history. The proposal for considering picture books therefore covers cross-border classes of students in Italy and Slovenia who are learning Slovenian or Italian and are able to communicate in both languages. Moreover, we are developing the intercultural ability that includes understanding multifaceted identities and avoiding stereotypes, but also means intercultural attitude, which is reflected in the curiosity and openness of the teacher and student to new things, knowledge of their own and other cultures, the ability to interpret them and a critical approach to different cultures (Byram, Gribkova & Starkey, 2002).

2. The Emotional Dimension of Learning in the Classroom Experiencing Literature

The proposed picture book is suitable for teenagers due to their problematic subject matter, as they are attracted to literary works that depict problematic topics such as death, and, as Alenka Žbogar (2010, p. 427) states, "they experience the world more complex and less idealistically, which coincides with the psychological structure of this age period: increased interest in mutual relationships, deepening into new experiences, desire to understand the

[2] A foreign language is a language that is not the official language of a certain country, so a neighboring language is also a foreign language at the same time, but we define it more specifically. Neighboring languages are languages that have the status of a second language both in the curriculum and in the environment where the students live (Čok 2021: 8). In the cross-border Slovenian-Italian area, Slovenian and Italian are the so-called i. neighboring languages.

surroundings and evaluate the value system of others". They look for for stories and, on a symbolic level, the meaning of life, a deeper, inner meaning, constants, values, beliefs, ideals and authentic role models, examples for imitation and morally worthy realizations (Blažić, 2010, p. 23). In order to give young readers a stories that will represent a challenge and arouse emotions in them, we chose the topic of war, which is presented in both picture books from the point of view of the personal story of ordinary soldiers.

In the picture book *Anton!* by Lucija Stepančič and Damijan Stepančič, which takes place in 1917, we read the story of Anton, a 19-year-old soldier who was sent by the Austro-Hungarian Empire to the Soča front during the First World War. He received a letter at the front saying that his mother had died. One night towards the end of winter, there was an unusual calm, the cold subsided and everyone was asleep, when Anton suddenly saw his mother. She called her son Anton and lured him out of the trench, after which a grenade explosion suddenly rang out behind his back, which was fatal for all of his friends. After that Anton never saw his mother again. The picture is stylistically condensed and use artistic language (cf. Haramija & Batič, 2013, p. 25–26), with different levels of meaning the story addresses both children and adults (cf. Blažić, 2006, p. 668–669). The narrative is concise, the sentences are often short. The two soldiers are focalizers of the narrative, namely the work *Anton!* is structured in the form of a walk from the military shelter in half-sleep, following the soldier's gaze and following the soldier's mother. With a subjective view of the events through the eyes of the central characters, the story deepens the sense of direct experience and personal participation of the characters. This is the source of the reader's empathetic response, filling the empty spaces in the text with emotional content, which also affects his view of his own environment. The whirlwind of war is shown from the point of view of a simple young man, emphasizing the incomprehensibility and crudeness of the events and the cruelty of sudden death. In the picture book *Anton!* we find references to the experience of war in other soldiers, many of whom were already deceased. With this, the representation of war expands from an individual's perception to a collective event that also includes the opposing army.

Compared to the text of picture book, Damijan Stepančič's illustrations are emotionally expressive. The combination of two levels of communication, both verbal and visual (cf. Haramija & Batič, 2013, p. 26), gives the work as a whole a distinct emotional charge. Illustrations are drawn in yellow-black tones reminiscent of vintage photographs. The picture book clearly guides the reader's gaze along the path of the protagonist, who moves throughout the book. The realistic emphasis is visible above all on the faces of the soldiers, who are tired and suffering, which deepens the narrative of the events in the text in the direction of personal experience. The depiction of war is realistic and not idealized, illustrations show the fear and shock of soldiers – and stimulate class discussion on the experience of war by the different characters in the story. The focus in the illustrations of the discussed picture book is wider than in the text, as the images not only capture the protagonist's point of view, but also give a broader view of what is happening. Damijan Stepančič (2014, p. 72) describes his last illustration after the explosion in the picture book *Anton!* with the following words: "dead, torn, naked, unworthy of the name of man lie comrades, scattered on the muddy field, in the craters dug up by shells in the past days. It's like falling into already dug graves..."

The problematic thematization of war in the discussed picture book raises questions for the reader about human suffering, the story offers a shocking and multifaceted experience of violence and cruelty. The dead have a name and identity, the soldiers have emotions and

personalities. The visual-textual representations of the central characters in the discussed picture books focus on their experience of the war, which they try to portray "authentically, with all seriousness" (Stepančič, 2014, p. 69).

3. Learning Each Other's Language, Literature and History on the Basis of the CoBLaLT Model

In the following, we present a proposal for a didactic treatment of the picture books of Lucija and Damijan Stepančič. At the same time, we answer the questions of what role literature can play in the modern teaching of neighboring languages and why the two selected picture books are suitable for cross-border didactics of Slovenian as a foreign language.

3.1 The Role of Literature in the Modern Teaching of Neighboring Languages

Modern approaches continuously teach language, literature and culture and highlight the student's direct contact with texts, including literary ones. Reading literature "introduces the reader to more demanding uses of language, to the possibilities of organization opened up by language, prepares him for the disciplined use of language required by a predetermined linguistic structure, and leads him to learn about the possibilities of symbolic expression" (Grosman, 1989, p. 52). Among other things, students strengthen reading fluency and pragmatic and sociolinguistic knowledge (cf. SEJO, 2011, p. 35), while at the same time learning about spelling, new vocabulary and unconventional use of language. We agree with Lazar (1996) that contact with literature, which brings with it certain emotional content and thus attracts the reader, can help to learn a foreign language because readers have a personal relationship with literary texts or they connect emotionally with the foreign language to a greater extent. Literature brings confrontation, stimulation and provocation, raises questions or offers more answers to questions, and touches us, because it "moves our emotions, our beliefs fall into crisis, reorients our beliefs" (Falcetto, 2014, p. 56), which is especially important in border areas where neighboring languages meet, which are often the languages of painful memories (Raasch, 2002, p. 17 in Cavaion, 2020, p. 18). Among other things, literature allows young readers to broaden their perception of different people and events, and thereby also better understand their own personality and events in their lives (Nodelman, 2003, p. 27–28).

3.2 The Emotional and Experiential Aspects of Literary Reading in Class

Contemporary literary studies are often based on the emotional dimension of the reception of literature, which in the past was mostly neglected. They highlight the awareness that literature, including youth literature, is not only a set of information that the reader accepts, but also provides an experience that includes the subjective participation of the recipient. Literature is therefore not just a set of information that the reader accepts, but also an experience that includes the subjective participation of the reader.[3]

In researching the emotional and experiential aspects of literary reading, an important concept is the so called embodiment of knowledge, which explains that the distinction

[3] This is also shown in the picture books, i.e. a special book format, which combines text and illustration into a single whole; The picture book therefore has three semantic components: the text, the illustrations and the content-design relationship between the text and the illustration. This relationship is called interaction, because the text affects the understanding of the meaning of the illustrations and vice versa, the illustration changes or complements the meaning of the text (Haramija & Batič, 2013, 23).

between the emotional and cognitive dimensions of reading literature is not justified. The modern model of cognition no longer corresponds to the traditional separation between mind and emotions or between mind and body, since all cognition is embodied, and the mentioned aspects are intertwined in the so called embodies simulation (Gallese & Caruana, 2016, 397-398). Research on literature from the perspective of neuroscience deals with the interpretation of an individual's response to the content of a literary work as a physical and emotional, not just an intellectual, phenomenon. They showed that the samples or representations that are stored in memory are of a multimodal nature. Words or object representations are organized in the brain as distributed neural assemblies. When receiving literary texts, different aspects of the reader's experience – physical, emotional and intellectual – are not only activated simultaneously, but are interconnected. As Herman (2008, p. 138) points out, cognitive literary science sheds light on how the "emotional part" of reading literary works is the foundation, as well as a condition for its "rational part". One of the justifications for why the emotional aspect is a fundamental part of reading literature originated in the field of cognitive psychology, namely the theory that human thoughts are structured as a narrative. Cultural psychology expert Jerome Bruner (1997, p. 53–55) argues in his monograph The culture of education that people structure their knowledge and findings in the form of a narrative, and this is how an individual's identity and his place in culture are formed. Bruner defends the opinion that the purpose of school is not only to convey information to students and to arrange knowledge into categories, but that school is an opportunity for students to make sense of the world around them and to enter their own cultural environment, which is realized through narrative. Patrik Colm Hogan (2011) argues that emotions are closely related to storytelling, which is an universal way of understanding and reflecting on our world and life. The structure of stories is thus a systematic product of the human emotional system, which is also crucial for understanding literary narratives. Similarly, Martha Nussbaum (2004, p. 290–291) explains that emotions are also structured in the form of a narrative, explaining the privileged role of art in helping people understand themselves.

3.3 The CoBLaLT Didactic Model and the Role of Picture Books in Cross-Border Meetings of Children

The CoBlaLT model refers to the learning of neighborhood languages in primary schools in border regions and is based on the establishment of systematic cross-border contacts (Čok, 2021, p. 64). According to this model, the discussion of picture books is placed in the cross-border Slovenian-Italian community, and its goal is for students to strengthen their experience and understanding of the history of their shared space through mutual contacts. The use of the CoBlaLT model that we propose follows the research of Irina M. Cavaion, which covered two elementary school classes, one from Slovenia and one from Italy, where students learn the language of the neighboring country - i.e. the class from Italy learned Slovenian, and the class from Slovenia learned Italian (cf. Cavaion, 2020, p. 134). The CoBlaLT model highlights the relationships between students who correspond through online tools and socialize in real life, while encouraging their motivation for intercultural learning of neighboring languages (cf. Cavaion, 2020). This type of activity of intercultural school meetings comes from the so-called pedagogy of visits and exchanges. Their goal is to increase motivation and encourage the development of intercultural sensitivity and create opportunities to speak and learn the neighboring language through (cross-border) participation of teenagers in a multilingual environment (Cavaion, 2020, p. 39). When devising this strategy, Irina M. Cavaion started from the possibilities offered by the contacts of students from two linguistically and ethnically different groups, "who, despite their geographical proximity, do not meet and who could be heavily burdened by unresolved social

inter-ethnic relations from the past" (Cavaion, 2020, p. 40). Cross-border intergroup contacts affect the exchange of attitudes and changes in the students' value system, the author argues, which is why she advocates joint activities of students (Cavaion 2020).

The selected picture books are highly emotionally expressive, so they offer an experience of otherness, which deepens in the environment of cross-border contact between students (cf. Cavaion, 2020, p. 63). The texts of the picture books are short and stylistically refined, which is why even students whose first language is not Slovenian or Italian but are learning this language will understand them. By encouraging the students to talk about work with their peers in Italian, even students whose first language is Slovenian will strengthen their ability to communicate in the neighboring language. Although, as Ana Toroš (2022, p. 342) states, literature dealing with cross-border topics can be "burdened with national stereotypes and prejudices, self-images and heteroimages, which can complicate the teaching of literature in ethnically heterogeneous classes", the common confrontation of students with both sides of the border with problematic topics motivationally.

The proposed activities offer both students and teachers a space that is not burdened by curricular requirements that separate the learning of the first and second language, history and literature into the framework of individual school subjects (for example Slovene as mother tongue, History, Italian as second language). The activities offer a different perspective on the content that students learn, as the primary activity is personal contact between them: students communicate with their peers, socialize and make friends. On the other hand, due to the strong emotional charge of both picture books, the starting point of the activities is emotional, which again represents a departure from established school practice, which emphasizes the primary aspect of acquiring knowledge. Students are invited to metacognitively reflect on the information they receive at school and through various media. Based on the example of a war theme presented through the eyes of simple and vulnerable individuals, the students can critically evaluate other historical information they encounter. The students learn that it is important to consider the point of view of the information given and the answer to the question of who is speaking and what is being communicated. This is the potential of literary works that tell subjective stories when compared to "objective" narratives of history.

The activities are derived from the CoBLaLT model (Cavaion, 2020, p. 244-252) and aimed at establishing interpersonal contacts between students both via online tools and in person. In the first week the teachers of the two included classes from Italy and Slovenia present the project to the students and make them aware of contacts before the meetings via an online platform. In this session the teacher prepares the students for an oral self-presentation at the first meeting, preferably in the second, neighbouring language (i.e. Slovenian or Italian). In the second week of the activity a video conference with the entire class takes place, where students meet for the first time and introduce themselves to each other, where they can choose between a presentation in the school's teaching language or neighborhood language. This is followed by conversations in the online chat room between pairs of children from each of the classes and the task of preparing an oral description of the new peers the students have met and their presentation. After this session the students keep in touch with each other by posting short personal texts on the blog and exchanging e-mails for the purpose of deepening acquaintance between them. The next session is a preparations for a live class meeting on the topic of the two picture books by Lucija Stepančič and Damijan Stepančič. The first aloud reading of the two picture books in each of the classes is followed by an individual silent reading. Then it's time for students to express their reactions in the neighbouring language. The first aloud reading of the two picture books in each of the classes

is followed by an individual silent reading. This is followed by the teacher's presentation of the basic facts about the historical time in which the two picture books are placed. For homework, the students collect different types of material about the First World War, which the teacher checks in class at the following session and which will be used in the reunion of the two classes. At the next session the live meeting of the two classes takes place. The teacher reads the literary works again and the students present their impressions to each other. This is followed by a historical contextualization of the events based on the material prepared by the students through independent work. Based on the material collected and presented by the students, the teacher summarizes the central framework of the war context. They conclude with the joint creation of a poster summarizing the historical events during the First World War in the area of present-day Primorska in Slovenia, or Friuli-Julian landscape in Italy. After the presentation of the posters, it is time to reflect on historical events from the point of view of the experiences of literary characters and the reflection of history through the eyes of small people, victims of war. Classroom reflection involves collecting students' impressions of the first lesson after the exchange, while provoking discussion about what they have learned. Students are encouraged to keep in touch with the other class on the project blog by sharing their impressions.

4. Conclusion

Since the picture book generated a certain social environment with its cultural, social and political influences, the students can experience these aspects through them, and with the problematic topic of war in the cross-border area, they can gain a deeper understanding of the common history and gain sensitivity to the suffering of the little people that the picture book brings to the students. Students learn about the history and cultural history of the area and the literary system of the neighboring language, which they acquire, and, according to Rahimi (2014), literature can also make them aware of discrimination and power hierarchies in society. Based on the discussed picture books, students can learn about the consequences of social pressures on individual soldiers and their families. It is important that they encounter the topic of war not only from the point of view of historical data, but also from the personal stories and experiences of individuals of that time, which in addition to language ability also strengthens empathy. Here, among other things, we highlight expressions of interpersonal solidarity between the otherwise warring actors of the war, as well as the narration of the literarized history of space through the eyes of simple individuals. On the other hand, through problematic questions and independent research of historical facts, students acquire complex knowledge about past events in the area where they live. Literature is therefore not only a means on the basis of which an individual gets additional confirmation of his beliefs and values of his own culture, but in this way the student takes on a perspective from which he can judge different beliefs and values that he encounters in literary works when learning about (literary) history cross-border area. This means that the reader recognizes his own political-cultural environment and assumptions that he is able to change (cf. Johnston, 2000). From the point of view of social constructivism, students' contact with literature also has the potential of social movements. Reading the discussed picture books represents a new experience that enables cross-border classes to discuss challenging historical topics from the point of view of universal feelings with which they can identify, and on this basis, they strengthen their knowledge of the history of the common space.

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Simulation or Fake: Will Extended Reality Provide a More Vivid Learning Experience?

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Abstract
Extended Reality (XR), encompassing Virtual Reality (VR), Augmented Reality (AR), and Mixed Reality (MR), is a unifying term for technologies ranging from fully real to entirely virtual environments. It's known for its potential to offer immersive and realistic learning experiences. EDUCAUSE Horizon Report: Teaching and Learning Edition, published by the US professional organization, mentioned extended reality three times as one of six technologies and practices that will influence the future development of higher education from 2020 to 2023. However, the quality of current systems for the application of XR in education varies; the effectiveness of the application is still somewhat controversial and needs in-depth discussion due to the limitations of the application equipment and other reasons. This research aims to explore the effectiveness of extended reality in education, in particular, whether extended reality can provide a more realistic and immersive learning experience. This study adopts a combination of literature review and case study analysis. Through a comprehensive survey of relevant literature, it analyses the definition, characteristics and application scenarios of extended reality technology and combines actual cases of XR in training to explore the effects and applications of XR in education. The study indicates that extended reality can provide a more realistic and immersive learning experience, especially when the system is highly interactive or with a virtual learning environment, which can enhance the sense of realistic and experiential learning.

Keywords: Extended Reality (XR), Immersive Learning Experience, Virtual Reality (VR), Augmented Reality (AR), Mixed Reality (MR)

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Introduction

Background

With the rapid advancement of digital technology, Extended Reality (XR), encompassing Virtual Reality (VR), Augmented Reality (AR), and Mixed Reality (MR), has gradually become a cutting-edge trend and research focus in the field of education (Milgram et al., 1995). These innovative technologies, by constructing immersive and interactive virtual environments, have ignited endless possibilities for improving educational practices, thus attracting widespread attention and active investment from educational institutions and experts around the world (Johnson et al., 2016). However, despite the widely recognized potential and opportunities of XR in education, there remain numerous disputes and challenges regarding its realism, accessibility, and educational efficacy (Bailenson et al., 2006). Some studies have even questioned its applicability and long-term effects in specific educational contexts (Klopfer et al., 2018). Therefore, this research aims to explore in depth the effectiveness of extended reality technologies in the field of education, specifically whether it can provide a more realistic and immersive learning experience.

Aim & Objectives

Aim: The main aim of this study is to delve into the effectiveness of Extended Reality (XR) in education, particularly in terms of whether it can provide a more realistic and immersive learning experience. Objectives: 1. Understand and Define the Fundamental Aspects of XR: Through a review of relevant literature and existing applications, this objective seeks to gain a deep understanding of XR's definition, characteristics, and its application in education. 2. Evaluate XR's Realism and Immersion: Assess how XR can provide lifelike educational experiences by examining system interactivity and virtual learning environments, corroborated by actual case studies. 3. Examine Limitations and Controversies of XR in Education: Investigate the potential drawbacks and contentious aspects of employing XR in education.

Significance

A comprehensive understanding of this issue not only contributes to the advancement of frontier educational technology but also possibly offers valuable practical guidance and decision-making references for educators and policymakers. This study adopts a hybrid method of literature review and case analysis, thoroughly examining existing academic and practical literature, analyzing the definition, characteristics, and application scenarios of extended reality technology, and coupling with actual cases of XR in various educational backgrounds and training environments, to explore the effects and applications of XR in education in an objective and profound way (Wu et al., 2013; Radu, 2014).

Literature Review

In the comprehensive exploration of the effectiveness of Extended Reality (XR) in the field of education, a thorough and diversified literature search strategy was adopted. Considering the interdisciplinary nature of XR technology and its rapidly advancing trends, this study was not confined to retrieving literature from a single database. As such, a broad search was conducted across various databases including ELSEVIER, IEEE Explore, and China's Wanfang Data, also encompassing master's and doctoral theses closely related to the research

theme that were published in recent years. To ensure coverage of the latest developments and applications of XR technology, the journals were limited to those published after 2017, and, for reading convenience, only Simplified Chinese and English literature was collected. The choice of search keywords encompassed Extended Reality (XR), Virtual Reality (VR), Augmented Reality (AR), Mixed Reality (MR), Immersive Learning, as well as terms related to teaching or training.

In terms of literature selection, we considered not only the novelty and relevance of the literature but also focused on its quality and reliability. Firstly, the influence and recognition by scholars of the literature were assessed through citation counts. Simultaneously, as the citation counts of newly published papers may not adequately reflect their value, we specifically took into consideration the journals where the papers were published, with a preference for papers indexed in SCI. SCI is not just an information retrieval system, but also an important standard for measuring the quality and influence of academic journals. Such selection criteria contribute to ensuring the breadth and depth of the literature review, while also guaranteeing the quality and credibility of the referenced literature.

Definitions

Extended Reality (XR): XR is an umbrella term encompassing virtual, augmented, and mixed reality technologies, as well as other forms of alternate, expanded, or immersive reality applications, including those not yet invented.

The main purpose of XR is to broaden human experiences, especially the senses of existence and the acquisition of cognition (Lokesha & Bhagya, 2020).

XR is an umbrella term that includes the following types of applications:

Virtual Reality (VR): The application simulates a completely different environment around the user.

Augmented Reality (AR): The application layers content over a digital view of the real world.

Mixed Reality (MR): The application combines its own environment with the user's real-world environment and allows them to interact with each other.

Characteristics of XR

1. Immersiveness

Immersiveness is the most eye-catching feature of XR, with the application of virtual reality being the most prominent. By simulating the real-world environment, learners are immersed in it. Immersiveness helps create a "sense of presence" in the virtual environment, making people feel as if they are truly in the virtual world (Martín-Gutiérrez et al., 2017). Immersive virtual reality enhances learners' engagement and emotional connection, thereby promoting cognitive and emotional learning (Jensen & Konradsen, 2018). Immersiveness provides experiences that cannot be obtained through traditional learning environments, such as immersing in historical scenes or complex scientific concepts.

2. Interactivity

Interactivity is another core element in XR. XR allows learners to interact with the virtual environment through voice, gestures, and touch, receiving learning feedback through interaction with the system. This interaction makes the learning process more natural and intuitive. Interactivity supports collaborative learning and increases learner engagement and dynamic participation (Chen et al., 2017). In virtual experiments or role-playing scenarios, interactivity makes learning more vivid and practical.

3. Personalization

Supporting personalized learning is an important innovative direction for XR technology. As human activities transition from natural to digital platforms, there is a transformation in sensory and practical ways. XR can combine data analysis and artificial intelligence technologies to adapt to different learners' needs and interests. These customized learning paths can promote more effective and in-depth learning. Intelligent teaching systems in virtual environments enhance learning outcomes. With the rise of large models like GPT in recent years, GPT can analyze learners' input and interaction history to understand their interests, knowledge levels, and learning styles, providing personalized content and feedback.

4. Accessibility

Accessibility refers to how XR technology can make educational resources transcend geographical and temporal constraints (Radianti et al., 2020). XR can provide educational opportunities for those in remote areas or unable to attend school in person. Through XR, students can access advanced scientific experimental equipment and museum collections (Merchant et al., 2014). This feature democratizes and popularizes education, making once "out-of-reach" fields like aerospace more "accessible."

5. Interdisciplinarity

XR technology can support interdisciplinary learning, integrating knowledge and skills from different disciplines. XR can enhance learning outcomes for students at all stages and can be applied to multiple subject areas. The potential of XR in promoting interdisciplinary understanding, such as integrating mathematics, science, and art, is significant. Interdisciplinarity helps cultivate students' comprehensive quality and creativity, providing multi-angle perspectives for solving real-world problems.

XR in Education

Extended Reality (XR) as a highly adaptable technology and tool is being actively integrated by many industries to enable rapid pre-job training and quick familiarization for industry newcomers. In the medical field, Ferri et al. (2020) described the experiences of 122 medical students undergoing training with 21 simulated clinical cases online. Most medical students were satisfied with the training and gave it high praise. In the commercial sector, XR can offer "panoramic, zero-distance" capabilities to support virtual office platforms, such as Meta's Horizon Workrooms and Microsoft's Mesh, aiding Human Resources departments in enhancing employees' work lives and virtual collaboration in a 3D environment (Veronica, 2021). Meanwhile, the military field is utilizing virtual reality in interdisciplinary research, including pilot flight simulation and training, mission planning, and rehearsal (Ahir et al.,

2020). In culture and tourism, immersive technologies like VR panoramas and AR live tours can tackle the promotional challenges of tourism. Branstrator et al. (2022) created an XR system course based on nature tourism to engage visitors in deeper thinking about biocultural conservation issues.

In the field of education, XR technology is demonstrating unprecedented potential. By creating immersive learning environments, XR provides students with a more vivid, more intuitive learning experience (Wu et al., 2013). For theoretical education, XR can visualize complex concepts, helping students to better understand and grasp them (Merchant et al., 2014). In skills training, virtual reality simulators have been employed for practical training in clinical medicine, aviation, and engineering, offering experiences similar to real environments (Kavanagh et al., 2017). Furthermore, the assessment of learning effectiveness is also a key application area for XR in education. By tracking and analyzing students' interactions within virtual environments, educators can gain in-depth insights into students' understanding and mastery (Radianti et al., 2020). Overall, the application of XR in the educational field provides new dimensions and possibilities for teaching and learning, foreshadowing future trends in education.

With the vigorous development of XR technology, it has been widely applied in the field of education and has demonstrated powerful teaching potential. A large amount of research results show that compared with traditional teaching methods, XR technology can significantly improve learning effects and inject fresh vitality into education. For example, Hu et al. (2021) discovered through comparative experiments that compared with two-dimensional simulation software, the immersive virtual environment of VR can greatly enhance students' practical skills, improve problem solving and self-efficacy, which proves VR's unique advantage in improving learning outcomes. In addition, Hamari et al.'s (2016) research also clearly points out that designing XR games with challenging elements can greatly increase students' learning interest and participation, thus achieving better teaching results. More noteworthy is that an empirical comparison found out that compared with the traditional safety card teaching method, immersive safety education games based on XR can enable learners to acquire better knowledge mastery and long-term memory retention (Chittaro & Buttussi, 2015). It can be seen that XR technology brings an extremely immersive virtual experience to education (Yoo, 2022). Of course, we should also pay attention to the fact that over-reliance on XR may bring higher cognitive load to learners, which needs careful research in order to achieve appropriate application of XR technology in the field of education.

Research Gap

Although technologies such as Extended Reality (XR) and Virtual Reality (VR) are gradually maturing in the field of education, especially making significant progress in immersive learning environments, gamified learning, and special education (Radianti & Wohlgenannt, 2020), there are still many aspects that have not been fully explored. First, although the application of virtual reality technology in basic education has begun to emerge, its implementation cycle is relatively short, and it is mostly carried out in semi-immersive learning environments, lacking comprehensive teaching strategies and effective evaluation systems (Makransky & Mayer, 2019). Secondly, although some important research focuses on the practical application of XR technology in law and basic education, its potential value and actual impact in other specific subject areas have not been fully understood and studied. Additionally, although features such as intelligent interaction and context awareness have

been reflected in educational design, how to ensure the effective integration of these new technologies with existing educational systems and educational goals remains an unresolved challenge (Akçayır & Akçayır, 2017).

Case Study

Selection of Cases

In selecting cases for analysis, this study did not deliberately differentiate between various XR technologies (such as VR, AR, MR). This decision is based on the current trend in XR technology development, where the boundaries between individual components are becoming increasingly blurred. For example, Virtual Reality (VR) technology is gradually enhancing its ability to perceive the real world, while Augmented Reality (AR) is striving to provide an immersive experience akin to Virtual Reality. Therefore, this study primarily focuses on cases that maximize the characteristics of immersive experiences, particularly those that employ Virtual Reality (VR) as the main instructional tool. To ensure the comprehensiveness and diversity of the analysis, the selected cases encompass different countries and projects, thereby facilitating the exploration and analysis of the application and impact of XR technology in education from multiple angles and dimensions.

Case 1: The learning content using VR focuses on the fundamental knowledge and basic operations of electronic circuits in electronic technology. In this case study, 53 university students with educational-related majors from a university in Shanghai were selected as subjects. The students in the experimental group learned about the immersive VR experimental environment and became familiar with the corresponding operations through watching videos. Meanwhile, the students in the control group learned about the operation panel of 2D simulation software and became familiar with the corresponding functions through images and text descriptions(Hu et al., 2021). *Case 2*: Virtual reality learning environment using Ignys software to simulate fire scenarios, the training was based on a course document (for conceptual learning) and a VTE (for procedural learning). - 43 people (28 men and 15 women), aged 17 to 29 (A = 20, SD = 3.1) participated in the study. Their training ranged from the end of high school to masters. Most of them were students, the majority of whom had obtained a university degree in health and safety, The participants were divided into two immersion groups, those who were subjected to the condition of immersive environment and those subjected to the condition of non-immersive environment(Morélot et al., 2021). *Case 3*: This case create an activity based virtual reality experience for Thailand's Ministry of Digital Economy and Society to communicate information covering three topics. The demographic of interest for this study includes all those who participated in the Ministry of Digital Economy and Society's virtual reality experience during Digital Thailand Big Bang 2019, which was held from October 28th to October 31st, 2019 at the BITEC International Exhibition in Bangkok, Thailand. Convenience sampling was utilized to choose the sample. This yielded a sample size of 126 individuals during the duration of the investigation(Karnchanapayap, 2023).

These three cases provide a wealth of material and diverse perspectives for my research. They encompass a wide range of areas, from university education to vocational training, and extending to government and public communication. Through an in-depth analysis of these cases, it will be possible to comprehensively explore the potential and challenges of XR technology in the field of education.

Analysis Methodology

The analytical framework of this study is based on educational psychology and technology acceptance theory, aiming to comprehensively explore the application of Extended Reality (XR) in education. Educational psychology provides an in-depth understanding of immersive experiences, learning motivation, and cognitive processes. By analyzing how XR technology creates immersive learning experiences, their study reveal how virtual environments can promote students' attention, memory, and understanding (Makransky & Aaby, 2017). Furthermore, technology acceptance theory focuses on the usability and effectiveness of XR technology, as well as the attitudes and behaviors of teachers and students towards new technology. This theoretical framework helps analyze the key factors in people's acceptance and use of XR technology, including its practical contribution to achieving educational goals, and the acceptance and satisfaction of potential users (Davis, 1989; Venkatesh & Davis, 2000). By combining these two theoretical approaches, this case study aims to provide a comprehensive perspective to assess the potential and challenges of XR technology in education, offering profound insights for educators and researchers on how to utilize this emerging technology most effectively.

Based on the reflection and analysis of the above content, the analytical framework for the case study focuses on three core aspects: immersive experience, learning outcomes, and technology acceptance. The immersive experience examines how XR technology creates an immersive learning environment, emphasizing realism and engagement. Learning outcomes concentrate on the impact of XR technology on student motivation, understanding, and academic performance, directly related to educational goals. Technology acceptance explores the usability of XR technology and the attitudes and actual application of teachers and students towards using this new technology. This three-aspect framework provides a solid foundation for this study with its conciseness, comprehensiveness, and flexibility. It clearly covers the key aspects of XR technology in education and easy to understand. However, there may also be an oversimplification of complex interactive factors.

Table 1: Three Core Aspects of the Analytical Framework

Case Study	Immersive Experience (Realism, Engagement, etc.)	Learning Outcomes (Motivation, Understanding, Performance, etc.)	Technology Acceptance (Usability, Attitudes, etc.)
Case 1	Learning basic electronic circuit knowledge through VR experimental environment, 53 university students participated. • VR provides high immersion and interactivity, enhances situational perception • Triggers multisensory integration, enhances sense of presence	• No significant difference in knowledge acquisition between VR and 2D environments • VR significantly improves behavioral transfer, promotes skill transfer and problem solving • Enhances self-efficacy and deep learning	• VR leads to higher cognitive load and physiological discomfort • But learners have higher acceptance of VR technology

Case 2	Virtual reality learning environment using Ignys software to simulate fire scenarios, 43 participants. • Head-mounted displays and other devices increase sense of immersion • Life-size models of fire facilities enhance scene realism • Dynamic smoke and flame simulation improve situational perception	• The immersive environment improved procedural learning outcomes, but did not help conceptual learning • Prior knowledge in fire safety can enhance the facilitation effect of immersion on procedural learning	Technology acceptance was not measured in this study
Case 3	Activity-based virtual reality experience created for Thailand' s Ministry of Digital Economy and Society, 126 participants. • Oculus Quest head-mounted device provided immersive sense of presence • Minimalist design of the virtual environment	• Activity-based design enhanced audience participation and content comprehension • Most participants were able to correctly answer questions, indicating retention of content	• Majority appreciated the overall experience and aesthetics • A few were dissatisfied due to nausea and other issues

Key Insights From Cases

Case 1: The VR experimental environment is conducive to the cultivation of operating skills and cognitive transfer of basic electronic circuit knowledge. However, it needs to balance cognitive load and deep learning during the design process. Overall, VR has promising application prospects in engineering experimental teaching, especially in terms of problem solving and skills training. But the design of VR experimental environment should take cognitive load factors into consideration, and try to provide learners with a smoother and more comfortable learning experience. *Case 2*: The immersive VR environment using Ignys software improved procedural learning outcomes of fire safety training. But it showed no benefit for conceptual learning. Prior knowledge in fire safety can enhance the facilitation of immersion on procedural learning. The technology acceptance was not measured in this study. *Case 3*: The activity-based VR experience created for Thailand's Ministry of Digital Economy and Society increased audience engagement during the exhibition. Most participants actively took part in the experience and retained its content. While the majority appreciated the overall experience, a few suffered discomfort. This case study exemplified how VR can enhance audience participation through activity design.

Comparison and Contrast: These three case studies demonstrate the unique advantages of virtual reality technology in providing an immersive sense of presence and enhancing learning effectiveness. Case 1 and Case 2 both found that compared to conceptual learning, virtual reality environments have more significant effects on improving procedural learning and skills training. In these two cases, learners also showed higher acceptance of virtual reality technology, but negative impacts like increased cognitive load also occurred. Case 3, as an application of virtual reality technology in an exhibition scenario, has its own uniqueness with more focus on learning experience rather than learning outcome evaluation.

Key Findings: Through these three case studies, it can be discovered that virtual reality technology can enhance the experience of learning by providing an immersive sense of presence and designing participative activities. But its effects seem more prominent in

improving procedural learning and skills training, while the impact on conceptual learning is more limited. In addition, virtual reality can also facilitate deeper learning, but brings cognitive load as well, which needs balancing between the two. Overall, virtual reality technology has extensive application prospects in fields like engineering experimental teaching, safety training, and audience engagement in exhibitions.

Conclusion

Main Findings

This study has shown that extended reality (XR) technologies, especially virtual reality (VR), can provide more realistic and immersive learning experiences compared to traditional educational methods. The literature review revealed XR's key characteristics of immersiveness, interactivity, personalization, accessibility, and interdisciplinarity that enable vivid simulated environments and active student participation. Case studies demonstrated VR's advantages in improving procedural learning and skills training by increasing engagement and situational presence.

However, XR's effects on conceptual learning appear more limited. While most learners expressed acceptance towards VR technology, issues like increased cognitive load were also identified. This research implies that for engineering, safety training, and public engagement, VR has promising applications to enhance experiential learning. But conceptual subjects may require different strategies. Overall, XR holds significant potential to transform education, but optimal integration with curriculum and balanced design are crucial.

Implications and Limitations

This study provides valuable practical implications for educators and policymakers in leveraging XR, particularly VR technology, to modernize pedagogy. The research recommends designing highly interactive activities, adapting to individual needs, and balancing cognitive load to maximize XR's advantages while minimizing discomfort. However, there are limitations. The case analyses focused narrowly on VR without equal inclusion of AR and MR. The sample sizes were small and lacked diversity. Future studies should investigate a broader range of XR applications across diverse subjects, ages, and backgrounds. More objective measurements of learning effectiveness are also needed. With further research and thoughtful implementation, XR could greatly benefit students worldwide through more captivating, participatory, and personalized learning.

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The Spirit of Modern Academic Legal Education: Towards Governing Principles

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Abstract
The contribution promotes the idea of principles in academic legal education. Principles are taken to be abstract notions that can offer a certain direction of things in academic legal education. The paper posits that such principles should be taken into account both in the designing and the implementation of programmes of legal study and law degrees in the academic environment. Law is, of course, to this day, a largely divided discipline, especially considering that law has traditionally been in the hands of nation-states. By extension, legal education around the world may be perceived as largely divided too, because the discipline of law has been divided in the first place. However, the proposed principles are ones that ought to come with certain universal characteristics to them. Equally, they should also make allowance for certain local variation where possible, albeit not always and not necessarily. Recognition is also given to the fact that such a degree of local variation could be more significant where such could be justifiably supported by a domestic academic legal community and/or a domestic professional class of legal practitioners. Furthermore, the contribution offers specific examples of principles which can function as overall guiding principles for university law degrees around the world. The paper concludes with an overview of its main findings.

Keywords: Legal Education, Legal Pedagogy, Principles, Universities, Law, Doctrinalism, Contextualism, Critical Analytical Skills, Academic Citizenship, Practical Skills, Academic Freedom

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Introduction

Law, whilst a largely divided discipline, due to apparent divergences from legal system to legal system, can at the very least, proceed with certain common principles in the area of academic legal education. This exposition proposes a number of principles for the strengthening of legal education. These are principles that operate over and above the national characteristics that the different legal educational models around the world come with. The purpose of these principles is for them to act as guiding notions with certain universal characteristics to them, these principles being adaptable at the local level.

Principles in Legal Education

As the author has maintained elsewhere, principles, together with values, constitute the apex of human existence and endeavours (Platsas 2021: 18). Principles are not practices. Principles are not just common beliefs or ideological artifices. Principles are not doctrines either, as doctrines are not normally open to adaptation. For the purposes of academic education, however. principles could be perceived as starting points, one's initial compass in the world of pedagogic ontology (Platsas 2021: 18). These are abstract notions that can offer certain direction in the way academic legal education is formulated and delivered. In practical terms, principles can be helpful in the design and the implementation of programmes of legal study and law degrees in the academic environment. It would be important for designers of law programmes (as in law degrees) and law modules (as in law subjects) to actually agree between themselves certain core principles when it comes to the design and running of law degrees and subjects. If the right to education is a combination of positive and negative rights (Pasvenskienė and Astromskis 2020: 197), it is posited that the right to proper legal education is also a combination of such rights, academic instructors of law and legal scholars having a positive obligation to enable the learning of their students through positive action, ideally through following a principled approach in the designing and the implementation of degrees and subjects. More interestingly, the seven principles put forward in this paper are ones that should enhance the cognitive, transferable and interpersonal skills of future law graduates. Our future law students must therefore be allowed the great opportunity to rediscover law as well as themselves in the law school in order for them to acquire skills and abilities that would make them stand out in society and the global economic and professional environment.

Synopsis of Proposed Principles

The proposed principles of this contribution in brief are as follows (see also figure 1 below):

1. Legal doctrine
2. Context(ualisation) of legal knowledge
3. Critical analytical skills
4. Extrovert academic ethos (not just national law; not just law)
5. Academic citizenship
6. Practical skills
7. Academic freedom (principle of flexibility)

Figure 1: Principles of Modern Academic Legal Education

The above will be briefly explained in turn. It should be remembered that the above are proposed as governing, as in guiding, principles that modern legal education ought to follow. Adaptation, on the idea of national variation of education and, of course, on the principle of academic freedom could still be the case. Nevertheless, the more one departs from the core of the first six principles above, the greater the justification one ought to offer, when it comes to such departure in the building of law degrees and in the running of academic legal courses. Thus, as an example here, if local variation would allow for the offering of law degrees that would not cultivate an extrovert academic ethos amongst law students and future law graduates, such a choice would not be easily justifiable or defensible in the face of an interconnected world, where degrees, indeed modern law degrees, are and act as international professional passports. Reader would, thus, be reminded that the proposed principles herein are ones that come with certain universal characteristics, making the departure from such principles on local variation arguments an onerous task. Indeed, the proposed principles in this analysis are effectively minima that ought to be met by modern academic legal environments in one way or another. So too, the proposed principles are perceived as ones that should not hinder pedagogic innovation close to the tenets of academic freedom in the university learning environment. Nevertheless, in the pedagogic dilemma whether the proposed principles ought to be complied with or not to be complied with, the author would most certainly favour compliance with such principles, as these are rather common and intelligible ideas in the face of modern legal education. Let us now offer an overview of the proposed principles in turn.

Proposed Principle 1: Legal Doctrine

The first principle that ought to define law degrees and law subjects in the academic environment would be the one that recognises legal doctrine as a central aspect of modern legal academic education. Law is, in epistemic terms, a rather conservative and peculiar discipline. Indeed, to this day, law tends to be a highly nation-oriented and nation-driven subject, despite considerable legal harmonisation efforts in such continents as Europe. It is the case, however, because of the rather conservative nature of our subject as an epistemic field, that as academic instructors in law one of our main concerns is to teach certain legal doctrine(s) to student body. The conservative and peculiar nature of the subject of law in the academic environment can be further exacerbated by the fact that multiple external actors and institutions to the academic

legal environment affect such environment. Our colleagues from other theoretical disciplines find it challenging to comprehend why so many external actors and institutions ranging from professional legal associations, ministries of justice, ministries of education to parliaments and constitutional courts can have such a great say in the way academic law degrees are designed and, by extension, delivered. Of course, academic legal education is a crucial element of theoretical education in modern universities but, to make things more interesting or complicated (depending on one's perspective), the doctrines taught in academic legal environment may actually be ones that come with national characteristics to them and so on. However, despite the established and conservative character of doctrine in our teaching and learning in the modern law school, it is proposed that the teaching and learning of doctrine ought to remain a key principle of modern legal education. The choice in favour of this has to do with practicality: doctrine forms the core of our teaching in law and, as such, students of law would have to receive relevant cognitive skills prior to graduation. By extension, law graduates that would become masters of doctrine could upon further training readily use such in legal practice and/or other sectors of the economy.

Proposed Principle 2: Context (ualisation) of Legal Knowledge

Recognition is also given to the fact that a degree of local variation in legal education terms could be more significant where such could be justifiably supported by a domestic academic legal community and/or a domestic professional class of legal practitioners. Due to the fact that law tends to come with a strong national flavour as a subject, one takes it for granted that legal knowledge ought to be contextualised for the benefit of student body. However, the academic educator and instructor ought to be particularly careful in this respect: if, for instance, foreign legal material would be taught in the domestic environment, such contextualisation ought to be one that does not distort original cognitive essence of the matter to be delivered. Thus, contextualisation is acceptable as an exercise, when it retains original meanings, whilst allowing student body to immerse itself more gradually in 'foreign' legal matter and so on. However, it goes without saying that the presence of such subjects as comparative law, legal sociology and legal theory in the modern law curriculum would be particularly beneficial to student body in the contextualisation of legal learning. In any case, law, in its academic delivery, should be contextualised to a certain extent; after all, law remains a largely national subject to this day. Law, properly understood, is not just about the learning of substantive and procedural rules and techniques of litigation:

> Law is a facet of culture, economics and politics, a manifestation of power and a device for channeling and restraining it; law is one means for organizing society; it is a complex sociological phenomenon, a pervasive feature of organized society, and destined to grow in diverseness and complexity as societies change and as knowledge about human behavior grows (International Legal Center & Scandinavian Institute of African Studies 1975, para. 84).

However, over-contextualisation of the law is nowhere near ideal and would have to be avoided, as it could disconnect a domestic legal subject from world developments in its area. Finally, it would be important to state here that contextualisation of legal knowledge does not relate to the domestic legal sphere only. Indeed, the exercise of contextualising legal knowledge may also relate to the global context of political, economic and social developments, which the domestic study of law ought to follow to a certain extent. Thus, contextualisation of legal learning ought to be one that pays due recognition both to domestic and international legal, economic and social contexts.

Proposed Principle 3: Critical Analytical Skills

If there is one thing, one must cultivate in the modern law school, that would be the critical analytical skills of future lawyers. Law students must, therefore, straddle both doctrine and 'out of the box' type of thinking. Excellent critical skills are ones that would allow students to appreciate 'the uncertainty, ambiguity and limits of knowledge' (e.g. UK Quality Code for Higher Education – Part A 2014, 26). They must also approach the same matter by addressing it through more than one angle, i.e. if there are more angles than one. Above all, law students, as researchers, must offer more perceptions of the world than one, especially if there are more perceptions than one. *Ratio legis est anima legis* ('the reason of the law is its soul'): our students must learn to reason more and better. Analytical choices must be clear, to the point and would have to be justified. Our future law graduates must acquire these skills in the law school already for them to deploy such skills in the job market, whether in the legal profession or in other sectors of the economy.

Proposed Principle 4: Extrovert Academic Ethos

Lawyers ought to be operating in an extrovert fashion for the benefit of society rather than merely act as professionals educated and trained in law. Rather than producing monolithic law graduates with a narrow set of skills and a limited degree of understanding of real world issues, one must strive to inspire to our law students and future law graduates an ethos that would set them apart, an academic ethos that would distinguish them as professionals in the real world. Law graduates are in particularly high demand in so many different sectors of the economy in so many countries around the world. One must not be complacent, however. Simply because lawyers are in high demand in the job market, one must not sit on the laurels of the discipline's leading position amongst theoretical disciplines. As one might appreciate, law is still a divided discipline in epistemic terms. The classic quote is, of course, the one from Zweigert and Kötz, which act as a reminder to jurists, practitioners and all operating in law that theirs is a discipline which is still largely or mostly nation-oriented (Zweigert and Kötz, 1998, 75). This being the case, a more global, a more cosmopolitan type of ethos would be key for the future generations of lawyers and law graduates (Platsas, 2015). As such, the ethos of our future lawyers must be one that is extrovert and global, an ethos that transcends national frontiers and limitations. So too, it would be of the essence to remind our law students, many of whom might follow the legal profession that:

> law is not [just] a "job"; it is a way of life. Deficiencies in legal education, therefore, might affect the ability of future lawyers to develop relationships with the outside world to a very significant degree and create serious difficulties for them in terms of earning their living, with obvious repercussions on the enjoyment of their private lives (Pasvenskienė and Astromskis, 2020, 195).

This being the case, it would be quite important to create law graduates that would be fully equipped for the real world. Such graduates would have to have a clear set of interpersonal skills, cultivated in the university environment already; these would be skills that would be falling under the wider idea of an extrovert academic ethos that we ought to instil in our law students, an ethos that should eventually result in an extrovert professional ethos upon employment and so on.

Proposed Principle 5: World-Class Academic Citizenship

One would have failed as a law academic if one did not at least strive to create law graduates of a world-class ethos. To do so, one must first inspire law student body to the idea of academic citizenship that goes beyond the domestic (e.g. Coryell, Spencer & Sehin, 2014, 145-164). This is an idea that allows us to see students together with their instructors as major stakeholders in the academic environment. Even then, an excellent type of academic citizenship should not be one that remains in the academic environment *stricto sensu*; rather one must inspire law student body to the idea that their discipline, their subject, their school and their university are part and parcel of modern society. A world-class academic citizenship allows students to observe their learning environment as an integrated whole within wider domestic and global society. So too, this type of citizenship is about a world-class ethos and a perception of law that would eventually move beyond the domestic sphere. As stated, whilst law is a subject with a powerful national dimension, our future lawyers would have to be ones that would be distinguished by a world-class type of academic citizenship. Such a citizenship is about global interpersonal skills, world-class transferable skills and exemplary cognitive skills. It is about enhancing and developing "human abilities, consciousness, identity, integrity, potential […]" (Lee, 2019, 761-762). These skills and abilities combined would create lawyers that would be ready for world markets, the professional environment and multiple sectors of the economy; such lawyers could operate at a global level (rather than being ones confined in a domestic market or in a provincial type of legal ethos). Academic citizenship would then signify a type of legal education that would eventually move beyond mere legal instruction and classic legal devices. Such an approach would move the law school from *ekpaideusis* or *Ausbildung* (instruction) to *paideia* or *Bildung* (education), thereby creating a legal educational model that would reinforce "the intellectual, spiritual, and emotional development of the human being, of his or her intellectual, spiritual, and emotional potential" (Delbrück, 1992, 94). Accordingly, academic citizenship in the modern academic law school would not just be about cognitive skills in law but also about the very development of law students as intellectual, spiritual and emotional creatures.

Proposed Principle 6: Practical Skills

Law in the academic environment happens to be one of the most cultivated, learned but also most complex theoretical subjects. The subject's wide-ranging connotations to so many aspects of modern life are beyond doubt. Nonetheless, close to theory, our law students and graduates must be equipped with cutting-edge practical skills in law and beyond. Perhaps the academic law school ought not to be the place where practical skills are offered more than theoretical knowledge. However, practical skills must be offered in the modern law school, and these should be significant in qualitative and quantitative terms. Assessments with practical elements e.g. tackling legal scenarios through problem solving, cultivating advocacy skills, addressing potential clients in an appropriate fashion and obvious things such as running legal clinics on a pro bono basis for the community are a must for the law schools of the future. Naturally, there might be law schools and faculties that will choose a more theory-based approach for their graduates. However, it would be an omission, to state the least, if considerable practical skills were not offered in the law schools that would otherwise choose a more theory-based approach in their teaching and learning strategy. Thus, the question is not whether a law school or a faculty of law will offer practical skills to its students but at what degree, at what level and under which subjects it would do so. Also, for the benefit of reader, practical skills that law students ought to be equipped with upon graduation could include problem-solving skills, "decision making [skills] in complex and unpredictable situations" (UK Quality Assurance Agency for Higher Education, 2014, 28), advocacy skills, business and commercial skills,

negotiation skills and formal legal writing skills (such a list not being exhaustive).

Proposed Principle 7: Academic Freedom (Principle of Flexibility)

Furthermore, one must allow colleagues in the various legal systems and, by extension, in the academic legal environments thereof, the degree of freedom expected in the academic environment, to build, adapt and develop law degrees as they see fit (ideally in certain consultation with student body, relevant professional bodies and/or official authorities). All pedagogy, all research, all operations in Academia ultimately succumb to the principle of academic freedom. If we removed the spirit of academic freedom from higher education institutions all that one would be left with would be centres of mere indoctrination. By extension, the modern law school, must recognise that aside from its traditional adherence to doctrine, it must move beyond its classic pedagogic devices after a certain point. Doctrine is key but doctrine should not be the only thing. For instance, there is clearly great need to prepare our law graduates and curriculum to a technology driven future (Pasvenskienė and Astromskis, 2020). This can be achieved by adopting a more flexible type of teaching and learning strategies in legal education, such strategies being ones that would enable and offer interdisciplinary understandings of the law amongst other things. This idea, the principle of academic freedom (or flexibility), is one that comes in agreement with the UN's position vis- à-vis "adaptability" under Art 13 of the International Covenant on Economic, Social and Cultural Rights. Thus,

> education has to be flexible so it can adapt to the needs of changing societies and communities and respond to the needs of students within their diverse social and cultural settings (UN Committee on Economic, Social and Cultural Rights, 1999, 3).

Colleagues in the modern law school must, therefore, be afforded from their school, their institution, relevant regulatory bodies and their governments a sufficient degree of freedom and flexibility to offer an educational product that would be both principled and enabling; an educational product that would offer both classic law as well as more modern subjects within the legal curriculum (e.g. subjects that would be taken to be more interdisciplinary such as history, technology, economics, political science and so on).

Comparative Perspectives

The proposed principles are offered against a background of considerable fragmentation in world legal education. Legal education around the world tends to follow very different models. Additionally, it is the case that approaches with regard to admission to the law school around the world are also quite fragmented. Furthermore, considering the well-known fragmentation of law into national laws with the advent of the Westphalian paradigm, there is clearly no such thing as a single approach to legal education around the world. The length of academic legal studies can vary significantly from country to country, whilst in the USA a law degree is considered to be a postgraduate qualification, admission to the American law school being generally granted upon completion of a previous undergraduate degree (e.g. Martinez, 2015, 275-276). When it comes to legal training and qualifying as a practitioner, one observes also considerable fragmentation in the way practitioners train and qualify around the world. In Europe, academic legal education tends to respect professional legal requirements but there is considerable fragmentation in Europe too, when it comes to legal education and training. In other countries such as Saudi Arabia legal education is perceived as "another facet of [the] national legal system" (e.g. Alanzi, 2020, 72). Furthermore, unlike most continental European systems of legal education, the approach in the US law schools is one that is more training-

oriented, it being one in pursuit of preparing future practitioners. The approach in the English law school is one that could be perceived as somewhat less systematic to the traditionally systematic and highly doctrinal approach which one encounters in the teaching and learning of law in the continental European law schools but in England too legal education tends to follow a theoretical approach based on the "exegetical lecture and the inquisitorial tutorial" (Flood, 2011, 18), albeit with a certain emphasis on practicals and, of course, the common law technique. Practically, the approach of the English law school tends to be hybrid, combining both theoretical knowledge and practical skills.

Conclusion – A Few Final Thoughts

In any case, due to the centrality of the legal subject as an academic field for society and the economy, it would be important for legal education to be followed by abstract yet relatively solid principles that would act as useful reminders as to how law degrees and subjects should be formulated, implemented and delivered. By extension, such principles could certainly offer considerable guidance as to what sort of legal education one must strive for in the modern academic environment. It was the purpose of this paper to offer seven principles with universal characteristics for modern academic legal education. These principles would otherwise be open to certain justifiable adaptation based on local context and close to the universal principle of academic freedom in modern universities and, of course, in modern law schools and faculties around the world. Nevertheless, a more streamlined, a more principled approach would be key for the modern academic legal environment, as it would enable itself and its law students and future law graduates towards more fitting models of education with considerable benefit for society, law and economy.

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Online Flipped Learning for Engineering Students

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Abstract
The integration of digital tools into language teaching has increased with the COVID-19 pandemic. In parallel, online learning has become popular, resulting in a substantial amount of online courses. In addition, nowadays, it is preferred over traditional face-to-face learning in emergency situations. All of this has led educators and researchers to explore ways to improve online learning. Online flipped learning is one of the teaching strategies that can be used in online courses. However, there is not enough study to examine how successful online flipped learning is. Therefore, the aim of this study was to investigate the effect of online flipped learning on engineering students' foreign language learning in terms of self-efficacy and anxiety levels. For this purpose, a course was designed based on online flipped learning to measure the impact of the teaching method. The course "Technical Writing & Communication" was for third-year engineering students. The design was based on students' watching the asynchronous lesson recordings before online course sessions. During live online sessions, students were required to participate in the lesson activities which were based on the video recordings. One-group pretest-posttest design was used in the study. There were a total of 30 engineering students who completed both the pretest and posttest. The findings showed that online flipped learning had a positive impact on self-efficacy and the level of anxiety in foreign language learning. In conclusion, online flipped learning is an effective teaching method to teach a foreign language in an online setting.

Keywords: Online Flipped Learning, Higher Education, Self-Efficacy, Anxiety, Foreign Language Learning

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1. Introduction

The use of digital tools in teaching has been common recently. Especially in foreign language teaching, the digital tools have been integrated into the classroom practice so as to engage the students in the activities. One of the reasons why digital tools are commonly used in classrooms is that they draw the students' attention easily and they are practical to prepare and use for the teacher. Considering the students' use of computer and the internet as an important requirement of the 21st century, the teachers want to engage the students in the learning process in the most effective way (Gök et al., 2023).

Online learning has become an inevitable part of our lives with the outbreak of the pandemic COVID-19. It has started as the only means to carry on educational activities in pandemic lockdowns, so it was the solution in an emergency. However, the online applications and some activities have been a part of the teaching process to teach more effectively. After experiencing online teaching for a certain period of time, teachers have tried different ways to improve it. Online flipped learning is one of these various strategies to be used in language teaching.

According to The Flipped Learning Network (FLN) flipped learning is a model consisting "four pillars": "Flexible environment, Learning culture, Intentional content, Professional educator" (Arfstrom et al., 2013). Students are at the center of the flipped classroom. Before the lesson in the classroom, students are introduced to the lesson material. In this way, students are given some responsibility of their own learning process as well. The "flexibility" comes from the variety of the settings the teacher creates for the students. Students can work in the classroom on different task. Also, they start learning outside the classroom when they are preparing for the lesson. In addition, it is related to the "learning culture". Students are actively engaged in the learning process, which enables them to create a learning culture. Students are expected to be at the center of activities given by the teachers. However, teachers are not at the center of the activities. As for "intentional content", the teacher is considered to decide on which content is to be taught and to be actively learnt and used by the students. In this way, it can be said that teachers act as content creators for their students. The last pillar "professional educator" focuses on collaboration and cooperation among the teachers to improve their teaching.

As aforementioned, it is possible to have varieties of flipped learning. The integration of technology enables the students to be more actively engaged in the learning process as they have access to the videos, online activities shared before face-to-face lesson (Fulton, 2012). Another reason why online flipped learning is applied is that the use of technology based activities positively affect the students in terms of lower level of anxiety (Aydin, 2018). As for foreign language learning, especially in speaking skills, students have more anxiety. When online flipped learning is conducted, students will have a chance to be familiar with some of the contents before meeting in the classroom, which means they will be ready for the activities. Furthermore, they will participate in the activities with their classmates as a part of the learning process creatively. In addition, teachers will act as mentors and facilitators in the classroom rather than lecturer; therefore, students will be supported by their teachers, and they will feel less anxious. The less anxious they feel the more confident they are in the learning process, which means the level of self-efficacy gets higher. Online flipped learning depends on the students' having their own control on studying time and environment related to the materials shared online before the lesson in the classroom. This will improve learner autonomy at the same time. Self-efficacy is about a person's beliefs about the things they can

achieve. In online flipped learning, students are exposed to contents which they need to watch, analyze, think about, and evaluate. Therefore, they will be aware their own capacity to do all these (Bandura, 2006).

In conclusion, online flipped learning enables the students to raise awareness about their own capabilities for language learning process. As they are the actors of their own learning journey actively, they will improve their problem-solving and communication skills in language learning. Therefore, the purpose of this study is to examine the effect of online flipped learning on engineering students' foreign language learning in terms of self-efficacy and anxiety levels.

2. Research Method

One-group pretest-posttest design (Campbell & Stanley, 1963) was used as a research method in this study. One group is more feasible when all students are to be taught with the same method. Pretest-posttest design enables it to be measured whether the applied method creates a change in students.

2.1 Research Questions

There are two main research questions in this study:

RQ1. Does online flipped learning play a significant role in the *anxiety* level of the students?
RQ2. Does online flipped learning have a significant effect on students' *self-efficacy* in higher education?

The first research question focuses on the anxiety level of the students and investigates whether online flipped learning is suitable for decreasing the students' foreign language anxiety. The second research question is constructed to determine whether an increase in students' self-efficacy toward English can be achieved with online flipped learning.

2.2 Participants

Participants are 3rd-grade engineering students taking Technical Writing and Communication course at a public university in Turkey. The course is given as compulsory for students studying Mechanical, Energy Systems, and Materials Science and Engineering. The course aims to develop basic skills that students may need in their courses and professional lives. The medium of instruction is English in the university, and therefore, students took their courses in English from the beginning. In other words, their English knowledge level is at a level to follow lessons. Moreover, convenience sampling (Johnson & Christensen, 2019) was the sampling strategy to determine the participants since the instructor had easier access to the students in the course she taught.

2.3 Instruments

Two validated and reliable scales were used to collect data from the participants: (1) Foreign Language Classroom Anxiety Scale, and (2) English Self-Efficacy Questionnaire. Foreign Language Classroom Anxiety Scale was developed by Horwitz et al. (1986) to measure the anxiety level of students toward a foreign language. It consists of 33 five-point Likert-type items, ranging from 1 (Strongly disagree) to 5 (Strongly agree). English Self-Efficacy

Questionnaire developed by Wang et al. (2014) aims to measure the beliefs of students on their capability related to English. It contains 32 seven-point Likert-type items, ranging from 1 (I cannot do it at all) to 7 (I can do it well). It also includes 4 factors, each related to the basic skills of English: Listening, Writing, Reading, and Speaking.

2.4 Procedure

At the beginning of the course, students took pretests about their anxiety and self-efficacy related to English as a foreign language. There were a total of 62 students who filled out the pretests. Then, they followed the Technical Writing and Communications course given by the online flipped learning method for one semester. In the applied online flipped learning, the same type of video lecture was shared with the students by the instructor two days before online lesson time each week. The video lectures were prepared by the course instructor, and they were recorded in a professional studio. Students watched the videos asynchronously until the synchronous lesson time. The course was conducted live for 3 hours a week via an online platform during the semester. In the live sessions, the students did exercises related to the topic in the video they had watched before. Thus, in line with the purpose of flipped learning, the theoretical part was presented with video lectures, and they had the opportunity to practice more with exercises. At the end of the semester, a total of 30 students completed the posttests.

3. Results

This section presents the findings for each research question. The paired sample t-test was used to compare the pretest and posttest results. Although more students completed the pretest, the results of 30 students who completed both tests were used in the analysis.

3.1. Results for Students' Anxiety

The effect of online flipped learning on students' anxiety was investigated by comparing the students' Foreign Language Classroom Anxiety Scale pretest and posttest scores.

Table 1. Pretest-posttest results for students' anxiety

Variable	Test	n	Mean	SD	*df*	*t*	*p*
Anxiety	Pretest	30	2.76	0.73	29	2.374	0.024
	Posttest	30	2.51	0.62			

Table 1 shows the comparison of the pretest-posttest results for students' anxiety. The results show that online flipped learning significantly decreased students' anxiety ($M_{posttest}$=2.51 < $M_{pretest}$=2.76) towards foreign language ($t(29) = 2.374$, $p < .05$).

3.2. Results for Students' Self-efficacy

Students' self-efficacy was examined with the comparison of English Self-Efficacy Questionnaire pretest-posttest scores. Table 2 shows the comparison of the pretest-posttest results for students' self-efficacy. The results show that online flipped learning significantly increased students' self-efficacy ($M_{posttest}$=5.81 > $M_{pretest}$=5.37) about foreign language ($t(29) = -4.812$, $p < .05$).

Table 2. Pretest-posttest results for students' self-efficacy

Variable	Test	n	Mean	SD	*df*	*t*	*p*
Self-Efficacy	Pretest	30	5.37	0.81	29	-4.812	0.000
	Posttest	30	5.81	0.78			

As mentioned in section 2.3, it is possible to calculate the self-efficacy of students for each basic skill (Listening, Writing, Reading, and Speaking) separately. Therefore, separate self-efficacy scores for listening, writing, reading, and speaking were also determined in addition to the general self-efficacy score. These scores were also compared to see how much improvement has been obtained in self-efficacy for each skill. Table 3 shows the self-efficacy results for each basic skill of English:

Table 3. Pretest-posttest results for students' self-efficacy in terms of each basic skill

Self-Efficacy	Test	n	Mean	SD	*df*	*t*	*p*
Listening	Pretest	30	5.44	0.90	29	-2.695	0.012
	Posttest	30	5.71	0.97			
Speaking	Pretest	30	5.38	1.00	29	-4.203	0.000
	Posttest	30	5.90	0.81			
Reading	Pretest	30	5.46	0.79	29	-4.078	0.000
	Posttest	30	5.85	0.80			
Writing	Pretest	30	5.21	0.83	29	-5.528	0.000
	Posttest	30	5.76	0.79			

The separate self-efficacy results show that online flipped learning significantly increased students' self-efficacy about foreign language in terms of all basic skills. In other words, the proposed method has a positive effect on students' self-efficacy in terms of listening ($M_{posttest}$=5.71 > $M_{pretest}$=5.44), speaking ($M_{posttest}$=5.90 > $M_{pretest}$=5.38), reading ($M_{posttest}$=5.85 > $M_{pretest}$=5.46), and writing ($M_{posttest}$=5.76 > $M_{pretest}$=5.21).

4. Discussion and Conclusion

The results of the study showed that the online flipped learning has a positive impact of the students' self-efficacy while it decreases their anxiety level in language learning process. At the end of the term, a focus group including five students were interviewed about the online flipped learning conducted in the lesson. The students were asked questions about how useful they found the course choosing a number between 1-5 (1 is the minimum, 5 is the maximum level of satisfaction). They chose five for this question. Also, they were asked if they felt that their English skills improved, they said that speaking and writing skills improved most. In addition, they suggested more speaking activities in the following years for the course. In the light of the answers they gave, it was also understood that they found the asynchronous videos before the lesson beneficial. Although more detailed analyses of the interviews are planned in the future, it is clear from the comparison of the pretest and posttest results that online flipped learning can be utilized to increase the impact of online courses.

5. Limitations

This study has also some limitations. The first one is about sample size. Even if much more students completed the pretest, almost half of them completed the posttest. This can be expected since the course was mainly taught online. It is more challenging to involve all students in online education than in face-to-face education. Nevertheless, we could be able to reach enough number of participants at the end of the study. The other limitation of the study is that although the course started completely online as a result of a devastating earthquake in Turkey, all courses, including Technical Writing and Communications, were later switched from online to hybrid education upon the request of authorities. Even so, a few students followed the course face-to-face, and the data of the students who followed the course completely online were used in this study.

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Should Disciplines Define Learning Spaces?

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Abstract
Brazil has a robust system of public higher education institutions in which funding always depends on the importance that governments give to universities. The organizational methods and premises implemented in Latin America and particularly in Brazilian universities in the 1960s still have critical consequences on the campus. The spatiality and location in the city result from a comprehensive university reform that took place during the military rule. While the multidisciplinary departments defined the division of the campus, through their disciplinary fragmentations, there was an intentional distancing from the neighborhood. However, the importance of interdisciplinarity in university spatial organization is present throughout the campus social infrastructures. These institutions' networks have a large and crucial role for Brazilian society, providing public health assistance, language courses, sports activities, and other services. We argue that social infrastructure connections can enhance the importance of disciplinary exchanges to strengthen the relationship between the university, society, and ecology. In this work, we use a Brazilian campus to explore how its social infrastructures can support in overcoming disciplinary segregation. By reassessing territorial organization, public universities can strengthen fundamental services for social cohesion, care, and city functioning, as the so-called hard and social infrastructures are parallel in terms of their importance. This study contributes to expanding the concept of social infrastructure and its role in transdisciplinary fields, framing the campus dynamics in a context marked by climate change, social segregation, and the lack of public services.

Keywords: Social Infrastructure, University Campus, Brazilian Public Universities

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Introduction

Focusing on the main campus of the Federal University of Santa Catarina (UFSC) in Florianópolis, Brazil, we argue that by reassessing territorial organization, public universities can reinforce a fruitful platform to overcome critical disciplinary segmentation. At the same time, these institutions can strengthen fundamental services for social cohesion, care, and city functioning, as the so-called hard and social infrastructures are parallel in terms of their importance. This study contributes to expanding the concept of social infrastructure and its role in transdisciplinary fields, framing the campus dynamics in a context marked by climate change, social segregation, and the lack of public services. We mapped the main social infrastructures provided by the university on campus to highlight proximity relationships and possible associative links between the different social infrastructures, identifying the layers of provided services that make up the campus. Our proposal acknowledges that the disciplinary divisions in campus planning remain a significant hindrance to fully utilizing the potential of social infrastructures and their integration. This study explores how social infrastructure can enhance human connections and grant necessary public services to promote efficient urban life, social harmony, and ecological balance in cities. These social infrastructures can prompt a reevaluation of academic practices, emphasizing interdisciplinary curricula to strengthen the relationship between society and ecology.

A university campus may profoundly vary depending on where it stands. The Brazilian public universities, for instance, incorporate crucial urban social infrastructures and its campuses are places of organized complexity of public services. At the same time, these institutions host multiple forms of sociability that include their surrounding communities. However, public universities are increasingly underfunded, and their role in addressing the country's social problems is often ignored or distorted. Brazilian recent experiences include the public universities in the eye of a cultural war promoted by conservative sectors that depicted the university community as an investment with no real return to society and even as enemies of morality.

Garcia (1994) establishes a connection between the initial restructuring of academic frameworks and the Enlightenment era, closely tied to the emergence of modern Western science. The schism between university practices and the Roman Catholic Church, a significant knowledge transmitter, yielded profound ramifications. This divergence not only brought about disciplinary and thematic compartmentalization within organizational and administrative dimensions but also instigated a spatial transformation necessitating specialized academic facilities (Temple, 2014). Furthermore, García (1994) contends that the dichotomy between natural and human sciences emerged as an endeavor to systematize the realms of knowledge. Moving forward, in the 20th century, neopositivists embarked on a reductionist quest for scientific cohesion, which gradually permeated university organizational principles and physical infrastructures.

Disciplines have engaged in a collaborative exploration of their depths, yet this endeavor has often been accompanied by skepticism regarding attempts to amalgamate disparate fields. Discussing the disintegrated nature of sciences and urban dynamics, Lefebvre (1996) highlights that throughout a substantial portion of the 19th century, the sciences focusing on social reality evolved in opposition to philosophical concepts aiming to encompass the entirety through rational systematization. The author underscores how these sciences segment reality into analytical fragments, each wielding its distinct methodologies, sectors, and domains. Consequently, the environment was approached and comprehended as a

comprehensive yet intricate concept, susceptible to fragmentation due to the specialized approaches and investigations pursued by disciplines such as geography, climatology, and botany. This division of labor led to a montage-like environment perception. Following this, a wealth of literature emerges, expanding the horizons of learning environments' capacities. This literature considers these environments from a wide-angle perspective, recognizing them not only as traditional centers of learning, but also as vibrant hubs and social focal points. Importantly, this perspective does not dilute the educational aspects; on the contrary, it enhances them. This assertion finds support in research, underscoring that this inclusive approach measurably contributes to improve the learning experience, nourishing more extensive spatial diversity, geographical flexibility, and enhanced resource accessibility are provided for both students and educators compared to conventional classrooms (Carvalho & Goodyear, 2018; Cleveland & Fisher, 2014; Young & Cleveland, 2022).

Urban university campuses form the landscapes of cities with other urban, sociocultural, and biophysical systems. The interaction between the processes and components of these territories affects the campus and cities directly (Goddard & Vallance, 2013). Understanding the campus requires knowledge of the institution's history it belongs to. In its expanded context, our object of study, UFSC's main campus, is a component that illustrates the growth of state and federal public agencies and tourism in Florianópolis since 1960. UFSC's establishment is part of the educational modernization debates that marked Brazil in the 1950s, aimed at strengthening the country’s affluent elites. Governmental resources have led to public interventions contributing to the city's territorial occupation, as in other parts of the country. At the same time, workforce qualification was a necessity for operating the new service provision and public administration sector in a remote area of the city.

Campus Context and Disciplinary Segmentations

Urban university campuses form the landscapes of cities with other urban, sociocultural, and biophysical systems. The interaction between the processes and components of these territories affects the campus and cities directly (Goddard & Vallance, 2013). Understanding the campus requires knowledge of the institution's history it belongs to. In its expanded context, our object of study, UFSC's main campus, is a component that illustrates the growth of state and federal public agencies and tourism in Florianópolis since 1960. UFSC's establishment is part of the educational modernization debates that marked Brazil in the 1950s, aimed at strengthening the country’s affluent elites. Governmental resources have led to public interventions contributing to the city's territorial occupation, as in other parts of the country. At the same time, workforce qualification was a necessity for operating the new service provision and public administration sector in a remote area of the city.

In 1960, the construction of the university complex in a non-urbanized area was the object of conflict, as evidenced by the opposition from the team of architects responsible for the city master plan and the proposal for the university's implementation in the center of Florianópolis. The state government advocated for the campus outside the city center, in the Trindade district. The reserved plot was previously a swampy farm, and its selection was due to a political plan to promote urban development directed toward the east and north of the city (Teixeira, 2009). The two first plans for the new campus included comprehensive architectural, road, and urban spheres. The actual construction, however, was limited to the road and drainage systems, which were vital to expanding the surrounding neighborhoods (Neckel & Küchler, 2010) (Figure 1). Infrastructures like these give rise to temporalities, thereby composing what is known as infrastructural time (Appel, 2018). After the Brazilian

military coup d'état, the University Reform of 1968 redefined organizational and administrative parameters of higher education institutions, with a significant impact on the UFSC's project. The Reform emphasized economic rationalization and influenced by productive university models, territorial compartmentalization, and hierarchy.

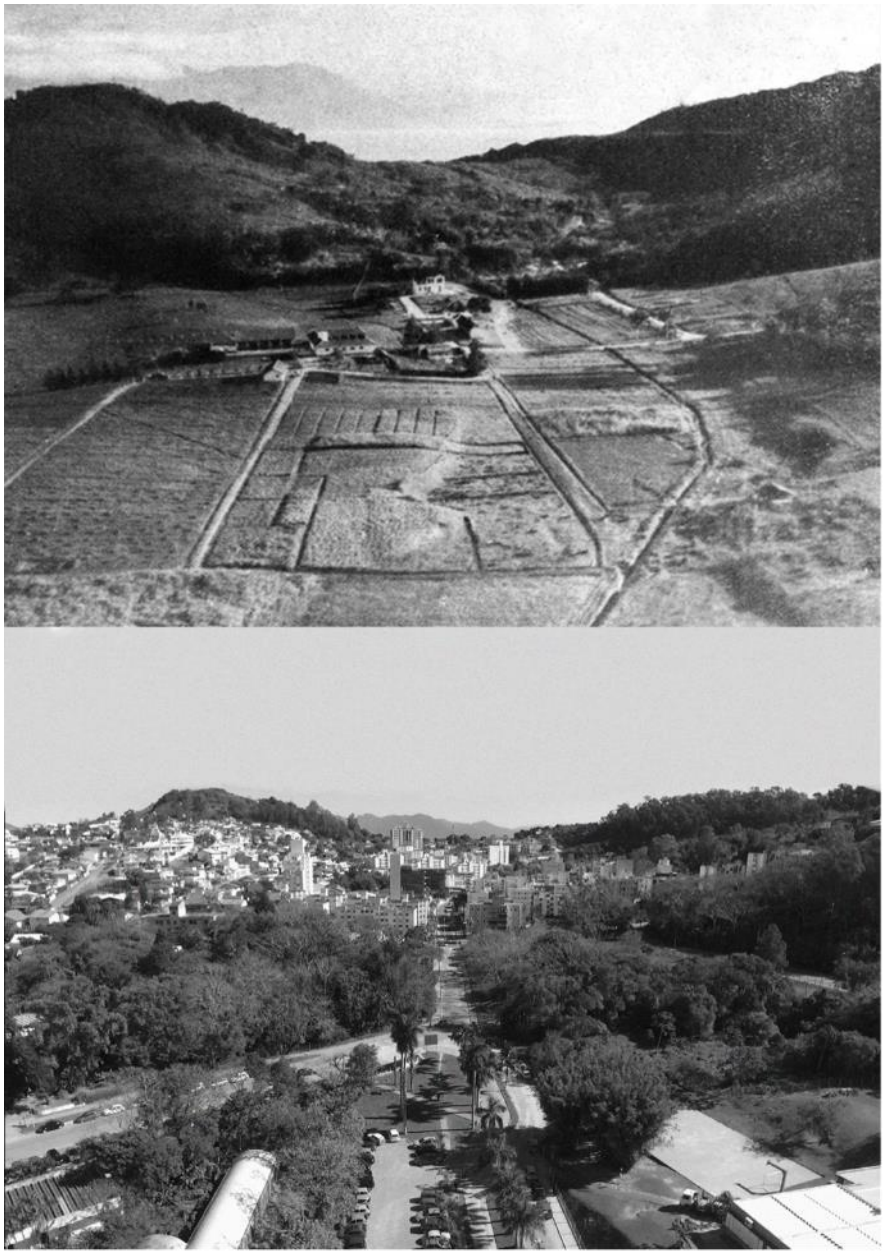

Figure 1. Above: taken in the 1950s, the plot where the campus now stands with part of the drainage system, viewed from the east. Source: UFSC Agecom. Below: Same region in 2016. The landscape formed by these infrastructures serves as a temporal reference for the campus and its environment. Source: authors.

The Manual for Integral Planning of the University Campus[1] by Rudolph Atcon (1970) guided a large part of the organization of Brazilian universities. It reflects a strict belief in post-Reformation pragmatic rationalism. Atcon established the division of universities into centers associated to large disciplinary fields, eliminated any duplicate infrastructure,

[1] From portuguese “Manual sobre o planejamento integral do campus universitário”, our translation.

hierarchically organized the rectory, disciplinary centers, and other collegiate bodies, and emphasized the vital role of departments over schools (Cunha, 1988; 2014). The United States acted in Latin America in the cultural and educational fields as part of the Cold War through bilateral agreements. Documents such as the Manual are part of a significant series of other legal provisions, academic exchanges, and other cultural and political actions guided by the US government. Atcon envisioned the connection between universities and society through fundamental infrastructure and services, the university hospital, and the sports facilities. However, these connections presented a contradiction as the community could only penetrate to a certain extent the campus domain through these social infrastructures.

The "Manual" segments knowledge into different disciplinary centers, a feature that was part of the university's initial plans but exacerbated by the Atcon documents. These segmentations reflect the current scientific understanding of natural laws and are evident in different disciplinary and spatial practices. Atcon used zoning to reinforce the spatial segregation of the hypothetical campus depicted in his Manual. He conceptualized this zoning based on areas of knowledge (Figure 2). Architecture is responsible for the ordering and maintenance of this concept, as it describes the protocols for space formatting (Easterling, 1999). Nonetheless, it is crucial to engage in a thorough and nuanced analysis of the significance of these reforms and the Manual's pivotal role in shaping administrative changes within the university. This examination should consistently acknowledge the overarching influence exerted by the Federal Government, without overlooking the diverse local contexts and political-regional distinctions. These documents represent a synthesis of both theoretical and practical endeavors, unfolding concurrently within the centralizing sphere of the federal government and the university staff. The varying degrees of importance and centralization attributed to the government further underscore the dynamic nature of this interplay.

The university campus mirrors these specialization procedures, highlighting the guidelines that govern them, and their ability to simplify and standardize infrastructure through modular protocols (Appel, 2012; Tsing et al., 2019). An approach to infrastructural space could prioritize the fundamental components of urban life and social care. Thus, social infrastructure encompasses quality urban spaces and their essential characteristics that can have a significant impact on everyday life and extreme weather events (Klinenberg, 2016; 2018). Quality urban spaces include sociability, physical provision, and programmatic-institutional organization, linked to the socio-spatial and community characteristics of the regions (Latham & Layton, 2019; 2022).

The UFSC campus area is over 400.000 sq. meters, comprising around 60 departments with almost 50.000 students, staff, and faculty. The university provides free of charge multiple and disconnected services and summarizing them is not straightforward. Nonetheless, we present some of the principal social infrastructures below. The campus boasts several social infrastructures related to health, including the University Hospital (HU) and teaching clinics. The HU is one of the largest hospitals in the State and is a significant provider of the Brazilian Unified Health System[2], which offers universal and free access to health services for all (Gelbcke et al., 2018). The HU caters to approximately 10,000 clinical admissions and 40,000 emergency cases annually. Additionally, the campus has various teaching clinics, such as Dentistry, Speech Therapy, and Psychology. The University School receives around 1,000 preliminary and high school students, becoming a recognized social education infrastructure for the metropolitan region. Other social facilities on campus include the Child

[2] From portuguese Sistema Único de Saúde, our translation.

Development Center, extracurricular courses in foreign languages, and academic events open to the community, which attract thousands of people. The Sports Center occupies a significant part of the southern section of the university complex and comprises several infrastructures such as sports courts, swimming pools, athletics track, soccer field, and gymnasiums with multipurpose courts. The Center for Elderly Studies fosters inclusion and collaboration with the elderly public on campus. These social infrastructures are scattered throughout the campus separated by the internal road system and the campus river network. Parking lots constitute a significant feature and barrier all over the campus, particularly between buildings and the riverbanks (Kos et al, 2017).

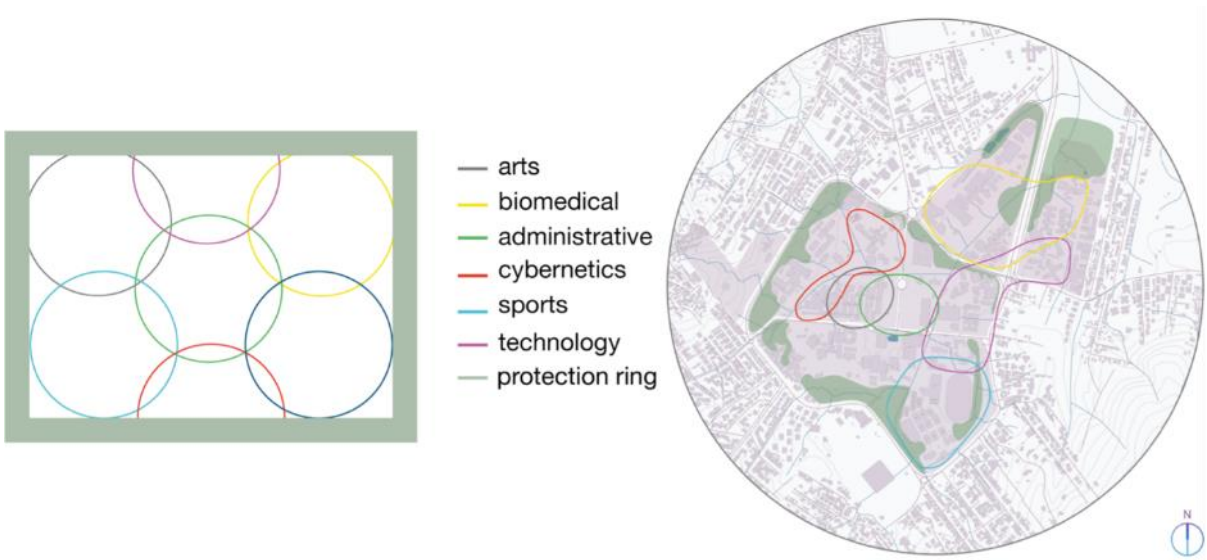

Figure 2. On the left, is the diagram of the Atcon Manual and its basic sectorization, while on the right, this schematic is superimposed onto the UFSC campus. Source: authors.

Reframing Divisions, Emphasizing Social Infrastructure

It is crucial to acknowledge the adaptability of the concept of social infrastructure, as its varying spatialities and sociability are different and specific to different regions worldwide, which requires different typologies of sociotechnical systems. We developed Latham and Layton's (2019; 2022) research categories to direct our study about the possibilities of integration and visualization of social infrastructures on campus. Additionally, we referred to the University Service Charter (UFSC), a document that outlines UFSC's primary services enhancing their capacity to meet the evolving needs of Brazilian society more efficiently and effectively. We centered on investigating these on-campus social infrastructures georeferencing them across thematic overlays, disregarding their departmental affiliations (Pavan, 2022). Our analysis of the campus's social infrastructures focused on the following themes: social health infrastructures, community education, leisure and sports, elderly care, culture, mobility, and open spaces as social infrastructure.

Part of the inspiration for building the visualization model came from an infrastructural inversion in which the substrate turns into a substance. Infrastructural inversion is an analytical concept involving an epistemological change in the studies of large-scale technological infrastructures, delineating its properties (Bowker, 1994; Star & Ruhleder, 1996). The representation option underscores the object-relational quality of infrastructures, establishing syntactic relationships with and connecting to other multilayered. This inversion introduces action and representation possibilities of the campus organization through

functional coexistence in its different social infrastructures, thus surpassing disciplines as the only possible division.

To assess the potential of the university, we developed diagrams of social infrastructures focusing on specific aspects of the infrastructural space. To ensure flexibility, we established a negotiable structure integrating existing experiences with emerging virtual relationships in the campus's infrastructural space. After conducting a thorough survey, we georeferenced the typologies in a Geoinformation System Software. With the obtained coordinates, we organized the actions into circuits using Kepler.gl, an online geospatial analysis tool. By connecting the social infrastructure in a network, the software interpolated the circuits using Delaunay's Triangulation. This approach maximizes the smallest angle of all triangles, avoiding those with a reduced internal angle, leading to circuits formed with greater flexibility (Figure 3). Together, these circuits form paths and directions that impact the campus's performance and social impact.

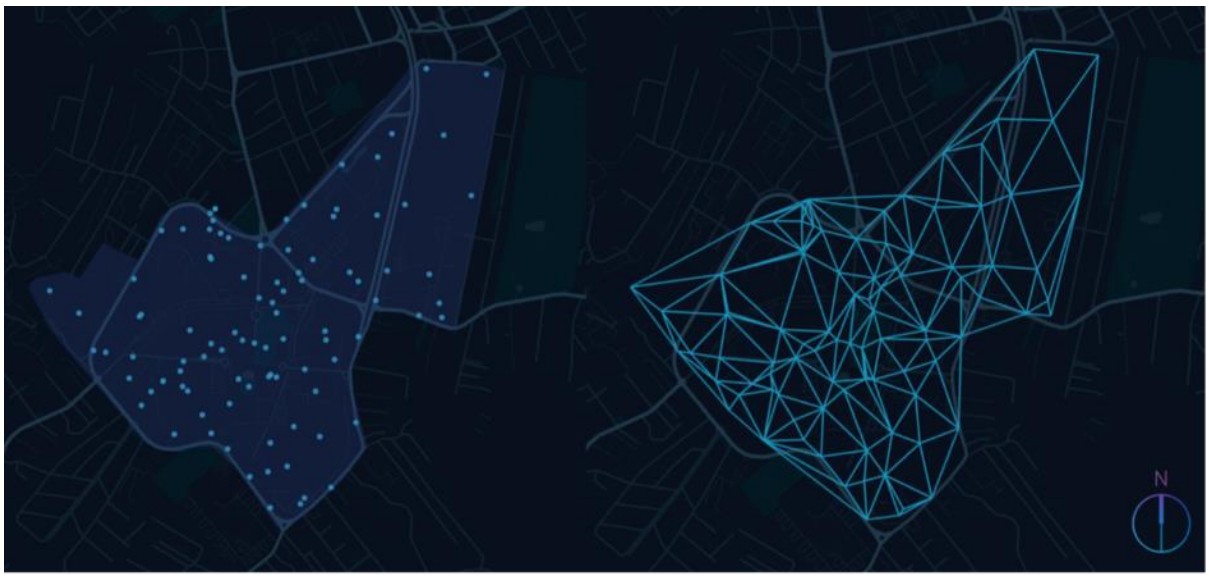

Figure 3. Different georeferenced points attached to social infrastructures generated the triangles, posteriorly employed to generate the circuits. Source: authors.

By visualizing each circuit based on its proximity relations, we can identify the layers of services that make up the campus (Figure 4). We are calling circuits the surface delimitation and the perimeter formed by uniting different social infrastructures. The overlapping distribution of these infrastructures highlights their ubiquitous and permeable nature throughout the campus. Each category, disseminated across the university, adds richness to the campus and is reinforced by the distributive terms of these circuits, which each compose a layer. Furthermore, we examined social infrastructures and typologies beyond discipline ties, recognizing that their management by different sectors within the same institution challenges the notion of a systemic view.

The interaction between the university and the external community is an essential part of university outreach and takes place through various educational and social activities, such as projects, courses, and cultural or leisure activities provided by the institution. A critical part of this process has been integrating activities currently not intricately connected concerning space or themes. For example, when we designed the social health infrastructure diagram, we considered locations such as clinics and the university hospital, sports facilities, and other buildings that play a significant role in intergenerational care, emphasizing their spatial

complexity. For the social education infrastructure circuit of the community, we considered locations whose educational activities are part of official programs and are central to the organization of the university's physical spaces.

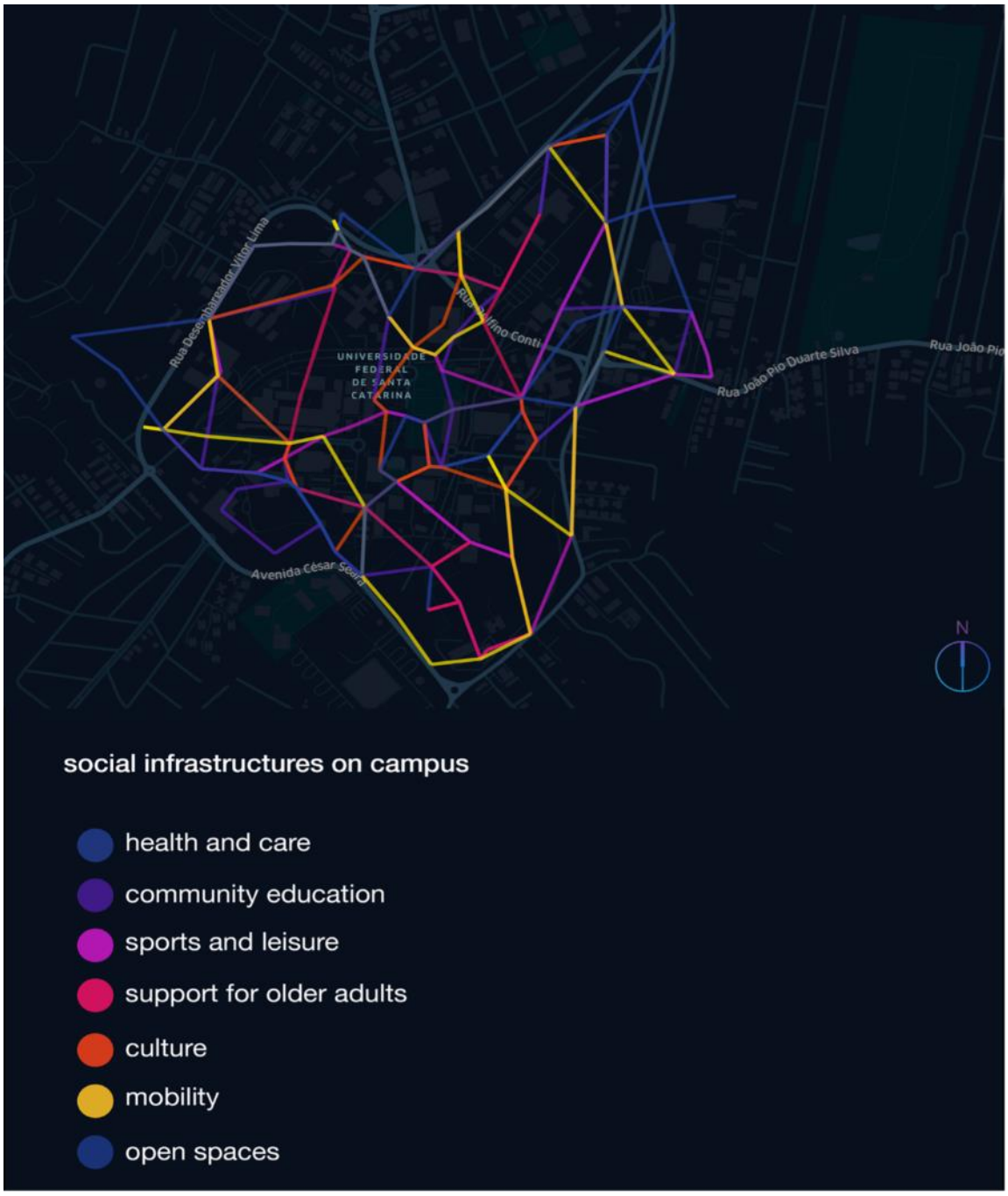

Figure 4. Diagram overlaying the social infrastructure circuits on the UFSC campus. Source: authors.

Working with social infrastructure requires flexibility beyond the end function of the spatialities we evaluate. Even in the case of the campus, whose primary focus is higher education, integrating schools and the community on the university campus effectively promotes education and socialization in the community. The University School presents an example of community interaction through parent-teacher associations, allowing for continuous dialogue and expanding the integration between schools and the city. This

network of social infrastructure aimed at education permeates most buildings of the university. However, the challenge is not only to integrate them, but integrate the open spaces to actively participate in this network.

Orr's hypothesis (2004) emphasizes that a campus is an object of learning and community education, as classes and lectures are. The social leisure and sports infrastructures are pivotal in this process. They offer collective activities in which interaction with the university's territory is crucial. In this sense, sports and leisure are social and cultural rights that energize public space. The diagram of social leisure and sports infrastructures reinforces these relationships, bringing the concept of social infrastructure closer to a space traditionally dedicated to research and study (Figure 5). Furthermore, they support the pedagogical potential of the university's territory, present in the mutual transfer of knowledge between scientific knowledge and other kinds of knowledge.

Figure 5. Public sports infrastructures on campus. Source: authors.

Among this new knowledge, we mention the inclusion of different perspectives about the public that occupies and attends the university. Population aging is an increasingly prevalent phenomenon worldwide and can lead to problems of a sedentary lifestyle, isolation, and mental and physical frailty. Social infrastructures concerning people over certain ages must consider generational particularities and avoid prejudices and ageism. The Center for Studies on Aging is the most prevalent and relevant social infrastructure in this domain. In addition to offering specific activities for the older adult population, the center serves as a gateway for older adults to learn about other activities developed on campus that are not related to the center's actions. It is necessary to be constantly updated and attentive to the senior population's substantial dynamics, considering their diverse needs, such as difficulty with mobility and other physical restrictions. Social connections and networks of sociability are fundamental to meeting the needs of this increasingly large population group and the consequential need for integrated health and social care. Another relevant issue is campus

diversity. The university is mostly a young community and placing them with older people opens their worldviews to different society's needs.

Mobility on campus raises concerns about transportation dynamics in the metropolitan region of Florianópolis. This is also the case for most students who live in the city's peripheral neighborhoods of the island, who depend on the campus's public transportation. Controversially, this reality results in pressure for parking spaces on campus that, together with the original road infrastructure, defines an urban design that fragments opportunities for exchange between the disciplinary centers. The extensive infrastructure for private vehicles, however, is a facility offered primarily to a specific class that resides in the surrounding neighborhoods, coupled with the argument that pedestrian access is limited and precarious, making it uninviting for walking. Nonetheless, reframing the quality and permeability of pedestrian sidewalks is one of the most potent acts to ensure its social infrastructure qualities in the campus context, favoring encounters and vital interaction for society's dynamics.

We consider the diagram of free space systems as a valuable tool for understanding the social infrastructure present on the university campus and its relationship with the surroundings. These spaces should orient the development of dynamics related to the biophysical matrix, visual perception, and accessibility. Part of its ecological complexity derives from the intersection of several ecosystems such as mangroves, rivers, and hilltops. Additionally, its topographic position places it as a link between these ecosystems and the ocean downstream. The circuit of free space systems illustrates a green and blue infrastructure, addressing water dynamics processes, not just the logic of efficient drainage. It is essential to recognize these free spaces as areas of opportunity for intervention in the territory, promoting life quality of its inhabitants and sustaining new sociabilities. In this sense, it is crucial to consider these free spaces in urban planning and recognize their importance in the structuring of the city.

By highlighting the social infrastructures through the circuits our intention is not to limit the possibilities of interaction through design. This model offers an alternative method to visualize the thematic areas that make up the campus infrastructure. By emphasizing social infrastructure, we provide an alternative perspective on the campus organization. What is at the core is the possibility of overcoming the fragmented multidisciplinary model that rules university planning in the Brazilian public university system since Atcon, separating it from the city. Acknowledging these complex infrastructure systems that the university support subverts the disciplinary ruptures of the administrative structure and the campus segregation from its neighbors.

Conclusion

The social infrastructure is responsible for delivering care and preserving the "life-worlds" of individuals (Hall, 2020; Lathan & Layton, 2022). It encompasses a multitude of systems that are often ignored and undervalued, yet crucial to the proper functioning and sustainability of society. In the context of exploring the infrastructural space, it became evident that sociotechnical systems possess underlying political and material implications that are not always apparent upon initial observation. We can make an analogy with a library. It would be reductive to assume that the biggest potential of such a place is restrained to the dynamics to access the collection traditionally organized by corridors of knowledge areas. In an era where accessing collections is increasingly detached from physical libraries, these spaces are evolving to become hubs of diverse services. These services not only redefine the purpose of libraries but also have the potential to significantly enhance various facets of visitors' lives.

This study, thus, embarks on a comprehensive exploration of multifaceted approaches rooted in the domains of science and technology studies. These approaches provide valuable insights for scrutinizing social infrastructures as pivotal cornerstones within the intricate spatial tapestry of a university campus.

When campus maps are limited to displaying the primary activities of educational environments, simplified into academic buildings associated with specific disciplines, they may not accurately represent the connections of services provided by the university. However, diagrams considering the social infrastructures interconnected by the different departments may encourage society's participation in scientific work through transdisciplinary interaction. Many infrastructures appear more than once in the circuits, which allows for identifying interdisciplinary encounters and their flexibility and multiplicity of purposes, following Latham and Layton (2019). Understanding the social impacts of these often-undervalued infrastructures is crucial as they serve various purposes. Placing them at the forefront is significant for both the university and society's awareness. Furthermore, it creates meaningful bridges to connect the various worldviews separated by the disciplinary fields on campus, as well as with the outside community.

Infrastructure systems are essential to society, and their interdependence is an imperative aspect of their functionality. Even when these subsystems work well independently, their interruption or absence impacts the activities and services of the totality. The social potential of the UFSC campus and other infrastructures in the city is complex and may be difficult to grasp. However, it is critical to recognize their importance and prioritize their enhancement as a permanent objective of political forces. We believe this will contribute to the success of the university's values of being an inclusive and interdisciplinary institution, and that society can adapt actively to changing times based on community cohesion.

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