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From Conflict to Connection: Emotional Literacy and Cultural Responsiveness in Higher Education

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Abstract

This cross-disciplinary study interrogates the emotional and social dynamics underpinning college students' experiences of interpersonal conflict. Integrating both health and education perspectives and drawing insights from a qualitative research base-including self-reflection reports and semi-structured interviews-this paper explores how emotional literacy and cultural responsiveness serve as catalysts for constructive relationship management and student well-being. The analysis is situated within established frameworks of emotional literacy, conflict theory, and contemporary practices in higher education, centering concepts such as emotional interdependency and emotion-driven violations. Thematic findings reveal the critical roles of empathy, emotional reciprocity, and context-aware interventions in supporting resilience and relational repair. The paper advances evidence-based recommendations for educators and university administrators, including the promotion of empathy-building workshops, reflective dialogue practices, and integrated wellness curricula. By situating emotional literacy as central rather than supplemental to the higher education mission, and by embracing culturally responsive pedagogies, institutions can more effectively prepare students for global citizenship, personal agency, and peacebuilding in increasingly complex and polarized societies. Thus, this paper aligns with SEACE's themes of Global Citizenship and Education for Peace, advocating for a paradigm shift toward emotionally intelligent and culturally responsive educational communities.

Keywords: emotional literacy, cultural responsiveness, interpersonal conflict, higher education, emotional interdependency

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Introduction

The transition to higher education is often marked by profound emotional and social challenges. As students navigate new environments, relationships, and expectations, their capacity to manage emotions, resolve conflicts, and connect across diverse identities becomes foundational to their academic and personal success. Recent research demonstrates a surge in anxiety, loneliness, and burnout among college students, exacerbated by academic pressures, digital saturation, and global instability. Yet, the institutional response has often lagged behind these developments, with emotional support structures remaining fragmented, reactive, or marginal to the academic mission.

This paper bridges conceptual and practical divides by positioning emotional literacy-not as a supplementary or remedial concern-but as the structural core of resilient, culturally responsive higher education. Through integrated qualitative methodology, we explore how college students experience, interpret, and manage interpersonal conflict on campus. By examining patterns of emotional interdependency, expressions of negative affect, and the capacity for empathy, our findings highlight avenues for cultivating not only student well-being but also more just, effective, and inclusive learning environments.

Key questions addressed in this paper include:

- In what ways do emotional literacy and cultural responsiveness intersect to shape conflict experiences among college students?
- How do deficits in empathy and emotion-driven violations impede relationship quality and student flourishing?
- Which interventions can educators and administrators employ to cultivate emotionally intelligent, culturally adaptive communities aligned with the ideals of global citizenship and peace education?

By integrating current literature with original qualitative insights, we seek to inform both theory and praxis-building a case for systemic, cross-disciplinary reform in how emotional and relational skills are developed within higher education.

Literature Review

Emotional Literacy in Higher Education: A New Paradigm

Emotional literacy, encompassing the recognition, understanding, expression, and regulation of emotions, has emerged as a non-negotiable competence for thriving in the 21st-century classroom. While historically treated as an adjunct to “real” academic content, recent scholarship recognizes emotional literacy as foundational to learning, resilience, and well-being.

Studies stress clear distinctions between emotional literacy, social emotional learning (SEL), and emotional intelligence (EI). While SEL is generally programmatic, and EI is conceived as a measurable trait, especially in professional contexts, emotional literacy emphasizes a communicative, ongoing process grounded in language and critical self-social awareness.

With neuroscience revealing direct links between emotion regulation and cognitive function, the imperative for integrated emotional education intensifies. Emotional disturbances, such as test anxiety or family conflict, compromise learning engagement. Conversely, emotional

literacy equips students with tools for stress management, conflict navigation, and collaborative problem-solving-skills increasingly vital in unpredictable times.

Shortcomings of Current SEL Practices

Despite increased adoption of SEL frameworks, implementations are often fragmented and detached from core curricula. Weekly modules or isolated programs dilute SEL's effectiveness and risk reducing emotional engagement to mechanical, script-driven tasks. Teachers, often insufficiently trained, may treat SEL as a box-ticking exercise rather than as a foundation for learning and school culture.

Research underscores the profound impact of SEL when holistically integrated. The widely recognized CASEL framework emphasizes competencies like self-awareness, self-management, social awareness, relationship skills, and responsible decision-making-all directly linked to academic achievement and long-term life success (Darwich et al., 2025).

Curriculum Integration Across Disciplines

Integrated emotional literacy moves beyond isolated lessons, embedding empathy-building, emotional awareness, and resilience training into all disciplines. In humanities, reflective writing and analysis of character emotion arcs cultivates empathy. In STEM, frustrations become opportunities for studying perseverance, group problem-solving, and ethical dimensions of discovery. Even physical education, through teamwork and sportsmanship, provides rich affective learning experiences.

Pedagogically, there is a call to shift from content transmission to experiential, emotionally engaged learning. Project-based, collaborative, and reflective practices-journaling, role-playing, and dialogue-are proven to foster both emotional and intellectual growth (Schonert-Reichl & Roeser, 2016).

Cultural Responsiveness in Teaching

Culturally responsive teaching (CRT) recognizes and validates the cultural assets, traditions, and lived experiences that diverse student populations bring to campus assessment (Van Ingen et al., 2022). CRT challenges deficit models and promotes equity by integrating multicultural materials, diverse perspectives, and inclusive pedagogies. Effective CRT approaches involve self-reflection on instructor biases, active engagement with students' cultural backgrounds, and deliberate effort to diversify course content and assessment (Van Ingen et al., 2022).

Research suggests that culturally responsive emotional literacy creates space for divergent norms and expressions of emotion, while still emphasizing shared values of empathy and mutual respect. Family engagement, community partnerships, and acknowledgment of varied forms of emotional intelligence are integral to CRT's effectiveness (Hutchison & McAlister-Sheilds, 2020).

Interpersonal Conflict and Conflict Theory in Education

Conflict among college students is common, often stemming from miscommunication, clashing values, academic stress, and evolving cultural identities (Ceballos Vacas & Rodriguez Ruiz, 2023). Conflict theory, rooted in the work of Marx, Althusser, Bowles, and Gintis, views

educational institutions as sites of power negotiation, reproducing or challenging social inequalities through hidden curricula and differential access to cultural capital (Ferrare & Phillippo, 2023).

Within classrooms, conflict frequently manifests as interpersonal friction-student-student, student-faculty, or student-administration interactions. Critical to resolution is an understanding of "emotion-driven violations" (behaviors rooted in unmanaged affect) and "emotional interdependency" (mutual influence of emotional states within relationships). Healthy interdependence supports resilience and relational repair; unhealthy dependencies or conflict avoidance often erode trust and connection (Bhattacharjee, 2025).

Models of conflict management identify five main styles: integrating, avoiding, dominating, obliging, and compromising. Emotional intelligence-including skills such as empathy, self-regulation, and emotional awareness-is consistently associated with more adaptive, less destructive approaches (Shonk, 2023).

Emotional Interdependency and Reciprocity in Relationships

Contemporary relational theory emphasizes the value of balanced emotional interdependency, where partners provide mutual support, communicate openly, and co-regulate emotions (Mukhopadhyay, 2025). Emotional reciprocity-defined as the give-and-take of empathy, validation, and support-predicts trust, relationship satisfaction, and effectiveness in conflict resolution (Buunk & Schaufeli, 1999).

Research on college campuses finds that deficits in reciprocity, unidirectional dependency, or chronic suppression of emotional needs frequently underlie both persistent conflict and mental health challenges (Everhart, 2016).

Thematic Analysis in Studying Emotions and Conflict

Qualitative thematic analysis, particularly when attuned to emotional nuance, enables the identification of latent patterns and relational dynamics that may not be readily apparent in quantitative data. Emotion-sensitive thematic analysis emphasizes both explicit and implicit emotional content, capturing the interplay between cognition, affect, and behavior (Buetow, 2025).

Methodological reflexivity-critical self-awareness of the researcher's positionality and influence-enhances rigor and authenticity in qualitative studies of conflict, emotion, and culture (Ortlipp, 2008).

Campus Wellness and Integrated Mental Health Curricula

Increasingly, leading universities have designed campus-wide wellness initiatives and curricula that embed mental health, resilience, and self-care directly into courses, student life, and faculty development (Gross et al., 2010). Programs such as UCLA's Healthy Campus Initiative, Duke's DuWell, and the University of Southern California's "Thrive" course demonstrate the positive impact of holistic, systemic integration of wellness education (Gross et al., 2010). Research confirms improvements in student mental health, engagement, and academic outcomes.

Methodology

Research Design

This study adopts a cross-disciplinary, qualitative research design, employing both self-reflection reports and semi-structured interviews to explore how college students navigate interpersonal conflict and emotional dynamics on campus. The methodological approach is rooted in interpretive paradigms, emphasizing the co-construction of meaning and researcher reflexivity (Kalkbrenner et al., 2021). The research focus privileges depth over breadth, seeking to surface lived experiences, emotional patterns, and culturally shaped understandings of conflict.

Participants

Participants were undergraduate students from a diverse metropolitan university, representing multiple academic disciplines, cultural backgrounds, and years of study. Purposeful sampling ensured inclusion of students with varying experiences of campus conflict, self-reported engagement in wellness or emotional literacy programming, and fluency in different cultural contexts.

Data Collection

Self-Reflection Reports

Students submitted confidential written narratives reflecting on recent interpersonal conflicts, focusing on emotional triggers, responses, and outcomes. Prompts encouraged examination of self-regulation, empathy, emotional strategy, and the resolution or escalation of conflict.

Semi-Structured Interviews

In-depth interviews, lasting 45–60 minutes, were conducted individually. An interview guide covered topics such as conflict experiences, perceptions of emotional literacy, cultural influences, coping strategies, help-seeking behaviors, and suggestions for campus interventions. Interviews were audio-recorded and transcribed verbatim.

Ethical approval was secured from the university's research ethics board. Confidentiality, voluntary participation, and informed consent were rigorously maintained.

Thematic Analysis

The data were subjected to emotion-sensitive thematic analysis (Johnson et al., 2019):

1. **Initial Coding**: Both manifest (explicit) and latent (implicit) references to emotion, conflict style, empathy, and cultural responsiveness were identified.
2. **Theme Development**: Codes were grouped into clusters reflecting recurring emotional dynamics, relationship patterns, and links to conflict management strategies.
3. **Collaborative Reflexivity**: Multiple researchers reviewed and refined themes, engaging in ongoing reflexive dialogue regarding their interpretive frames, disciplinary backgrounds, and cultural contexts.
4. **Reporting**: Themes were contextualized within the broader literature and exemplified with illustrative quotations, with all identifying information removed.

Findings

Emotional Interdependency Shapes Conflict Management Styles

Analysis revealed a strong correlation between the degree of emotional interdependency students experienced in relationships and their preferred conflict management styles.

Secure and Adaptive Interdependency

Students in relationships characterized by healthy mutual support and open emotional sharing (interdependency) were more likely to use integrating/collaborative or compromising conflict management styles (Mukhopadhyay, 2025). They described feeling "safe to be vulnerable," "heard in conflict," and "able to work things out even when angry."

Emotional Over-Dependency (Codependence)

Where relationships tipped toward codependence or imbalances of emotional investment, students reported using more obliging or avoiding styles-often at the cost of suppressing their needs, leading to resentment and eventual relational breakdown (Ferrare & Phillippo, 2023).

Isolation and Detachment

A number of participants, especially those struggling with mental health or lacking social supports, reported excessive independence or avoidance, resulting in unresolved conflicts, loneliness, and decreased help-seeking.

Negative Emotion Expression and Emotion-Driven Violations

Students frequently recounted conflict episodes marked by intense negative emotion-anger, embarrassment, envy, or anxiety-that led to "emotion-driven violations" such as shouting, public humiliation, cold-shouldering, or online aggression. Notably, almost all such incidents were described in hindsight as "regrettable," with students identifying poor emotion regulation, lack of perspective-taking, or cultural misunderstanding as drivers. Themes included:

- Escalating Emotional Cycles: Once negative emotions were expressed in a heated or unsafe climate, emotions in the dyad or group often intensified (emotional contagion), making repair more difficult.
- Retrospective Insight: Through reflection, students described recognizing patterns-such as impulsivity, tendencies to "catastrophize," or misreadings of intent-highlighting the potential for emotional literacy education to prevent or de-escalate conflict.

Empathetic Communication as a Buffer

Students who described practicing empathetic communication-including "active listening," "checking in before reacting," or "trying to see their point of view"-reported more constructive and lasting resolution of conflict.

Not only did these dialogues result in apology, forgiveness, and relational strengthening, but students also reported increased self-confidence, trust, and academic engagement post-resolution. Conversely, the absence of empathetic communication was cited as a major cause of ongoing resentment or social withdrawal.

Emotional Reciprocity and Relationship Repair

Emotional reciprocity-a willingness to both receive and offer emotional support-emerged as a core indicator of relationship resilience in both peer and student-faculty interactions (Bunnk & Schaufeli, 1999). Relationships characterized by mutual validation, sharing of feelings, and flexible role-taking in times of stress demonstrated high rates of "relational repair" even after significant rupture. Students described these relationships as "safe harbors" and the individuals as "anchors" in campus life.

Cultural Dimensions of Emotional Literacy and Conflict

Cultural background significantly influenced students' perceptions and expressions of emotion, as well as their tolerance for direct versus indirect conflict styles. Some international students noted challenges in deciphering idiomatic expressions or interpreting emotional cues in academic English, while others cited cultural norms against open disagreement or emotional display.

Successful navigation of these differences depended on:

- Culturally responsive faculty who modeled inclusivity and created "brave spaces" for sharing.
- Peer networks or mentorship programs fostering cross-cultural dialogue, empathy, and mutual learning.

Interventions, Supports, and Systemic Gaps

Students described a spectrum of experiences with campus interventions:

- Empathy-building workshops, reflective dialogue groups, and integrated wellness curricula were viewed as highly beneficial, especially when made core to courses or required programming.
- Students who accessed peer counseling or campus wellness initiatives (particularly those with low barriers to entry and clear referral pathways) reported greater ability to manage stress and recover from conflict.
- However, many noted underutilization of services, lack of faculty awareness, or perceived stigma around emotional expression and mental health-seeking.

Discussion

Integrating Emotional Literacy as Foundational, Not Optional

Findings from both the literature and participant narratives converge on the necessity of centering emotional literacy as a foundational pillar of higher education-not as an enrichment or optional supplement. Neuroscience and educational research alike support the view that emotional regulation, empathy, and relationship skills are vital for academic engagement, resilience, and well-being.

Professional development for faculty and curriculum designers should treat emotional literacy as integral, informing everything from lesson planning to classroom assessment. Core principles include:

- Embedding reflective dialogue and emotional check-ins across disciplines.

- Providing explicit instruction in emotional vocabulary, perspective-taking, and conflict management.

Culturally Responsive Emotional Literacy

Effective implementation must be adapted to the cultural realities and diverse lived experiences of the student body. Culturally responsive pedagogies acknowledge that emotional norms, conflict styles, and help-seeking behaviors are not universal, and that effective emotional literacy education requires:

- Respecting students' home cultures and integrating diverse emotional narratives and expressions in coursework, readings, and dialogue.
- Training educators to recognize and respond to cultural differences in emotional expression and communication styles.
- Engaging families and communities as co-educators and allies in fostering emotional well-being.

The Role of Educators, Administrators, and Peer Networks

Educators are frontline architects of emotionally responsive environments. They model vulnerability, set expectations for respectful engagement, and use formative assessment to track relational dynamics and student well-being. Administrators must:

- Invest in professional development targeting both emotional literacy and cultural competence.
- Support policies that embed wellness outcomes into curricular and co-curricular programming.
- Develop partnerships with counselors, peer mentors, and community agencies to create a campus-wide "network of care" (Kalkbrenner et al., 2021).

Peer mentoring programs and student-led initiatives, such as empathy workshops or cross-cultural learning cohorts, complement formal instruction by providing spaces for practice, modeling, and mutual support (Everhart, 2016).

Reflective Dialogue and Transformative Conflict Engagement

Thematic analysis and empirical studies support the efficacy of reflective dialogue practices, including nonviolent communication and transformative mediation, in supporting constructive conflict engagement and repair. Core elements include:

- Facilitated spaces for sharing emotional narratives, active listening, and collaborative problem-solving.
- Structure for mirroring, validating, and reframing participants' emotional content, with a focus on empowerment and self-determination.
- Emphasis on learning and growth, rather than winning or "agreeing to disagree."

Such practices both prevent escalation and foster deeper connection, bridging divides and modeling skills essential for global citizenship and peacebuilding (Bhattacharjee, 2025).

Empathy-Building and Campus Wellness Initiatives

A growing number of universities now demonstrate the benefits of embedding coordinated wellness, resilience, and empathy-building interventions into curricular structures (Goss, Cuddihy and Michaud-Tomson, 2010). Examples include:

- Required credit-bearing wellness courses.
- Peer mentoring and support groups.
- Holistic health initiatives integrating physical, emotional, and social well-being.

Rigorous assessment shows that students completing such programs report higher engagement, reduced stress, and improved academic and relational outcomes.

Conclusion

Higher education stands at a crossroads: Will it continue to silo emotional and cultural development as marginal concerns, or will it embrace the paradigm shift necessary to equip the next generation for resilience, empathy, and constructive engagement in a complex world?

This study demonstrates that emotional literacy and cultural responsiveness are not "soft skills" but essential literacies for navigating conflict, sustaining well-being, and realizing the ideals of global citizenship and peace education. By centering experiential, culturally responsive emotional literacy throughout the curriculum, universities can break cycles of emotional isolation and conflict, supporting every student's flourishing.

Practical next steps include:

- Embedding emotional literacy into core curricula, with required elements for all students and faculty.
- Institutional investment in faculty and staff training in emotional and cultural competence.
- Adoption of campus-wide empathy-building workshops and reflective dialogue as standard practice.
- Rigorous, ongoing assessment of wellness outcomes and educational impact.

In embracing these changes, universities will not only address current crises of student well-being but also model the kind of adaptive, ethical, and compassionate citizenship that our interconnected future demands.

Declaration of Generative AI and AI-Assisted Technologies in the Writing Process

The author declares that Copilot, an AI-assisted writing software, was used in proofreading and refining the language used in the manuscript. The usage was limited to correcting grammatical and spelling errors and rephrasing statements for accuracy and clarity. The author further declares that, apart from Copilot, no other AI or AI-assisted technologies have been used to generate content in writing the manuscript. The ideas, design, procedures, findings, analyses, and discussion are originally written and derived from careful and systematic conduct of the research.

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From Pen and Paper to Prompt Engineering: Financial Literacy and AI Integration in Japanese EFL Classrooms

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Abstract

This study examined the effects of a brief, three-session AI-assisted financial literacy intervention on Japanese university students' financial knowledge, saving behavior, and attitudes. The intervention, delivered in mandatory English as a foreign language (EFL) courses at a private university in western Japan, was structured using the AI Assessment Scale (AIAS; Perkins et al., 2024) to guide the progressive integration of generative AI from no AI use to full AI collaboration. Ninety-nine students completed a pre-intervention survey and fifty-five completed a post-intervention survey using the Youth Financial Literacy Short Scale (YFLSS; Potrich et al., 2025), supplemented by measures of perceptions of AI-assisted learning and financial self-efficacy. Independent samples *t* tests revealed no significant pre-post changes in financial knowledge, saving behavior, or financial attitudes. However, post-intervention data indicated that most students perceived AI as beneficial to their learning, with 81.8% reporting effective AI use and 69.1% verifying AI output before application. Financial self-efficacy was moderate to strong for budgeting and emergency fund concepts but substantially lower for specialized knowledge, such as the 4% retirement rule. Thematic analysis of student essays, presentations, and AI interaction logs identified three qualitative themes: localized optimization and problem solving, structural reasoning facilitated by AI as a logic architect, and anxiety reduction through metacognitive awareness. These findings suggest that the primary value of short-term AI-assisted financial literacy interventions may lie in building applied competence, fostering critical engagement with AI, and reducing financial anxiety among young adults, rather than in shifting standardized test scores.

Keywords: financial literacy, generative AI, AI assessment scale, Japanese university students, financial self-efficacy

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Introduction

Historically, Japanese households have favored saving over investing. For decades, a reliable pension system meant that citizens had little incentive to risk their money in pursuit of higher returns. Currently, 51% of Japanese household financial assets are kept in simple savings accounts, while only 19.6% are in bonds, stocks, and funds (Bank of Japan, 2025). However, a series of economic and demographic shifts has begun to change this deeply rooted financial culture. In 2014, as part of an effort to stimulate the economy, the Japanese government introduced the Nippon Individual Savings Account (NISA), a tax-advantaged investment program designed to encourage households to invest rather than keep their money in low-yield bank accounts. In 2019, Japan's Financial System Council reported that retirees need approximately 20 million yen beyond their pension to live comfortably (Financial System Council, 2019), a finding that prompted widespread concern and motivated many citizens to learn about investing for the first time. Since then, awareness of investing has grown. According to the Financial Services Agency (2025), the number of NISA accounts increased 1.2 times between December 2023 and December 2024. The Japan Financial Literacy and Education Corporation (J-FLEC, 2025) reported that the number of securities held by two-person households rose sharply from 481 in 2024 to 755 in 2025, and that preferences for financial products shifted from a focus on security (45% in 2016; 26% in 2025) to profitability (17% in 2016; 41% in 2025). These trends suggest that Japanese households are not only becoming more aware of investing but are actively changing their financial behavior from risk avoidance to asset growth.

Alongside this economic shift, the Japanese government lowered the legal age of adulthood from 20 to 18 in April 2022 (National Diet of Japan, 2018). As a result, 18-year-olds can now sign contracts and obtain loans without parental consent, making young people more vulnerable to financial risks. To address this, the Ministry of Education, Culture, Sports, Science and Technology (MEXT) embedded financial education into the national curriculum starting in April 2022, with high school students learning about financial products, investment, and risk management (Horie & Oyabu, 2021). Despite these policy changes, research on financial literacy among Japanese youth remains limited. Self-reported financial confidence in Japan is considerably lower than in other developed nations, with only 12% of respondents rating their knowledge as high, compared to 71% in the United States (Central Council for Financial Services Information, 2022). This gap between financial awareness and actual literacy underscores the need for effective educational interventions, particularly at the university level.

At the same time, the rapid advancement of generative artificial intelligence (AI) has introduced new possibilities and challenges for education. Research on AI in education has expanded rapidly, with a recent meta-analysis of chatbot-based interventions finding a small but statistically significant positive effect on learning performance across educational contexts (Laun & Wolff, 2025). However, integrating AI into teaching is not without risk. Holmes and Tuomi (2022) noted that while AI allows learners to personalize the system based on their input, the technology is limited in scope and often provides a fixed learning path that may not fully address individual needs. In financial education specifically, Roberts (2023) tested ChatGPT on standardized financial literacy assessments and found that while the AI outperformed most human test-takers, it made unexpected errors on questions involving nuance and quantitative reasoning, leading him to conclude that AI will accelerate progress on financial literacy but cannot replace the need for foundational financial education. Niszczota and Abbas (2023) similarly evaluated GPT models on financial literacy tests and found that

while GPT-3.5 demonstrated limited proficiency, GPT-4 achieved a near-perfect score, suggesting that AI's financial capabilities are improving rapidly but that users still require adequate literacy to interpret and verify AI-generated responses.

One framework that addresses the challenge of integrating AI responsibly into instruction is the AI Assessment Scale (AIAS), developed by Perkins et al. (2024). The AIAS provides a five-level rubric for integrating generative AI into educational assessment, ranging from Level 1 (no AI permitted) through Level 5 (full AI collaboration). Rather than taking a binary allow-or-prohibit approach, the AIAS encourages educators to specify the degree and type of AI engagement appropriate for each task, thereby fostering transparency, ethical use, and the progressive development of AI-related skills. In the present study, the AIAS was adapted from an assessment framework into a pedagogical usage scale to structure the intervention. This adaptation represents an underexplored use of the AIAS: rather than guiding how students are assessed, it guided the sequencing of instruction, with each session corresponding to an increasing level of AI engagement.

Recent research has begun to examine how AI tools can be integrated into financial literacy courses at the university level. Gorham and Mills (2024) found that a 15-week AI-enhanced personal finance course significantly improved students' financial knowledge and behavior, though financial attitudes remained largely unchanged. A follow-up study (Gorham & Mills, 2025) expanded the investigation to three universities and found that students who did not use AI tutors exhibited stronger financial behaviors in some categories, suggesting that instructional design and socioeconomic factors may play a greater role than AI itself. However, research in this area remains limited in several respects. Existing studies have focused primarily on semester-long courses in Western educational contexts, leaving open the question of whether shorter interventions can produce meaningful outcomes. Little research has examined AI-assisted financial literacy instruction in English as a foreign language (EFL) settings, where language proficiency adds an additional layer of complexity. Moreover, the use of the AIAS as a pedagogical sequencing tool, rather than solely as an assessment framework, has not been previously investigated. The present study addresses these gaps.

This study advances existing research by evaluating the effects of a brief, three-session AI-assisted financial literacy intervention on Japanese university students' financial knowledge, saving behavior, and attitudes. In contrast to prior studies that examined semester-long courses, this investigation centers on a short-term intervention delivered in mandatory EFL classes at a private university in western Japan. The intervention was structured using the AI Assessment Scale (AIAS; Perkins et al., 2024), which provided a systematic framework for progressively introducing AI at increasing levels of student engagement. Employing the validated Youth Financial Literacy Short Scale (YFLSS; Potrich et al., 2025) and supplementary measures of perceptions of AI-assisted learning and financial self-efficacy, the study provides a focused quantitative assessment of the outcomes achievable through a brief, structured intervention. Additionally, thematic analysis of student-produced artifacts, including essays, presentation materials, and AI interaction logs, provides qualitative insights into students' engagement with AI tools across AIAS levels and their application of financial planning concepts.

Research Purpose and Questions

This study examined the short-term impact of an AI-assisted financial literacy intervention on Japanese university students' financial knowledge, saving behavior, and attitudes, as well as their perceptions of AI as a learning tool and their financial self-efficacy. It also explored how

students applied financial planning concepts and engaged with AI by analyzing their written and oral coursework, as well as AI interaction logs. The intervention was structured around the AI Assessment Scale (Perkins et al., 2024), which guided the progressive integration of generative AI across three instructional sessions. The following research questions were addressed:

1. What effect does a brief AI-assisted financial literacy intervention have on Japanese university students' financial knowledge, saving behavior, and financial attitudes as measured by the YFLSS?
2. What are Japanese university students' perceptions of using generative AI in a financial literacy learning context?
3. To what extent do students report financial self-efficacy in applying the financial planning concepts covered in the intervention?
4. What themes emerge from students' essays, presentations, and AI interaction logs regarding their engagement with AI tools and application of financial planning concepts across the AIAS levels?

Methodology

Setting and Participants

The study was conducted at a private university in western Japan with approximately 26,800 undergraduate students across 14 faculties. The participants were first-year students enrolled in mandatory intermediate-level EFL courses. Their academic backgrounds varied, with students drawn from the School of Theology and the Faculties of Policy Studies, Letters, Social Studies, and Commerce. All participants were native Japanese speakers. The intervention was implemented across two reading and writing (RW) sections and two listening and speaking (LS) sections over a three-week period, with one 90-minute session per week.

Table 1
Participant Demographics

Characteristic	Pre-survey (*n* = 99)	Post-survey (*n* = 55)
Course type		
Reading & Writing	52	28
Listening & Speaking	47	27

Note. All participants were first-year students and native Japanese speakers.

A total of 99 students completed the pre-intervention survey, and 55 completed the post-intervention survey, yielding an attrition rate of 44.4%. The attrition was primarily due to student absences on the day the post-survey was administered during Session 3. Absence rates were roughly proportional across the four sections, with no single section accounting for a disproportionate share of missing respondents. Because the post-survey was administered only at the end of the final session, students who were absent for any reason, including illness, scheduling conflicts, or other commitments, were not captured. This level of attrition is a methodological limitation, as it raises the possibility that the post-survey sample may differ systematically from the pre-survey sample (e.g., if less motivated or lower-performing students were disproportionately absent). This issue is addressed further in the Conclusion. The study

received ethical approval from the university, and informed consent was obtained from all participants prior to data collection.

Classroom Procedures

The intervention was implemented over three consecutive weekly sessions, each structured using an adapted version of the AI Assessment Scale (AIAS; Perkins et al., 2024). Rather than serving as an assessment rubric, the AIAS functioned as a pedagogical framework to guide the progressive integration of generative AI into instructional activities. This approach draws on the concept of AI as a cognitive scaffold, in which AI tools extend students' capacity to engage with complex tasks, and the structured progression ensures that foundational understanding is established before reliance on AI. Table 2 provides an overview of the intervention design.

Table 2
Summary of Intervention Design Across AIAS Levels

Session	AIAS Level	Activity	AI Use
1	Level 1 (No AI)	Financial planning worksheet with example case; guided calculation tasks	None
2	Levels 2–3 (AI-Assisted)	New case; complete financial plan with AI support; AI feedback on drafts	AI for calculations, scenarios, feedback
3	Levels 4–5 (Full Collaboration)	Summative task: group presentations (LS) or individual reports (RW)	Full AI collaboration; critical evaluation required

Note. LS = Listening and Speaking sections; RW = Reading and Writing sections.

Session 1

In accordance with AIAS Level 1 (No AI), students received direct instruction in foundational financial planning concepts. As most students had little prior exposure to financial planning, the session focused on building a shared knowledge base. The instructor introduced a five-step financial planning process: (a) budgeting, (b) building an emergency fund, (c) planning investments, (d) setting a retirement target, and (e) calculating a possible retirement age. Students were not permitted to use AI tools during this session. Working in groups of three to four, they read an example case and completed a series of guided tasks: adjusting income and expenses to increase monthly savings, calculating an appropriate emergency fund amount, determining how much the persona in the case could invest monthly and as a lump sum, and identifying the persona's target retirement age and the savings needed to reach it. The instructor circulated among groups, observing their processes and explaining unfamiliar terms and calculation methods. All work was completed by hand on paper worksheets.

Session 2

Students were presented with a new example case and tasked with developing a comprehensive financial plan utilizing AI support. Corresponding to AIAS Levels 2–3 (AI-Assisted Ideation and AI-Assisted Editing), various generative AI tools were employed to assist with calculations, explore alternative savings scenarios, and generate recommendations for plan improvement. After completing an initial draft, students submitted their plans to the AI for

feedback and suggestions. They were instructed to critically assess the AI's recommendations and to accept, modify, or reject them in accordance with the financial planning principles introduced in Session 1. This session aimed to provide students with practical experience using AI as a collaborative tool while emphasizing the need for independent judgment when interpreting AI-generated output.

Session 3

Students demonstrated what they had learned through a summative task. In the LS sections, students delivered group presentations in which they explained how they had used AI to improve their assigned financial planning case, describing the changes they made and the reasoning behind their decisions. In the RW sections, students wrote individual reports analyzing the financial plan they had developed, reflecting on the role AI played in the process, and evaluating the quality of the AI's suggestions. In both formats, students were expected to demonstrate not only financial planning knowledge but also critical engagement with AI-generated content.

Quantitative Instrument

The primary quantitative instrument was the Youth Financial Literacy Short Scale (YFLSS; Potrich et al., 2025), a validated measure designed to assess financial literacy among young adults across three dimensions: financial knowledge, saving behavior, and financial attitudes. The YFLSS was selected for its brevity, cross-cultural applicability, and alignment with the intervention's targeted constructs. The instrument was administered in both English and Japanese to accommodate varying levels of English proficiency.

In addition to the YFLSS, the post-intervention survey included two supplementary scales. The first measured students' perceptions of AI-assisted learning, with items addressing the perceived usefulness, ease of use, and trustworthiness of generative AI as a learning tool in the financial literacy context. The second measured financial self-efficacy, with items asking students to rate their confidence in performing specific financial planning tasks covered during the intervention, such as creating a budget, calculating compound interest, and evaluating investment options. Both supplementary scales used a five-point Likert format. Items were developed by the researcher based on the instructional content and reviewed for face validity prior to administration.

Qualitative Artifacts

The qualitative data consisted of three types of student-produced artifacts collected during Session 3. From the RW sections, 51 individual written reports were collected in which students analyzed their financial plans and reflected on their use of AI. From the LS sections, 16 group presentation slide sets, each with accompanying notes, were collected. In addition, 34 AI interaction logs were collected from consenting participants across all sections. In total, 101 artifacts were included in the qualitative analysis. These artifacts provided evidence of how students engaged with AI tools at different AIAS levels and how they applied, adapted, or rejected AI-generated financial planning suggestions.

Data Collection and Analysis

Quantitative data were collected at two time points. The pre-intervention survey, which included the YFLSS and demographic questions, was administered at the beginning of Session 1. The post-intervention survey, which included the YFLSS, the AI-assisted learning perceptions scale, and the financial self-efficacy scale, was administered at the end of Session 3. Surveys were distributed and completed electronically using Google Forms during class time. A total of 99 students completed the pre-survey and 55 completed the post-survey, yielding an attrition rate of 44.4%. Because the surveys were administered anonymously and student identifiers were not collected, individual responses could not be matched across time points. Pre-post comparisons were therefore conducted using independent-samples designs rather than paired-samples tests.

For Research Question 1, independent-samples *t* tests (Welch's) were used to compare pre- and post-intervention scores on the YFLSS dimensions of financial knowledge, saving behavior, and financial attitudes. Effect sizes were calculated using Cohen's d for all major comparisons. Chi-square tests of independence were conducted on individual financial knowledge items to examine item-level changes, and a Mann-Whitney *U* test was used to confirm the parametric findings for the knowledge composite. Internal consistency of the Likert-scale measures was assessed using Cronbach's alpha. Internal consistency was not computed for the dichotomous knowledge items using Cronbach's alpha, as items of varying difficulty violate the assumptions of that statistic; the Kuder-Richardson 20 (KR-20) formula would be more appropriate for such items but was not computed given the small number of knowledge items. For Research Questions 2 and 3, descriptive statistics (means, standard deviations, and percentage distributions) were computed for the AI-assisted learning perceptions and financial self-efficacy scales, respectively, both of which were administered only in the post-survey. Pearson correlations were computed to explore relationships among post-intervention measures.

All statistical analyses were conducted using SPSS version 31. Preliminary calculations were also performed using AI-assisted statistical tools (Gemini and Claude) for initial data exploration and descriptive-statistics verification, but all final results reported in this paper were confirmed using SPSS.

For Research Question 4, the qualitative artifacts were analyzed using reflexive thematic analysis following the six-phase approach described by Braun and Clarke (2006). The researcher, who was also the course instructor, first read all 101 artifacts to become familiar with the data, then generated initial codes related to students' engagement with AI and the application of financial planning concepts. Codes were organized into candidate themes, which were reviewed and refined through iterative re-reading of the data. Because the analysis was conducted by a single researcher, a reflexive approach was adopted in which the researcher maintained an audit trail of coding decisions and revisited earlier coding as new themes emerged. The analysis specifically examined patterns across the AIAS levels, focusing on how the nature and depth of student engagement with AI shifted from Session 1 (no AI) to Sessions 2 and 3 (progressively greater AI involvement). Representative excerpts from student essays, presentation notes, and AI interaction logs were selected to illustrate each theme.

Results

Research Question 1: Financial Knowledge, Saving Behavior, and Attitudes

Research Question 1 asked what effect a brief AI-assisted financial literacy intervention has on Japanese university students' financial knowledge, saving behavior, and financial attitudes as measured by the YFLSS. Because the surveys were administered anonymously and respondents could not be matched across time points, pre-post comparisons were conducted using independent-samples tests.

Financial Knowledge

Financial knowledge was assessed using five items covering compound interest, stock diversification, discount calculation, inflation, and interest computation. Each item was scored dichotomously (1 = correct, 0 = incorrect), yielding a composite score ranging from 0 to 5. Internal consistency was not computed for the knowledge scale using Cronbach's alpha, as dichotomous items of varying difficulty do not meet the assumptions of that statistic; the Kuder-Richardson 20 (KR-20) coefficient would be the appropriate reliability measure for such items but was not computed given the limited number of items.

As shown in Table 3, overall financial knowledge scores were virtually identical between the pre-survey (M = 3.92, SD = 1.39) and post-survey (M = 3.91, SD = 1.46), and the difference was not statistically significant, $t(152) = 0.042$, $p = .966$, Cohen's $d = 0.007$. Chi-square tests on individual items similarly revealed no significant pre-post differences. The item on stock diversification showed the largest numerical increase (from 65.7% to 74.5%), but this difference did not reach statistical significance, $\chi^2(1) = 1.302$, $p = .254$. Both the discount calculation item (87.9% and 87.3%) and the compound interest item (79.8% and 78.2%) showed high accuracy and remained stable. A Mann-Whitney U test confirmed the parametric results ($U = 2664.5$, $p = .817$).

Table 3
Financial Knowledge Item Performance: Pre- vs. Post-survey

Knowledge Item	Pre % Correct	Post % Correct	χ^2	p
Q1: Compound interest	79.8	78.2	0.056	.813
Q2: Stock diversification	65.7	74.5	1.302	.254
Q3: Discount calculation	87.9	87.3	0.012	.913
Q4: Inflation impact	69.7	67.3	0.097	.756
Q5: Interest calculation	88.9	83.6	0.863	.353
Total (*M* out of 5)	3.92 (1.39)	3.91 (1.46)	$t = 0.042$	.966

Note. SD in parentheses for the total score row. Pre $n = 99$; Post $n = 55$. Cohen's $d = 0.007$.

Saving Behavior

Saving behavior was measured using seven Likert-scale items (1 = Never to 5 = Always for frequency items; 1 = Strongly Agree to 5 = Strongly Disagree for attitudinal items). The five positively-worded frequency items demonstrated good internal consistency in both the pre-survey (α = .837) and post-survey (α = .821).

As presented in Table 4, no significant pre-post differences were found on any individual saving behavior item or on the composite score of the five frequency items (pre M = 3.08, SD = 0.96; post M = 2.98, SD = 0.90), $t(152) = 0.59$, p = .555, Cohen's d = 0.11. The two attitudinal items regarding spending orientation also showed no significant change across time points. These results indicate that the brief intervention did not measurably alter students' self-reported saving behaviors or spending attitudes.

Table 4
Saving Behavior Items: Pre- vs. Post-survey Comparisons

Saving Behavior Item	Pre *M*	Pre *SD*	Post *M*	Post *SD*	*t*	*p*
Reserve money for future	3.34	1.12	3.16	1.03	0.94	.347
Keep part of income monthly	3.31	1.26	3.25	1.21	0.28	.779
Save for long-term goals	2.29	1.17	2.20	1.21	0.47	.642
Save more with salary increase	3.09	1.27	3.02	1.16	0.35	.726
Saved money past 12 months	3.31	1.31	3.27	1.30	0.18	.855
Prefer spending over saving*	2.68	0.97	2.53	0.94	0.93	.355
Money is made to spend*	2.03	0.85	2.09	0.89	–0.41	.680
Composite (items 1–5)	3.08	0.96	2.98	0.90	0.59	.555

Note. Scale: 1 = Never/Strongly Agree to 5 = Always/Strongly Disagree. *Attitudinal items; lower scores indicate stronger spending orientation. Pre n = 99; Post n = 55. Cohen's d = 0.11 for the composite.

Research Question 2: Perceptions of AI-Assisted Learning

Research Question 2 asked about Japanese university students' perceptions of using generative AI in a financial literacy learning context. Six items assessed students' perceptions of AI use in the financial literacy instruction (post-survey only; 1 = Strongly Agree to 5 = Strongly Disagree). The five positively-worded items showed acceptable internal consistency (α = .625). While this value is below the conventional threshold of .70, it is not uncommon for short scales with a limited number of items in exploratory research and is considered acceptable for a conference proceedings paper reporting on a newly developed instrument.

As shown in Table 5, students reported broadly favorable attitudes toward the AI-assisted learning experience. The strongest endorsement was for the item on learning to use AI

effectively for academic work, with 81.8% of respondents agreeing or strongly agreeing (M = 2.09, SD = 0.82). A substantial majority also agreed that AI improved group project efficiency (69.1%; M = 2.22, SD = 0.88) and that they felt confident using AI for future assignments (70.9%; M = 2.24, SD = 0.94). Regarding conceptual understanding, 56.4% of students agreed that AI helped them understand financial concepts better (M = 2.51, SD = 0.84), though a notable 34.5% were indifferent. The reverse-coded item was rejected by 65.5% of respondents, with only 7.3% agreeing, suggesting that students perceived AI as additive rather than detrimental to their learning. Importantly, 69.1% reported that they checked the AI output before using it, indicating critical engagement with the technology.

Table 5
Student Perceptions of AI-Assisted Financial Literacy Instruction (n = 55)

AI Perception Item	*M*	*SD*	Agree %	Neutral %	Disagree %
AI helped understand financial concepts	2.51	0.84	56.4	34.5	9.1
AI improved group project efficiency	2.22	0.88	69.1	23.6	7.3
Learned to use AI effectively	2.09	0.82	81.8	10.9	7.3
Confident using AI for future work	2.24	0.94	70.9	14.5	14.5
Would have learned more without AI*	3.73	0.87	7.3	27.3	65.5
Checked AI output before using	2.24	0.96	69.1	16.4	14.5

Note. Scale: 1 = Strongly Agree to 5 = Strongly Disagree. Lower means indicate stronger agreement. *Reverse-coded item. Agree = Strongly Agree + Agree; Disagree = Disagree + Strongly Disagree.

Research Question 3: Financial Self-Efficacy

Research Question 3 asked to what extent students report financial self-efficacy in applying the financial planning concepts covered in the intervention. Four items measured students' perceived financial self-efficacy following the intervention (post-survey only; α = .678). As with the AI perception scale, this reliability coefficient is below the .70 threshold but is consistent with the exploratory nature of this instrument and the limited number of items. As Table 6 shows, the highest self-efficacy was reported for understanding the importance of an emergency fund, with 78.2% agreeing or strongly agreeing (M = 2.07, SD = 0.86). Over half of participants felt confident creating a simple monthly budget (56.4%; M = 2.60, SD = 1.12), and 63.6% indicated that they knew how to calculate retirement needs (M = 2.62, SD = 1.25). However, confidence was markedly lower for explaining the 4% rule and its relationship to retirement, with only 27.3% agreeing and 49.1% disagreeing (M = 3.25, SD = 1.13). This pattern suggests that while students gained confidence in general financial planning concepts, more specialized knowledge, such as the 4% rule, may require additional instructional scaffolding.

Table 6
Post-intervention Financial Self-Efficacy (n = 55)

Self-Efficacy Item	*M*	*SD*	Agree %	Neutral %	Disagree %
Confident creating monthly budget	2.60	1.12	56.4	16.4	27.3
Understand emergency fund importance	2.07	0.86	78.2	12.7	9.1
Know how to calculate retirement needs	2.62	1.25	63.6	7.3	29.1
Can explain the 4% rule	3.25	1.13	27.3	23.6	49.1

Note. Scale: 1 = Strongly Agree to 5 = Strongly Disagree. Lower means indicate stronger agreement.

Relationships Among Post-intervention Measures

Pearson correlations were computed to examine relationships among the post-survey measures. The composite AI perception score was not significantly correlated with either financial knowledge (r = .138, p = .316) or financial self-efficacy (r = .137, p = .318). These non-significant correlations suggest that students' positive perceptions of AI as a learning tool did not directly translate into higher knowledge scores or greater financial self-efficacy, and that the pathways through which AI-assisted instruction may influence financial literacy outcomes warrant further investigation.

Research Question 4: Qualitative Findings

Research Question 4 asked what themes emerge from students' essays, presentations, and AI interaction logs regarding their engagement with AI tools and application of financial planning concepts across the AIAS levels. The thematic analysis of 101 student artifacts and AI interaction logs revealed that the structured, progressive integration of AI allowed students to move beyond generic financial advice toward highly personalized, logically sound financial strategies.

Theme 1: Localized Optimization and Problem Solving

A recurring theme was the use of AI to solve localized financial constraints that students found difficult to navigate manually. By using AI as a collaborative tool at AIAS Levels 2–3, students identified specific solutions grounded in the Japanese context for their assigned personas.

Student 511-04 (Persona: Hiroshi) wrote: "I recommended him to move to a suburban area that is close to his work and receive company assistance. This change allowed him to reduce the expenses from ¥180,000 to ¥100,000." Student 522-09 (Persona: Yumi) reported: "I used AI to find specific discount grocery stores in her neighborhood. By switching to 'Gyomu Super,' we saved ¥15,000 monthly, which AI then calculated into her NISA investment plan."

Theme 2: Structural Reasoning and the Logic Architect

Students utilized the AI to bridge the gap between raw data and a cohesive financial narrative. The AI acted as what might be termed a logic architect, helping students structure their arguments around the 50/30/20 and 4% rules learned in Session 1.

Student 511-12 reflected: “To live a wonderful life of saving, it is important to review a current situation, make a financial plan, and make a retirement strategy. AI helped me see how these three things connect together.” Student 515-02 noted: “At first, I didn’t understand why the 4% rule mattered. But after the AI showed me 20 different years of market data, I realized that saving is about managing risk, not just having money.”

Theme 3: Anxiety Reduction Through Metacognitive Awareness

Perhaps the most significant qualitative shift was the reduction in financial anxiety. By simulating long-term outcomes, the AI provided a sense of agency that manual calculations alone could not provide.

Student 519-18 wrote: “I understand that this anxiety comes from a lack of knowledge. Therefore, I need to learn more about financial matters and build a more secure future, too. The AI plan showed me that even with a small salary, retirement is possible if I start now.” Student 511-21 stated: “I was scared of the stock market. But the AI simulation showed that even if the market crashes, the 4% rule protects me. I feel more confident to try investing now.”

Discussion

The present study examined whether a brief, three-session AI-assisted financial literacy intervention structured around the AIAS could influence Japanese university students' financial knowledge, saving behavior, and attitudes. The findings paint a nuanced picture: while quantitative measures showed no significant pre-post changes, the post-intervention survey and qualitative data revealed meaningful engagement with both AI and financial planning concepts.

Interpretation of Quantitative Findings

The absence of significant changes in financial knowledge, saving behavior, or attitudes is not entirely surprising given the intervention's brevity. Three 90-minute sessions likely provided insufficient time to shift deeply rooted financial behaviors or significantly increase factual knowledge. Moreover, relatively high pre-intervention knowledge scores (M = 3.92 out of 5) suggest a possible ceiling effect. The YFLSS measures recognition-level knowledge, which may not capture the applied financial reasoning that the intervention was designed to develop. These findings are consistent with Gorham and Mills (2025), who found that instructional design variables may matter more than AI access alone.

Regarding students' perceptions of AI-assisted learning, the post-intervention data indicate a largely favorable response. The finding that 81.8% felt they had learned to use AI effectively and 69.1% reported checking AI output before using it suggests the AIAS-structured progression helped develop both practical AI skills and a critical disposition toward AI-generated content. Introducing AI only after foundational knowledge was established may have contributed to this critical engagement.

As for financial self-efficacy, the pattern of strong confidence in budgeting and emergency funds but low confidence regarding the 4% rule suggests the intervention was more effective at building confidence in broadly applicable financial concepts than in specialized technical knowledge. This underscores the importance of distinguishing between general and specialized financial self-efficacy when evaluating short-term interventions.

Integration of Quantitative and Qualitative Results

The divergence between null quantitative results and rich qualitative findings is perhaps the most instructive aspect of this study. Thematic analysis revealed that students engaged in sophisticated financial reasoning, localized advice to the Japanese context, used AI to structure multi-step financial plans, and reported reduced financial anxiety. These outcomes suggest the intervention's value lay at a level that standardized instruments were not designed to capture, consistent with a view of AI as a cognitive scaffold for complex, real-world tasks.

Conclusion

The quantitative results showed no significant pre-post changes, indicating that three sessions were insufficient to shift standardized literacy scores. However, post-intervention data revealed favorable views of AI-assisted learning, moderate to strong self-efficacy in several financial planning domains, and qualitative evidence of substantive, critically reflective AI engagement.

These findings carry several implications. First, the value of short-term AI-assisted interventions may be less about improving test scores and more about building applied competence, reducing financial anxiety, and developing critical AI use, outcomes that matter in a Japanese context where financial confidence remains low despite growing policy attention (Financial Services Agency, 2023; Sticha & Lusardi, 2023). Second, the AIAS framework (Perkins et al., 2024) proved practical for structuring progressive AI integration, helping ensure critical rather than passive engagement. Third, the divergence between quantitative and qualitative findings highlights the importance of mixed-methods designs, as standardized instruments alone may underestimate the depth of student learning.

Several limitations should be acknowledged. The anonymous survey design prevented matched pre-post comparisons. The 44.4% attrition rate introduces possible non-response bias. The intervention was brief and embedded in EFL courses where financial literacy was not the primary focus. The sample was drawn from a single private university. The supplementary scales for AI perceptions (α = .625) and financial self-efficacy (α = .678) have not been independently validated. Finally, the qualitative analysis was conducted by a single researcher on a subset of student artifacts.

Future research should employ matched or longitudinal designs, extend the intervention period, and replicate across multiple institutions. Researchers might also develop performance-based assessments aligned with the applied learning revealed by qualitative data, and investigate specific mechanisms by which AI-assisted instruction influences financial self-efficacy, potentially through experimental designs comparing AIAS-structured integration with unstructured AI access.

Declaration of Generative AI and AI-Assisted Technologies in the Writing Process

The author declares that generative AI tools were used during the research and writing process. During data analysis, Gemini and Claude were used for preliminary statistical calculations, which were subsequently verified using SPSS version 31. During the writing process, Claude was used for proofreading, language refinement, and formatting assistance. The ideas, research design, data collection, analysis, and interpretation are the original work of the authors.

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Challenges and Pedagogical Readiness for EMI: Evidence From a Vietnamese University

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Abstract

This study investigates the challenges university lecturers face and their readiness to teach major subjects in English under English-Medium Instruction (EMI) frameworks at a public university in Vietnam. Using survey data from university lecturers, we examined six domains: student challenges, lecturer capacity, curriculum, teaching materials, assessment, and academic support through descriptive statistics and reliability analysis. We then explored correlations between lecturer characteristics such as qualifications, English proficiency, teaching experience and their perceptions across these domains. While no strong associations were found for sex or experience, higher qualifications were linked to more critical self-ratings in preparedness and assessment practices. The study also captured strong consensus on institutional recommendations, including training needs, academic exchange, and policy incentives. Findings underscore the importance of structured pedagogical support over assumptions based on seniority or EMI exposure.

Keywords: English-Medium Instruction (EMI), higher education, Vietnam, lecturer challenges

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Introduction

Over the past two decades, the global expansion of English-Medium Instruction (EMI) and Content and Language Integrated Learning (CLIL) has emerged as a defining feature of higher education internationalization. Universities in Europe, North America, and East Asia have increasingly adopted EMI in specialized disciplines—particularly in science, technology, engineering, mathematics (STEM), business, and international studies—not only to attract international students but also to prepare domestic graduates for participation in the global knowledge economy (Rose et al., 2023; Wächter & Maiworm, 2014). In Europe, the Bologna Process has accelerated the proliferation of EMI programs as part of cross-border harmonization efforts, while in East Asia, countries such as Japan, China, and South Korea have strategically invested in EMI to enhance international rankings, research collaboration, and graduate competitiveness (Galloway et al., 2020). This worldwide movement has also gained momentum in Southeast Asia, where specialized academic courses delivered through CLIL/EMI are increasingly common as universities pursue global competitiveness and regional integration (H. T. Nguyen et al., 2017). Thailand's English for Integrated Studies (EIS) initiative integrates content learning with English acquisition in technical subjects, supported by targeted teacher training and digital resources. Similarly, Malaysia, Indonesia, and the Philippines have implemented EMI-based programs in engineering, science, and business to align curricula with global standards and facilitate student mobility (Kirkpatrick, 2014; Lei & Hu, 2022).

In Vietnam, the higher education system has historically been strongly localized, with Vietnamese being the sole language of instruction across most universities and academic programs. This monolingual approach, while effective for ensuring accessibility and cultural alignment, has over time posed limitations to the international integration of Vietnamese graduates, especially in the context of globalization and labor market competitiveness (T. A. Nguyen, 2024; H. Tran & Jin, 2021). As English has become the global lingua franca of science, technology, and business, the limited exposure of Vietnamese students to academic English has emerged as a critical barrier to their participation in international academic networks, research collaborations, and graduate employability in transnational contexts (Phan et al., 2024).

In recent decades, the Vietnamese government has made a concerted push to internationalize its higher education sector, recognizing the need to equip students with the linguistic and intercultural competencies necessary for global engagement (L. T. Tran & Nguyen, 2018). Within this broader strategy, EMI has been increasingly promoted as a core mechanism for elevating the international profile of Vietnamese universities and enhancing the global competitiveness of their graduates. EMI refers to the use of English to teach academic subjects in countries where English is not the dominant language, and its implementation in Vietnam reflects both global trends and local aspirations for modernization (Vo et al., 2022). EMI programs are often introduced through advanced, high-quality, or internationalized degree tracks that are designed to attract elite students and faculty, foster international partnerships, and align curricula with global academic standards (L. T. Tran & Nguyen, 2018).

Despite these policy-level initiatives, the transition toward EMI has encountered a range of challenges. Studies have documented that many Vietnamese institutions struggle with insufficiently prepared teaching staff, uneven student English proficiency, and a lack of supporting infrastructure for content and language integration (Phan et al., 2024). Moreover, the implementation of EMI in Vietnam often takes place without adequate training in EMI methodology, which is crucial for balancing subject-matter learning with language acquisition

(L. T. Tran & Nguyen, 2018; Vo et al., 2022). As a result, some EMI courses have been criticized for reverting to code-switching or even translation-based approaches that limit students' opportunities to develop academic English fluency.

Nevertheless, there is growing empirical evidence that EMI programs can enhance the academic mobility and employment prospects of graduates, provided they are well-resourced and supported by effective pedagogy (Dearden, 2014; TT Ha Nguyen, 2024; L. T. Tran & Nguyen, 2018). Lecturers and institutional leaders have increasingly recognized the strategic value of EMI in aligning with ASEAN regional standards, attracting international collaborations, and responding to national goals for educational reform. As such, EMI in Vietnam is not merely a linguistic shift but a broader transformation in educational philosophy, governance, and global positioning.

However, the success and sustainability of specialized EMI courses and programs in Vietnam and across Southeast Asia remain uneven. Studies have documented persistent challenges, including insufficient English proficiency among both lecturers and students, lack of CLIL-specific pedagogical training, limited access to appropriate teaching materials, and institutional constraints that hinder effective implementation (Kirkpatrick, 2014; Phan et al., 2024; Vo et al., 2022). While these issues have been noted in broader EMI literature, empirical data on how specific lecturer characteristics, such as qualifications, English proficiency, and teaching experience, relate to perceptions of EMI delivery in specialized subjects remain limited. Furthermore, there is a scarcity of research capturing lecturers' own prioritized recommendations for improving EMI programs in the Vietnamese context.

These observations point to two critical evidence gaps: (1) Limited understanding of the relationships between lecturer background factors and their perceptions of EMI challenges, preparedness, and resource adequacy in specialized higher education courses; and (2) Lack of empirical data on the institutional and policy-level interventions most valued by lecturers for improving EMI quality. To address these gaps, this study focuses on lecturers in specialized courses at a Vietnamese agricultural university where instruction is delivered in English. The study aims to: (1) quantitatively assess the associations between lecturer characteristics and perceptions of EMI implementation in specialized courses; and (2) document and interpret lecturers' recommended strategies for improving EMI delivery, with a view to informing institutional policy, faculty development, and resource allocation.

Methodology

Participants

Participants are lecturers from a major public university in Vietnam. They represented diverse faculties including Biotechnology and Business Administration. The majority held a master or PhD degree, with most reporting English proficiency at B2 or C1 level.

Instrument

The questionnaire used in this study was developed based on theoretical frameworks and empirical studies on EMI, as reviewed in domestic (TT Ha Nguyen, 2024; TT Hang Nguyen & Nguyen, 2024) and international literature. The instrument consists of three main parts: demographic information, perceptions of EMI implementation, and recommended institutional improvements.

The core measurement section includes 49 Likert-scale items grouped into six subscales reflecting critical dimensions of EMI delivery: (a) Student Challenges (3 items); Lecturer Preparedness (13 items); Curriculum Design (7 items); Teaching Materials (5 items); Assessment Practices (10 items); Academic Support (11 items).

Each subscale comprises multiple items measured using a 5-point Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree). Item content was designed to capture both pedagogical and linguistic aspects of EMI implementation, in line with recommendations from prior research on bilingual and EMI instruction in higher education contexts. The questionnaire was reviewed by subject-matter experts and piloted among lecturers involved in high-quality programs at the university. Items were refined to ensure content validity, linguistic clarity, and practical relevance to the Vietnamese higher education setting. The aim was not to validate a new measurement scale but to explore how lecturer characteristics (such as qualifications, English level, years of EMI experience) correlate with perceptions of EMI-related challenges and preparedness. The survey also included open-ended items about support needs and recommendations.

Results

Participant Characteristics

Table 1 presents the demographic and professional profiles of the 30 lecturers who participated in the survey. The majority were female (66.7%), and most held a Ph.D. degree (73.3%), with an additional 16.7% holding the academic rank of Associate Professor. Participants represented various faculties, with the highest proportions coming from Biotechnology (26.7%) and Accounting and Business Administration (26.7%), followed by Agronomy and Rural Economics. In terms of EMI responsibilities, 50% had taught one course, while 20% had taught more than three. English proficiency levels were relatively high, with 66.7% of participants self-reporting at C1 or C2 levels. The majority of lecturers (93.3%) had more than 10 years of teaching experience, while 83.3% had at least 5 years of experience specifically in EMI contexts, indicating a well-qualified and experienced cohort for this study.

Table 1
Participant Characteristics (N = 30)

Variable	Frequency (n)	Percentage (%)
Sex		
Male	9	30.0
Female	20	66.7
Qualification		
M.Sc.	3	10.0
Ph.D.	22	73.3
Assoc.Prof., Ph.D.	5	16.7
Faculty		
Biotechnology	8	26.7
Agronomy	7	23.3
Rural Economics	6	20.0
Accounting &BA	8	26.7
Environmental	1	3.3
EMI courses in charge		
1 course	15	50.0

2 courses	9	30.0
> 3 courses	6	20.0
English proficiency		
B1	2	6.7
B2	8	26.7
C1	12	40.0
C2	8	26.7
Teaching experience		
5–10 years	2	6.7
> 10 years	28	93.3
EMI experience		
1–5 years	5	16.7
5–10 years	15	50.0
> 10 years	10	33.3

Descriptive Statistics and Reliability

Table 2 presents the descriptive statistics and internal consistency values for the six EMI subscales. Mean scores indicate generally positive lecturer perceptions across most dimensions, with the highest average rating observed for Assessment Practices (M = 4.20, SD = 0.66), followed closely by Lecturer Preparedness (M = 4.09, SD = 0.67) and Curriculum Design (M = 4.01, SD = 0.71). The lowest mean was recorded for Student Challenges (M = 3.47, SD = 1.00), suggesting more varied responses regarding the extent of challenges faced by students in EMI contexts. Cronbach's alpha values ranged from 0.641 (Teaching Materials) to 0.887 (Lecturer Preparedness), indicating acceptable to high internal consistency for all subscales. According to conventional benchmarks, values above 0.60 are considered acceptable for exploratory research, and values above 0.80 reflect strong reliability. These results support the use of the six subscales as reliable measures for assessing lecturer perceptions of EMI implementation. All scales showed acceptable to high reliability, supporting internal consistency.

Table 2

Descriptive Statistics and Reliability of EMI Subscales (N = 30)

Subscale	Items	Mean	SD	Cronbach's Alpha
Student Challenges	3	3.47	1.00	0.778
Lecturer Preparedness	13	4.09	0.67	0.887
Curriculum Design	7	4.01	0.71	0.804
Teaching Materials	5	3.95	0.67	0.641
Assessment Practices	10	4.20	0.66	0.825
Academic Support	11	3.76	0.74	0.865

Note. SD: Standard Deviation.

Correlation Between Lecturer Characteristics and EMI Subscales

To investigate how lecturer profiles relate to their perceptions of EMI challenges and readiness, Spearman's correlation analyses were conducted between six subscale scores and key background variables: English proficiency, general teaching experience, EMI experience, academic qualification, sex, faculty, and number of credits taught in English. Table 3 presents the results of Spearman's correlation analysis examining the associations between lecturer characteristics and their responses across six key EMI subscales: Student Challenges, Lecturer

Preparedness, Curriculum Design, Teaching Materials, Assessment Practices, and Academic Support. Several significant correlations emerged. Notably, faculty affiliation was positively correlated with perceptions of Student Challenges ($\rho = 0.46$, $p = 0.011$), suggesting that the perceived difficulty of working with students of varying English proficiency may differ across disciplines. Qualification level was inversely associated with Lecturer Preparedness ($\rho = –0.43$, $p = 0.017$) and Assessment Practices ($\rho = –0.52$, $p = 0.003$), indicating that lecturers with higher qualifications such as associate professors or Ph.D. holders) reported lower self-assessed readiness or flexibility in these areas. While English proficiency was not significantly associated with any of the subscales, there was a marginal negative correlation between English level and Curriculum Design ($\rho = –0.33$, $p = 0.073$) and Teaching Materials ($\rho = –0.34$, $p = 0.067$), suggesting that more proficient lecturers might be more critical of existing curricular and material structures. No other statistically significant correlations were observed for variables such as sex, teaching experience, or years of EMI teaching, although some relationships approached significance (e.g., sex with Academic Support, $\rho = 0.35$, $p = 0.057$). These findings highlight the nuanced ways in which lecturer background factors relate to their perceived challenges and instructional readiness in English-medium contexts.

Table 3a

Correlation Between Lecturer Characteristics and EMI Subscales (N = 30)

Subscale	Qualification		Sex		Faculty		Courses taught	
	ρ	p	ρ	p	ρ	p	ρ	p
Student Challenges	–0.03	0.879	–0.10	0.585	0.46	0.011	–0.25	0.181
Lecturer Preparedness	–0.43	0.017	0.01	0.953	–0.20	0.296	0.09	0.642
Curriculum Design	–0.11	0.555	0.09	0.633	–0.11	0.547	–0.10	0.606
Teaching Materials	–0.23	0.226	–0.04	0.817	–0.24	0.203	0.27	0.153
Assessment Practices	–0.52	0.003	0.00	0.993	–0.18	0.336	0.11	0.571
Academic Support	–0.05	0.804	0.35	0.057	0.10	0.590	–0.13	0.497

Table 3b

Correlation Between Lecturer Characteristics and EMI Subscales (N = 30)

Subscale	Eng Level		Teach Yrs		EMI Yrs	
	ρ	p	ρ	p	ρ	p
Student Challenges	0.04	0.830	0.12	0.533	–0.05	0.794
Lecturer Preparedness	0.00	0.990	0.20	0.284	0.01	0.954
Curriculum Design	–0.33	0.073	0.12	0.513	0.04	0.814
Teaching Materials	–0.34	0.067	–0.24	0.194	0.04	0.848
Assessment Practices	–0.20	0.296	0.02	0.903	0.01	0.959
Academic Support	0.12	0.535	0.06	0.745	–0.08	0.655

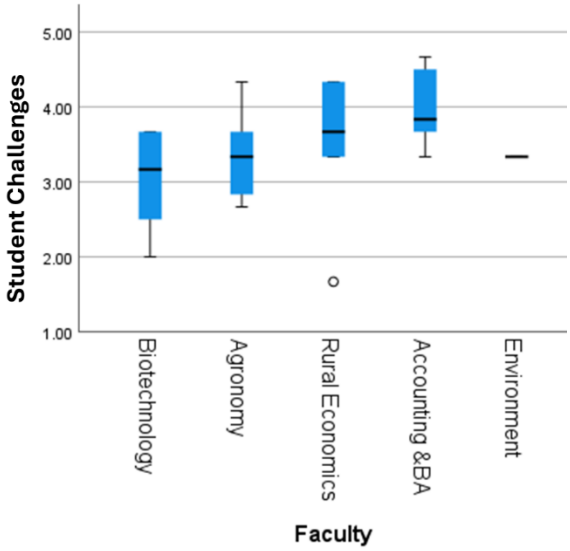
These findings imply that perceptions of EMI readiness and difficulty are not straightforwardly predicted by experience or demographic background. Higher-qualified lecturers may possess greater self-awareness or higher standards, which could explain their more critical self-ratings. Moreover, the lack of correlation with teaching volume suggests that institutional training and support, rather than experience alone, play a crucial role in shaping EMI readiness. Future studies might explore qualitative dimensions such as teaching self-efficacy, institutional climate, and exposure to international pedagogy.

Perceived Student Challenges by Faculty

To explore whether perceived student-related challenges (Subscale: Student Challenges) varied significantly across faculties, a Kruskal–Wallis H test was performed. This non-parametric method was chosen due to the small sample size and potential violation of normality assumptions. Results indicated a marginally non-significant difference in perceived student challenges across the five faculties: Biotechnology, Agronomy, Rural Economics, Accounting & Business Administration, and Environment ($H(4) = 8.248$, $p = .083$). The p-value approached the borderline of practical significance, warranting cautious interpretation. Descriptive boxplots revealed that lecturers from Accounting & Business Administration and Rural Economics reported higher perceived student challenges compared to their peers in Biotechnology and Agronomy. Lecturers from the Environment faculty showed lower variation, but with a small sample size, their results should be interpreted cautiously. While post-hoc comparisons were not conducted due to the lack of a statistically significant overall test, these findings suggest that perceptions of student readiness for EMI may differ across disciplinary contexts, possibly reflecting variations in student English proficiency, course content complexity, or faculty support culture.

Figure 1

Boxplot of Perceived Student Challenges by Faculty (N = 30)



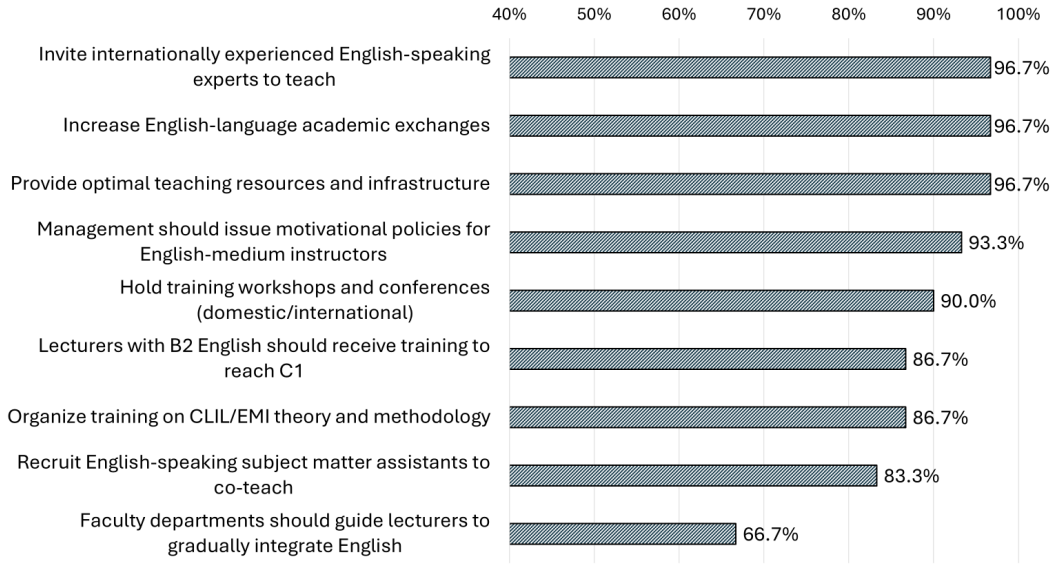
Measures for Improvement

Figure 2 summarizes lecturers' measures for enhancing the effectiveness of EMI in specialized subjects. The most strongly endorsed suggestions, each receiving support from 96.7% of respondents included: inviting internationally experienced English-speaking experts, increasing opportunities for academic exchange in English, and improving infrastructure and access to teaching materials. These priorities reflect a clear demand for both external expertise and internal resourcing to support EMI delivery. Other widely supported initiatives included policy-level motivation from institutional leadership (93.3%), participation in professional development workshops and conferences (90.0%), and language training opportunities for lecturers with B2-level proficiency to advance to C1 (86.7%). Equally, pedagogical training in EMI methodology and co-teaching with English-speaking subject matter assistants were seen as valuable by over 80% of participants. The least frequently endorsed, though still majority-

supported, recommendation was for faculty-led scaffolding of English use in instruction (66.7%). This suggests that while lecturers acknowledge the importance of gradual English integration, they may prioritize more systemic or resource-driven interventions over internal procedural shifts. These findings collectively underscore a strong appetite for strategic, well-supported, and collaborative improvements to EMI implementation at the institutional level.

Figure 2

Proportion of Lecturers Supporting Measures for EMI Teaching Improvement



Discussion

The present study examined Vietnamese lecturers' perceptions of EMI in specialized university courses, focusing on challenges, preparedness, curriculum design, teaching materials, assessment practices, and academic support. The results reveal generally positive perceptions across most subscales, high internal consistency of the measurement instrument, and specific correlations between lecturer characteristics and perceived challenges. These findings align with and extend previous research on EMI in both global and Southeast Asian contexts.

Lecturers reported the highest mean scores for Assessment Practices and Lecturer Preparedness, suggesting that despite the relatively recent introduction of EMI in Vietnamese higher education, many instructors feel confident in their ability to deliver assessments and manage classroom activities in English. This mirrors trends observed in other emerging EMI contexts, where assessment frameworks are often more easily adapted than full curriculum reform (Galloway et al., 2020; Rose et al., 2023). The lowest mean score was for Student Challenges, indicating that lecturers perceive significant variation in students' readiness to engage with content in English. This is consistent with research from other Southeast Asian countries showing that linguistic proficiency, disciplinary vocabulary, and confidence are persistent barriers for students in EMI settings (Dooey, 2010; Walkinshaw et al., 2017). Such challenges may be especially pronounced in technical fields like biotechnology and agronomy, where specialized terminology is dense and not easily acquired without strong language support.

Cronbach's alpha values for the six subscales ranged from acceptable to high, supporting the reliability of the instrument. The relatively lower reliability for Teaching Materials (0.641)

likely reflects variability in access to and quality of EMI-appropriate resources across faculties – an issue documented in studies of EMI in resource-constrained contexts, including Thailand and Vietnam, where teachers report limited support and gaps in discipline-specific materials (Galloway & Sahan, 2021) and lecturers explicitly cite resource availability as a challenge (Vu & Burns, 2014). The Kruskal–Wallis results suggest marginal differences in perceived student challenges between faculties, with lecturers in Accounting & Business Administration and Rural Economics reporting higher challenges than those in Biotechnology and Agronomy. This may be due to differing baseline English proficiency levels among students in social sciences versus STEM disciplines, as well as variations in the availability of English-language materials. Similar discipline-specific disparities have been reported in Malaysia and Thailand, where STEM students often benefit from existing English-language textbooks, while social science students may rely more on localized materials in the mother tongue (Ali, 2013; Bowen et al., 2023).

The overwhelmingly high agreement among lecturers on recommendations such as inviting internationally experienced experts, increasing academic exchanges, and providing better resources highlights the importance of systemic, top-down support for EMI. Previous studies in Vietnam (L. T. Tran & Nguyen, 2018) and the broader ASEAN region (Kirkpatrick, 2014) emphasize that sustainable EMI adoption depends on institutional commitment, faculty training, and strategic investment in language and content integration. Recommendations such as targeted training for B2-level lecturers to reach C1 proficiency and organizing workshops on EMI methodology directly address capacity-building needs. Evidence from Japan (Brown & Bradford, 2016) shows that lecturer language upgrading programs can significantly enhance both teaching confidence and student outcomes. Evidence from Indonesia highlights that EMI lecturers frequently lack formal training in resource creation and pedagogical skills, with only 42 % reporting they received such support—pointing to the potential impact that structured language and professional development programs could have on both teaching confidence and student outcomes (Endri & Sari, 2023).

Globally, EMI has grown as part of the internationalization of higher education, particularly in Europe following the Bologna Process and in East Asia through strategic national policies (Galloway & Sahan, 2021; Wächter & Maiworm, 2014). Southeast Asia has followed suit, with countries like Thailand implementing the English for Integrated Studies program, Malaysia expanding EMI in science and engineering, and the Philippines leveraging EMI as part of its bilingual education tradition (Kirkpatrick, 2014; Yuniar Diyanti & Madya, 2021). In Vietnam, EMI and CLIL initiatives are still evolving. While elite institutions have launched full English-medium programs in disciplines such as engineering, business, and IT, the implementation at provincial universities and in specialized fields like agriculture remains inconsistent. Barriers identified in this study, student readiness, teaching materials, and varying faculty preparedness, are echoed in previous Vietnamese studies (H. T. Nguyen et al., 2017; Vo et al., 2022). This suggests that while policy ambitions are aligned with regional trends, operational challenges persist.

Despite growing adoption, empirical data on the effectiveness of EMI in specialized courses in Vietnam remains sparse. Many studies are descriptive rather than evaluative, and there is a lack of longitudinal research tracking student learning outcomes, language gains, and career impacts. This study contributes by providing quantitative correlations between lecturer characteristics and EMI perceptions but further mixed-methods research could explore causal relationships and contextual factors. Future studies should conduct longitudinal tracking of student cohorts in EMI courses to assess both content mastery and language development; compare EMI

effectiveness across disciplines, institutional types, and geographical regions; and evaluate the impact of specific interventions, such as EMI methodology training or co-teaching with language specialists.

This study is limited by its small sample size and the focus on a single university context, which may affect generalizability. The reliance on self-reported data also means that findings reflect perceptions rather than direct measures of teaching effectiveness or student outcomes. Additionally, while the Cronbach's alpha values indicate internal consistency, further validation of the instrument across diverse EMI contexts in Vietnam is warranted. While the present findings provide insights into EMI implementation from the perspective of lecturers, it is important to recognize that the study was conducted within a single agricultural university in Vietnam. The institutional setting, disciplinary mix, and specific EMI policies may differ considerably from those of other Vietnamese universities, particularly those in urban versus rural contexts, public versus private institutions, or with differing levels of internationalization. Consequently, the patterns observed, such as the distribution of English proficiency, the nature of student challenges, and the availability of teaching materials, should be interpreted as reflective of this particular institutional context rather than representative of Vietnam's higher education sector as a whole. This contextual specificity underscores the need for broader, multi-site studies to capture a more comprehensive picture of EMI practices in Vietnam.

Conclusion

In general, the current study underscores the potential of EMI in specialized Vietnamese higher education, while highlighting persistent challenges in student readiness, resource availability, and disciplinary differences. Addressing these issues will require coordinated policy support, targeted faculty development, and sustained research engagement. The findings provide both a diagnostic snapshot of current EMI implementation and a roadmap for institutional and national stakeholders seeking to align Vietnam's higher education with global and regional standards.

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Crossroads of Opportunity and Exclusion: Determinants of School Participation Beyond Compulsory Education in South Africa

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Abstract

Participation in education beyond the compulsory phase is determined by demographic, socioeconomic, and contextual inequalities. In South Africa, educational equity remains central to the national development agenda, however longitudinal evidence on participation in the post-compulsory phase remains limited. This paper examines school participation among youth aged 16 to 18 years using repeated cross-sectional nationally representative data from the South Africa General Household Survey from 2002 to 2022. Drawing from Bronfenbrenner's ecological systems theory and the household production framework, the study uses descriptive statistics and pooled multivariate logistic regression to analyse patterns of school attendance over time. The descriptive findings indicate that overall attendance increased from 83.1% in 2002 to 86.8% in 2022. The regression results show that school participation declines significantly with age, with older learners having lower attendance rates. Adolescents without disabilities had significantly higher school attendance, as the odds of attending school were more than twice as high for adolescents without disabilities relative to those with disabilities (OR = 2.416; $p < 0.001$). Lower participation is also associated with female gender, parental loss, residence on farms, larger household size, and reduced access to household services. The results show that while participation rates have improved in the post-compulsory education phase, significant elements of exclusion remain. The paper argues for greater policy attention to retention, impartial support, and more responsive academic and vocational pathways for young people at a critical point between schooling, employment, and adulthood.

Keywords: post-compulsory education, school participation, educational inequality, South Africa, youth transitions

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Introduction

School participation in the upper secondary phase constitutes a critical stage in the educational trajectories of young people. This is a complex development stage that includes the transition into adulthood. During this period, adolescents are faced with increasing pressures from household conditions, social vulnerability, labour market uncertainty, and uneven access to educational opportunities. In many countries, upper secondary education begins at the age of 15 and continues onwards (Harland, 1988). In South Africa, students enter post-secondary education when they turn 15 or when they reach the ninth grade, whichever occurs first (Taylor et al., 2010). During this schooling phase, pressures occur within a wider context of persistent inequality and differentiated educational outcomes. Importantly, the post-compulsory phase is key to understanding youth participation and exclusion. The literature indicates that continued schooling beyond compulsory education is influenced by demographic, household, school, and structural factors (Castejón et al., 2022). Studies in South Africa demonstrate that school progression and dropout are affected by poverty, poor school quality, delayed grade progression, and unequal educational resources (Branson et al., 2014; Fleisch et al., 2010; Spaull, 2013; Van der Berg, 2008). Furthermore, research points to the significance of disability, parental support, gendered responsibilities, and differentiated post-school pathways (Filmer, 2008; Grant & Hallman, 2008; Houtenville & Conway, 2008; Papier & Needham, 2022; Seginer, 2006). Unequal social conditions also affect youth transitions (Gayle, 2005; Heinz, 2009; Irwin & Nilsen, 2018). It is imperative to investigate the factors that influence school attendance during the post-compulsory schooling phase to inform policies that cater to the needs of older adolescents (Showers, 2025). Current policies mainly target children in the compulsory schooling phase, so it is important that research now focuses on studying the dynamics of school participation among youths to better inform policies and programmes.

Research Objectives

1. To examine trends in school participation among South African youth aged 16 to 18 years between 2002 and 2022.
2. To describe patterns of school attendance across selected demographic, household, and contextual characteristics.
3. To identify the factors associated with school attendance in the post-compulsory phase using pooled multivariate logistic regression.

Theoretical Framework

This study uses Bronfenbrenner's Ecological Systems Theory together with the household production framework. Bronfenbrenner's theory proposes that young people's educational participation is shaped by multiple layered environments and relationships, including the household, broader social settings, and structural contexts (Bronfenbrenner, 1979). The ecological perspective is particularly relevant because school participation among youth aged 16 to 18 years correlates with demographic, household, and contextual factors. The microsystem encompasses variables such as age, gender, disability, and parental survival; the exosystem includes household size and access to services; and the macrosystem involves race and area of residence (De Wet & Osman, 2018). The household production framework reinforces this by highlighting that schooling partly depends on how households allocate limited resources to children's education (Ahmad, 2005). Collectively, these frameworks provide a basis for analyzing how individual, household, and contextual factors relate to school participation during South Africa's post-compulsory education phase.

Methodology

This study is characteristic of quantitative research and uses a repeated cross-sectional design based on South Africa's General Household Survey questionnaires between 2002 and 2022. The analytic focus is on adolescents aged 16 to 18 years who are in or out of the post-compulsory phase of schooling. The study uses descriptive and inferential statistics and uses a pooled multivariate logistic regression to examine school participation trends from 2002 to 2022.

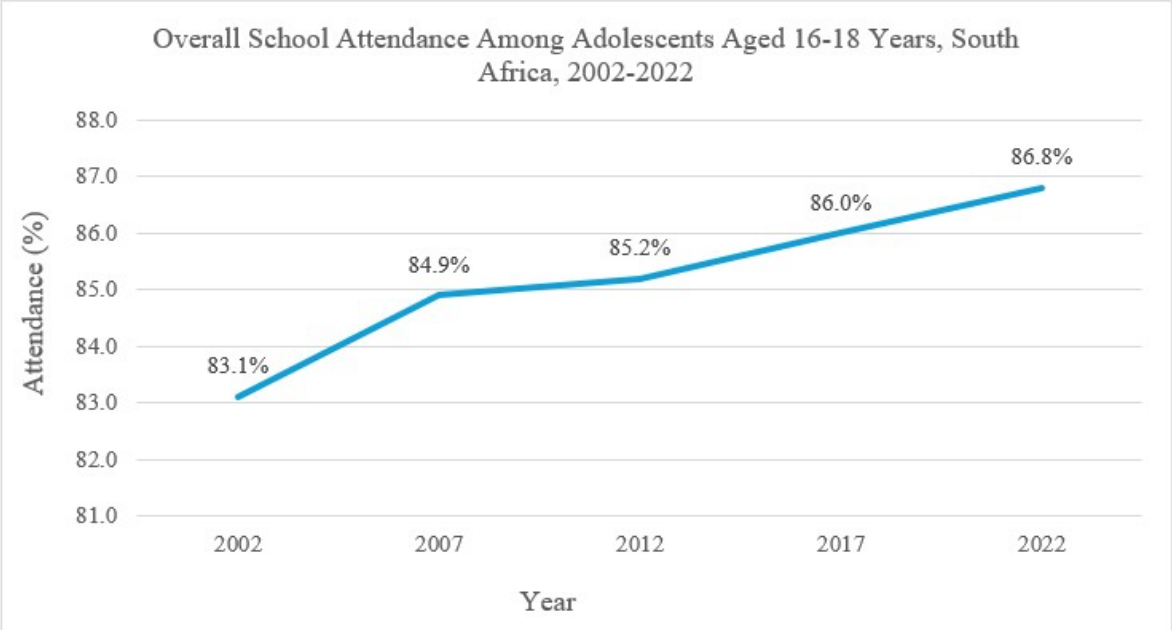
Empirical analysis was conducted in three phases. First, descriptive statistics were used to profile the weighted study population across sociodemographic and household characteristics. The inferential analysis included a weighted pooled logistic regression model to estimate associations between school attendance and selected individual, household, and contextual variables across all survey years.

The pooled multivariate logistic regression model was estimated using survey logistic regression and included 28,425 observations, representing a population size of 15,356,009. The model was statistically significant overall, with $F(29, 11104) = 56.45$ and $p < 0.001$.

Research Findings

Figure 1

Overall Trends of School Attendance, 2002–2022



According to data from the General Household Survey (GHS), South Africa observed a notable increasing trend in school enrolment among its youth aged 16–18 between 2002 and 2022. The percentage of the population enrolled in school rose from 83.1% in 2002 to 86.8% in 2022. This highlights a 3.7% percentage point increase in youth enrolled in educational institutions over the two decades. However, there was a slight dip in 2012 (85.2%) before reaching its highest point in 2022. The GHS indicates a positive trend towards increased school enrolment over two decades. A smaller proportion of the population is not attending school, suggesting potential improvements in access to education or a growing appreciation for formal schooling over time.

Descriptive Analysis of School Participation Trends

The descriptive analysis shows that school attendance among adolescents aged 16 to 18 years improved gradually over the study period. Overall attendance increased from 83.1% in 2002 to 84.9% in 2007, 85.2% in 2012, 86.0% in 2017, and 86.8% in 2022. This pattern indicates moderate progress over time, although the increase was not substantial. Age-based variation is pronounced across the period. In 2022, attendance was 95.0% among 16-year-olds, 91.1% among 17-year-olds, and 72.8% among 18-year-olds. This age gradient is consistent across the survey years and indicates that later adolescence remains a period when participation declines substantially. Descriptive results also show differences by gender. Male attendance was 86.0% in 2002 and 86.6% in 2022, while female attendance rose from 80.1% in 2002 to 87.0% in 2022. Although these percentages indicate convergence over time, multivariate analysis reveals that gender remains significant after adjustment for other factors. Substantial variation is evident across population groups. In 2022, attendance was 87.7% among African adolescents, 75.5% among coloured adolescents, 86.5% among Indian adolescents, and 92.3% among White adolescents. These differences point to continuing inequalities in post-compulsory school participation. Disability status is also strongly associated with attendance. Attendance among adolescents with disabilities rose from 48.2% in 2002 to 82.7% in 2022, while attendance among those without disabilities remained consistently higher, reaching 87.0% in 2022. Although this trend indicates improvement, the disparity remains significant. Household service variables also show uneven participation. Adolescents living in households with electricity had higher attendance rates than those without electricity, and attendance was lower in households without formal rubbish removal. These patterns suggest that household living conditions remain relevant to school participation in the post-compulsory phase.

Pooled Multivariate Logistic Regression Analysis

The pooled multivariate logistic regression analysis gives an account of the factors associated with school attendance when multiple predictors are considered simultaneously. The model was statistically significant overall and based on a large, weighted sample, supporting the robustness of the estimates. Age was the strongest predictor of school attendance. Compared to 16-year-olds, 17-year-olds had 51.3% lower odds of attending (OR = 0.487), and 18-year-olds had 82.1% lower odds (OR = 0.179). This shows retention declines as adolescents advance through post-compulsory education. Gender also remained significant in the pooled model. Female adolescents had lower odds of attending school than males (OR = 0.841), equivalent to approximately 16% lower odds of attendance. This result indicates that gendered disadvantage persists even when other household and contextual factors are considered. The results also indicate differences in school attendance across population groups. Coloured adolescents had significantly lower odds of attendance than African adolescents (OR = 0.379), while Indian adolescents exhibited lower odds with weaker statistical significance. These findings indicate that post-compulsory educational participation remains socially differentiated. Disability status had one of the largest effects in the model. Adolescents without disabilities had 2.416 times higher odds of attending school than those with disabilities. This result identifies disability as a determinant of school participation. Parental survival was significantly associated with school attendance. Adolescents whose fathers were deceased had lower odds of attendance (OR = 0.769), while those whose mothers were deceased had an odds ratio of 0.842. These findings suggest that parental absence correlates with reduced educational continuity. Household size also had a negative association with attendance. Compared with smaller households, adolescents in households with 7 to 9 members had lower odds of attendance (OR = 0.842), and those in households with 10 or more members had still lower odds (OR = 0.734). These

estimates suggest that household crowding and resource pressure may constrain continued participation in schooling. Household infrastructure variables were similarly important. The absence of electricity significantly reduced attendance odds by 44.1%, while the absence of formal rubbish removal reduced them by 40.2%. These conditions reflect household deprivation in the South African context. Geography remained significant in the pooled model. Adolescents living in traditional areas had 17% higher odds of attendance than those in urban areas, whereas adolescents living on farms had 55% lower odds than their urban counterparts. These results indicate that locational inequalities continue to influence participation in post-compulsory schooling.

Discussion

The descriptive and pooled multivariate analyses indicate that school participation among South African adolescents aged 16 to 18 years improved between 2002 and 2022; however, the pattern of improvement remained uneven. Aggregate attendance increased gradually over time, but participation remained influenced by age, gender, disability, parental survival, household conditions, and geography. The age gradient is especially significant. The marked decline in attendance among 18-year-olds indicates that late adolescence remains an essential point of educational discontinuity. This finding corresponds with South African research demonstrating that progression becomes increasingly fragile in upper grades and that dropout risk is closely associated with delayed progression and educational disadvantage (Lam et al., 2011).

The findings regarding disability indicate that inclusion in the post-compulsory phase remains incomplete. Although attendance among adolescents with disabilities improved over time, regression analysis shows that disability remains strongly associated with lower school participation. This is consistent with research demonstrating that disability is linked to substantial educational disadvantage in developing contexts (Mitra et al., 2013). The significance of parental survival, household size, electricity access, and rubbish removal indicates that post-compulsory school participation is deeply embedded in family and household conditions (Matheson & Woodward, 2014). These outcomes support the household production perspective, which conceptualizes educational participation as dependent on the distribution of material and social resources within households (Lehohla, 2017). They also corroborate ecological approaches that situate educational behaviour within interrelated social environments. The geographic results further show that educational opportunity remains spatially differentiated (Mishra et al., 2023). Farm residence is associated with particularly low attendance odds, while traditional areas show a more favourable pattern than urban areas in the pooled model. This suggests that the geography of post-compulsory participation cannot be reduced to a simple urban-rural distinction but reflects more complex forms of locational inequality. The results show significant policy implications. Progress in attendance rates should not be interpreted as evidence that exclusion has diminished. Increased focus is necessary on retention in the post-compulsory phase, particularly for older adolescents, learners with disabilities, youth experiencing parental loss, and those residing in materially constrained households or disadvantaged localities. This highlights that school retention and differentiated academic and vocational pathways are consistent with existing scholarship on the post-school system in South Africa (Gewer, 2010; Wedekind, 2010).

Conclusions

This paper examined the determinants of school participation among South African adolescents aged 16 to 18 years between 2002 and 2022 using repeated cross-sectional General Household

Survey data. The descriptive analysis showed that attendance increased gradually from 83.1% in 2002 to 86.8% in 2022. However, the pooled multivariate logistic regression analysis showed that substantial inequalities persisted. Age was the strongest predictor of school attendance, with especially low participation among 18-year-olds. Lower attendance was also associated with female gender, disability, parental loss, larger household size, inadequate household services, and residence on farms. These findings indicate that the post-compulsory phase remains structured by layered forms of social and material disadvantage. The study, therefore, points to the need for policy responses that prioritise retention, equity, and sustained institutional support during late adolescence. It also underscores the importance of strengthening educational and vocational pathways that reflect the diverse realities of young people as they navigate schooling, work, and adulthood. In South Africa, improvements in participation have not removed entrenched exclusion from post-compulsory education.

Suggestions for Further Studies

1. It is recommended to utilize longitudinal data to track educational trajectories through the post-compulsory years and examine transitions into dropout, completion, or alternative pathways.
2. It is a good idea to use qualitative or mixed methods approaches to understand how household dynamics, disability, and geography shape young people's continued participation in schooling in the post-compulsory phase.

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From Believers to Disbelievers: Understanding Student Diversity in Sustainability Education

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Abstract

Products with sustainable attributes cannot be marketed in the same way, just as sustainability education demands tailored pedagogical approaches. Sustainability education centers on promoting responsible choices and consumption in relations to Sustainable Development Goals (SDGs). Elements of sustainable education are being introduced to different tertiary curricula. While much of the current research discusses broad teaching and learning approaches, less attention is given to how individual differences among tertiary students receiving sustainability education affect their perceptions, learning processes, and real-world behaviors. Seeing tertiary students as consumers in their daily lives, this work expands the consumer model developed by Dalsace and Challagalla (2024), classifying students into three groups: true believers, agnostics and disbelievers of sustainability concepts. Drawing from our experience in implementing curriculum changes by explicitly incorporating environmental, social, and governance (ESG) concepts into various related marketing topics and refining the assessment items accordingly, we critically assess how different types of students learn and transfer the essential content of sustainability education in different assessment tasks. Our experiences reveal that different student types demonstrate significant differences in study strategies, perceived importance of learning materials and choices made in assessment. Our findings highlight the limitations of a mass approach to sustainability education, and provide practical insights in understanding the effective learning incentive to each student group and designing multiple assessments that fit the characteristics of different students.

Keywords: sustainability education, learning incentive, individual differences, tertiary education, curriculum change

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Introduction

Sustainability Education involves teaching individuals to make informed decisions to drive societal changes and protect our planet (Bodkin & Stevenson, 2007). Education for Sustainable Development is important in many business curricula, as it is seen as a prominent way to nurture future leaders to attain the Sustainable Development Goals (SDGs) (UNESCO, 2025). Not only is education itself named as one of the SDGs, but SDG number 12, "Ensure sustainable consumption and production patterns," clearly states that by 2030, people everywhere shall "have the relevant information and awareness for sustainable development and lifestyles in harmony with nature," which is expected to be accomplished through global citizenship education and education for sustainable development (United Nations, 2015). In Hong Kong, the local government has also set an agenda for universities to include global citizenship education in their curricula and to prepare students to address Hong Kong's international responsibilities (Skidmore, 2012).

Currently, ethical training is seen as an important part of marketing education (Bodkin & Stevenson, 2007). This covers a wide range of topics, including ethical decision making and specific areas such as inclusion and diversity, and sustainability. While much current marketing education utilises case studies (Bodkin & Stevenson, 2007) to train students as future business leaders, little research has been done on the influence of marketing ethics education on students as consumers (El-Sherbiny et al., 2023), which is of higher personal relevance to a larger population of students. While current curricula often treat sustainability education as a standalone topic, introducing students to the concept of recycling and responsible consumption, insufficient effort has been made to analyse students as consumers using the full range of consumer behaviour theories established by marketing scholars.

Our paper aims to bridge this gap by applying a relatively new consumer model developed by Dalsace and Challagalla (2024) and published in Harvard Business Review to investigate students' responses to a recent marketing curriculum change that incorporates sustainability education across different marketing topics as an integrated approach. In the current research, we adopt a case study approach, categorizing student responses according to Dalsace and Challagalla's (2024) framework. Specifically, our research is driven by the following question: To what extent, consumer theory related to sustainability could be applied in explaining students learning behaviour?

Literature Review

The Ethical Component in Marketing Education

Ethics is now an important part of many marketing curricula. It is widely agreed that marketing students' ethical values can be shaped by education (Bodkin & Stevenson, 2007). For example, business schools accredited by the American Assembly of Colleges and Schools of Business (AACSB), one of the major accreditors of top business schools, are required to offer ethical training to students, either as a full course or as part of other courses. Under this trend, many marketing courses are being restructured to include ethical training alongside traditional marketing education, which mainly focuses on understanding different marketing strategies, writing marketing plans, and designing marketing activities. As stated by El-Sherbiny et al. (2023), incorporating ethics into marketing education aims to nurture future marketing leaders who truly understand a broad range of sustainability practices and make ethical decisions.

Currently, different approaches are used in marketing ethics education (El-Sherbiny et al., 2023). While some institutions list ethics as a standalone topic within the marketing curriculum, others are pushing for a wider integration of ethics across different marketing topics. Uzorka et al. (2024) advocate for an integrated approach to marketing ethics education, as it develops personal relevance and connection. Accordingly, Bodkin and Stevenson (2007) further suggest that students' ethical perceptions are not simply developed by more class time. Such development needs to involve both active class time discussing marketing ethics and passive time for personal reflection on ethical dilemmas within a case study approach.

However, integrating ethical content into the marketing curriculum might not necessarily lead to the development of ethical values in students (El-Sherbiny et al., 2023). The current approach that trains marketing students to become future market leaders could be quite detached from the interests of many business students who take marketing as an elective subject and have less interest in pursuing a marketing career. Considering sustainability education as a specific area of ethical marketing education, Uzorka et al. (2024) argued that the efficacy of current ethical training in marketing education for fostering a true feeling of responsibility toward sustainability-related projects is questionable, given that much current sustainability education in the marketing field remains focused on building students' awareness, which is a rather preliminary stage in the education process.

To address this, a unique approach is to teach the current generation of students as future consumers (Babu et al., 2024). Unlike the conventional approach that positions ethical marketing education as an essential component for future leaders, seeing students as future consumers creates a stronger connection between ethical marketing education and students, as they are all likely to be shoppers every day in the near future, if not now. This approach is currently quite common in finance education. Financial literacy programs, which are considered an important part of financial education (Mancone et al., 2024), rather than training students to make financial decisions for a company, teach students topics such as budgeting, personal financial planning, and the use of different financial products, which are highly relevant. Although topics on sustainable consumption are also common in curricula, they are seldom linked to marketing education.

At such, many existing models developed by academics in the marketing field are rarely applied to describe students' consumer behaviour. Pandowo et al. (2021) once reported their findings on sustainability behaviour and students’ personal characteristics, suggesting a complex relationship between a number of individual traits. While personality dimensions, such as openness and agreeableness, affected sustainable behaviour in college students, attitude might not be enough to drive sustainability behaviour. During the purchase decision making process, happiness and satisfaction were found also influential in driving sustainable behaviour. Babu et al. (2024) presented another study to investigate the relationship between environmentally conscious and sustainable consumption behaviour. With a majority of business college students as respondents, their study suggested that environmental consciousness generally predicted purchase behaviour for green products, yet economic considerations also played a role in the decision-making process.

Categories of Sustainability Consumption

Our current work aims to bridge the concept of sustainability education with more specific marketing research in describing consumer behaviour. Customers value sustainability

features differently when they consider a purchase. Dalsace and Challagalla (2024) in their seminal work grouped customers into three broad categories, namely the true believers, agnostics, and disbelievers, and used different colours to represent each category. In an education context, similar findings are reported by Pandowo et al. (2021), who found that college students' sustainability behaviour varies by personality and other individual characteristics.

True believers are green customers who place a high value on sustainability (Dalsace & Challagalla, 2024). When they make purchase decisions, they are keen on purchasing sustainable products, even if it means sacrificing product performance and incurring higher cost.

Agnostics, or blue customers, understand the importance of sustainability, yet they also value product performance. If they do not need to sacrifice much in terms of performance and price, they will prefer to purchase sustainable products. Overall, they place a moderate value on sustainability. For example, agnostic customers will not buy an electric car primarily to prevent climate change. Instead, they buy an electric car to fulfil their transportation needs; reducing carbon emissions is only an ancillary benefit. That means customers will consider sustainability features only as an additional value on top of traditional benefits like product performance, convenience, and price. As stated by Babu et al. (2024), economic considerations affect students' choices of green products, even when they are environmentally conscious.

Gray-category customers are disbelievers in sustainability concepts. They do not care about sustainability, and they even hesitate to prioritise it based on its cost and perceived necessity. Not only do they not see any positive reasons for sustainability, but they often question whether there are hidden costs for sustainability attributes that they should not bear. Promotion of sustainability-related attributes could therefore lead to negative effects on these customers.

As suggested by Dalsace and Challagalla (2024), there are different strategies based on the three categories of interactions between sustainability and traditional benefits. First, sustainability could be independent of traditional product benefits, meaning that the impact of sustainability measures does not transfer to product quality and durability. In such a case, sustainability elements could only be positioned as a temporary premium to true believers and agnostic customers. A dissonance relationship explains the situation in which the sustainability elements of a product reduce performance or increase cost. In such a case, only a limited number of green customers would be willing to accept this offering in exchange for a performance sacrifice. Resonance refers to a situation where sustainability enhances performance. It is assumed that all customers can be targeted with resonant sustainability features. Still, in some Asian countries, brands should also promote the economic benefits to trigger personal relevance to sustainability initiatives (Babu et al., 2024).

Methods

This research presents a case study of an introductory marketing course at a tertiary institution in Hong Kong. As suggested by Yin (2014), case study research is effective for education programme evaluators to consider and reflect on the usefulness and relevance of a curriculum change. Our previous research has identified four factors contributing to a student's learning approach during transition periods, based on factor analysis of previously

validated questionnaire inventories for learning style (Chow et al., 2024). In the current research, we present our observations and experiences based on the same factors: choice of subjects, study methods and contents, sense of competition, and perception of instruction strategies.

The Case Institution and the Course

Since 2022, the institution's business division has established a Research Centre for Green Business with government funding. Since then, the institution has been encouraging its members to conduct research on green practices in the areas of accounting, supply chain management, and consumer behaviour. Not only has the research centre hosted public seminars and driven research collaboration, but it also has advocated for many curriculum changes within the institution to transfer knowledge to its students and create a greater impact on the institution.

In 2024, a curriculum change was proposed to incorporate environmental, social, and governance (ESG) content into the introductory marketing subject outline. The course is offered to around 2000 students every year. The majority of students are first-year business students across different business disciplines, including marketing, accounting, finance, and human resources, as well as students from other disciplines choosing this subject as an elective.

Before the curriculum change, green marketing, as a concept that advocates for minimizing the negative impact of products on the environment, was covered exclusively in a particular lecture related to Ethics in Marketing and Social Responsibility. To better reflect the growing importance of sustainability concepts in marketing, the subject team aimed to incorporate additional related ideas across different topics explicitly. For example, the subject team integrated the concepts of “Environmentalism” and “Diversity, Equity, and Inclusion (DEI) in Marketing” within the marketing environment topic, discussed packaging and recycling in the marketing mix topic, explored “Natural Resources and Marketing” under the topic of international marketing issues, and addressed additional sustainability-related concepts in the topic of ethical issues. Apart from that, the subject team also added relevant suggested readings for students interested in gaining a deeper understanding of sustainability-related topics.

Discussion

Given a generally large student population and an increasing number of students from diverse backgrounds due to internationalisation (Skidmore, 2012), we observed that the student population includes true believers, agnostics, and disbelievers. In other words, the consumer theory proposed by Dalsace and Challagalla (2024) can explain certain aspects of student learning behaviour (Pandowo et al., 2021).

Based on our observation, agnostics comprise a majority of the population, and this group of students, in general, takes a pragmatic approach to sustainability education. They generally understand the importance of sustainability-related topics, and they also consider personal relevance, such as whether these concepts are going to be included in the assessment. It appears that they choose the course for other reasons, such as grading, instructor reputation, and suitability for their personal timetable.

From our teaching experience, we can identify true believers in sustainability-related topics. They may be personally engaged in non-credit-based sustainability initiatives outside of school, such as farm revitalisation projects, and are highly engaged with teaching content related to their sustainability interests. Although they do not represent a large percentage of the student population, some students consult related journal articles to supplement their points in assessments.

We also observed that there are disbelievers in sustainability education. There have been a few occasions when students voiced concerns about using class time for sustainability education in our marketing classes. Some students prefer that teachers cover marketing strategies, discuss more business cases, or spend time on exercises for tests and exams. Viewing content related to sustainability and marketing as separate areas of study, some students may tactically skip certain content in sustainability education. While Hong Kong's population is overwhelmingly Chinese, students may perceive some sustainability education topics, such as Diversity, Equity and Inclusion (DEI), as quite irrelevant, especially given a course focus on the Hong Kong market. This group of students would rather spend more time studying traditional marketing concepts.

Table 1

Summary of Student Characteristics in Sustainability Education

	True believers (greens)	Agnostics (blues)	Disbelievers (grays)
Choice of subjects	Seek additional learning experiences	Choose based on other subject attributes	View sustainability content as a waste of class time
Study methods and contents	Pursue additional content; seek opportunities to apply concepts	Study only content relevant to exams; use standard methods	Actively avoid sustainability-related content
Sense of competition	Indifferent; view it as personal interest/differentiation	Engage if it improves grades/career prospects	Tactically skip to focus on traditional marketing
Instruction strategies	Indifferent (prefer mix of Independence & Resonance)	Respond to a mix of Independence & Resonance	Respond best to Resonance

Relevant Instruction Strategies

Given the identified categories of students, instructional strategies could be developed based on Dalsace and Challagalla (2024). Of the three marketing strategies introduced, “Dissonance” is the least relevant in education and for marketing sustainable products. Adopting “Dissonance” in instructional strategies means presenting concepts as a “bitter pill” to swallow, despite low perceived personal relevance. A lack of personal relevance could lead to a failure to market education related to ethics (Uzorka et al., 2024).

A resonance approach rewards students for learning related content in sustainability education (Dalsace & Challagalla, 2024). Under this approach, teachers need to fully integrate the concepts and align elements of sustainability education with the learning objectives of the subject. This approach is similar to the integrated approach advocated by Uzorka et al. (2024). By viewing sustainability education as an important dimension, it is

pedagogically reasonable to include its elements in tests and exams as integral dimensions of subject content, rather than treating them as additional topics. This approach requires clear mention of sustainability-related concepts in the subject's intended learning outcomes, allowing students to expect that mastery of such concepts will lead to better results in the course.

The independence approach to sustainability education suggests that learning related content does not necessarily affect course outcomes. This includes providing additional learning resources that are explicitly stated to be excluded from assessments. Given that few students are true believers, the independence approach could stimulate further learning for students who are actively seeking personal meaning through sustainability education (Bodkin & Stevenson, 2007).

Conclusion

This study applied the consumer model of Dalsace and Challagalla (2024) to the context of sustainability education, demonstrating its utility in understanding diverse student responses within a tertiary marketing curriculum. By categorizing students as true believers, agnostics, or disbelievers based on their valuation of sustainability concepts, the analysis reveals significant differences in their learning behaviour’s, study strategies, and engagement with assessment tasks. These findings underscore the limitation of a uniform, mass approach to teaching sustainability. Instead, they advocate for tailored pedagogical strategies, principally the resonance approach, which aligns sustainability learning with core course outcomes and assessments, and the independence approach, which provides supplementary resources for self-motivated learners. Ultimately, this paper contributes to the discourse on sustainability education by arguing for a more nuanced, student-centric framework that acknowledges and designs for learner diversity to enhance the effectiveness and personal relevance of ethical and sustainable development education in business programmes.

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Words That Work: The Role of Academic Writing in University and Beyond

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Abstract

Academic writing is more than just a university requirement; it serves to create, refine, arrange, convey, assess, teach and acquire knowledge and ideology within academic fields (Fang, 2021). Consequently, mastery of the academic writing style is a vital skill that cultivates communication, critical thinking, effective argumentation, creativity, research and information literacy and, thereby as Bora (2023) notes, laying groundwork for academic and career accomplishments. The current presentation delves into the long-lasting significance of academic writing skills, leaning on perspectives from well-known writers to showcase how writing stimulates intellectual growth throughout academic studies, thus becoming a central resource in graduates' professional lives. Through essay writing, research proposals, data analysis and interpretation, case studies, peer review practice and reflections, the workshop accentuates how academic writing enhances analytical reasoning, resilience, creativity and impact in various disciplines. Participants will renew appreciation of academic writing as not merely a scholarly activity, but as a lifelong tool for impact—a tool that completes the gap between higher education and the needs of an ever-changing professional setting.

Keywords: academic writing, writing pedagogy, critical thinking, creative activities, learner engagement, higher education

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Introduction

Writing plays a crucial role in academic life and knowledge development. In addition to recording ideas, writing serves as a valuable cognitive tool through which people build, refine and communicate knowledge. Through written language, ideas can be organized, evaluated and conveyed across time and space, ensuring intellectual dialogue among generations, disciplines and scholars. As Olson (1994) claims, the development of writing system fully transformed how humans conceptualize, build, and share knowledge.

In educational contexts, writing is broadly considered as one of the most demanding productive skills for learners to master. Unlike receptive skills, such as reading or listening, writing calls for vigorously generating meaning, structuring ideas logically and communicating them efficiently to an audience. According to Nunan (2003), writing is a multifaceted intellectual activity that encompasses producing ideas and making deliberate decisions about how those ideas are organized and expressed in coherent texts. From this prism, writing does not solely reflect thinking; instead, it makes thinking visible, structured and accessible to others.

Cognitive research further highpoints the complexity of writing process. According to Flower and Hayes (1981), writing integrates a number of interconnected processes, namely planning, translating ideas into text, along with reviewing or revising written content. These processes do not occur consecutively; instead, interact dynamically as writers move back and forth between creating ideas, drafting and revising their texts. Likewise, Berninger et al. (2002) argue that writing requires the coordination of lower-level transcription skills—such as spelling, punctuation and handwriting—with higher-rank processes, including organizing ideas, evaluating meaning and considering audience expectations.

White and Arndt (1991) label writing as an iterative and purpose-driven process. Writers constantly revisit earlier stages of their work, adjusting and refining their ideas in response to new insights or feedback. This iterative nature explains why efficient writing seldom emerges from a single attempt; rather, it develops through cycles of drafting, reflection and revision.

Collectively, these perspectives claim that writing is not simply about generating grammatically accurate sentences. Instead, it represents an active process of meaning-making in which writers build, evaluate and communicate ideas in purposeful ways. Regardless of its importance, many learners experience difficulties when developing writing competency. As stated above, writing demands the inclusion of multiple cognitive, linguistic and metacognitive processes, such as planning, organizing ideas, choosing proper language, monitoring meaning and revising texts for precision and coherence. These challenges may lead students to perceive writing as a daunting task. Therefore, educators should scrupulously create learning environments and design classroom activities which help learners in cultivating both technical and cognitive aspects of writing.

Recent educational research accentuates the significance of learner engagement in enhancing efficient learning outcomes. Christenson et al. (2012), Reeve (2012), and Skinner et al. (2009) describe engagement as a multidimensional construct that involves students' active participation, effort, emotional involvement and persistence in academic tasks. Hence, when students actively engage in meaningful tasks that require critical thinking, reflection and collaboration, they are more likely to develop more profound understanding and stronger academic skills. In writing instruction, engagement can boost through interactive and creative

activities that motivate students to explore ideas, express themselves and respond to real-world communicative context.

Along with exploring theoretical standpoints on writing and learner engagement, this article aims at discussing classroom activities that foster active participation and creativity in language learning, namely developing writing. Specifically, the article scrutinizes how creative and interactive tasks—such as essay, poetry, dialogue journal and reflective writing, storytelling, research proposals, peer review practice, data analysis and interpretation—can boost student engagement and support the development of writing skills. Through these activities, teachers can create dynamic learning environments that encourage students to actively participate in the writing process and develop stronger communicative proficiency.

Pedagogical Writing Tasks for Engagement and Skill Development

The Pedagogical Value of Dialogue Journal Writing

From a pedagogical perspective, dialogue journal writing aligns with theories that view writing as a social and reflective process. Dialogue journal writing refers to an ongoing written conversation between a student and an instructor in which ideas, reflections, questions and experiences are exchanges through informal writing (Peyton & Station, 1993). Unlike traditional writing tasks that prioritize accuracy and formal assessment, dialogue journals foster meaning-making, interaction and personal expression. In this approach, students regularly write short entries on the target topics related to their learning experiences, thoughts or course content, while instructors respond back with comments, questions and reflections that sustain the written dialogue. Those responses do not function as formal assessment: they serve as constructive and communicative feedback that motivates students to elaborate their ideas and keep on the exchange. According to Hyland (2019) and Farrell (2016), dialogue journals create a low-stakes writing environment where students can experiment with language, express their voices more freely and develop confidence in written communication.

Additionally, research indicates that dialogic and reflective writing practices can boost writing fluency and support the cultivation of ideas, as students engage in regular and purposeful written interaction. Such exchanges also enhance critical thinking and metacognitive awareness, inasmuch as students reflect on their experiences and articulate their thoughts in response to instructor feedback. More than that, the conversational nature of dialogue journals reinforces student-teacher relationships and enhances learner engagement by framing writing as meaningful communication, rather than merely assessment activity (Graham et al., 20216; Lee, 2017). Thus, dialogue journal writing not only supports the cultivation of writing skills, but also promotes independence and sustained participation in the learning process. Below, several types of dialogue journal writing are suggested and described.

Writing in Nature

This dialogue journal activity fosters reflective and mindful writing by transforming the writing process into a natural environment. Learners are asked to spend nearly 60 minutes in a natural setting such as a park, garden, trail or by a body of water, sensibly observing their surroundings and reflecting on their feelings and thoughts. After making the observations, students handwrite a journal entry of about 300–400 words in a paper notebook, purposefully avoiding the use of devices to lessen distractions. The entry should be written in the first person and keep an informal, conversational tone that captures authentic impressions and personal reflections.

Students are also encouraged to include drawings, brief quotations, questions or light humor in their entries, provided that these elements relate to their experience in nature. By combining observation with reflective writing, this task enhances emotional awareness, focus and creativity, along with a deeper personal connection to the writing process.

Sensory Writing Activity

The following dialogue journal activity helps students to develop descriptive language and imagery through focused sensory observation. For this activity, learners observe a shared object, either individually or in small groups, and are each assigned a specific sense – sight, sound, smell taste or touch. Afterwards, they write a short paragraph describing the object using only their assigned sense. Selected paragraphs are later combined to compile a collective, multi-sensory text. Through this process, students practice careful observation, concise word choice and collaborative creativity, boosting more profound engagement with the writing process while advancing expressive and descriptive writing skills.

Creative How-To Writing Task

In this activity, students practice writing conventions and cultivate instructional writing proficiency through a creative and engaging task. The teacher presents a humorous or imaginative topic (e.g. “How to make friends with an alien”, “How to convince your teacher that Monday should be a holiday”, “How to become famous overnight”, and so on) and asks students to compile an instructional text explaining the process. Students can craft their writing applying numbered steps, sequence words and time connectives in order to organize the procedure clearly. They are also encouraged to include backup details and explanations for each step. This activity helps students practice procedural writing while parallelly enhancing creativity and engagement in the writing process.

Diary Entry to the Future Self

Through this dialogue journal activity, learners engage in reflective and imaginative writing while exercising personal narrative skills. The task asks students to write a diary entry addressed to their future selves, focusing on a particular milestone, namely college entrance or graduation, starting a new job, marriage or retirement. Through this task, learners refer on their current experiences, aspirations and expectations for the future, which helps foster deeper personal engagement with the writing process. This task may also be extended into a sequence of entries in which students write about various unreal future events, hence creating an ongoing reflective dialogue that promotes the development of fluency, organization and expressive writing skills.

What If? Creative Writing Challenge

The last dialogue journal activity aims at helping learners to cultivate create writing skills, practice making connections between ideas, and overcome ambiguity about how to begin writing. For this activity, the teacher poses imaginative or humorous “what if” questions, such as “What if your cat could talk?” or “What if you could read everyone’s thoughts?” Students choose or are assigned a question and write a timed response, focusing on producing original ideas and investigating playful, unconventional scenarios. In this way, students engage in imaginative thinking, advance their narrative agility and build confidence in expressing creative ideas while boosting fluency and expressive writing skills.

Poetry on the Spot: Writing in the Moment

Inspiring spontaneity in writing is a crucial way to enhance creativity, flexibility and confidence in learners. Activities like Poetry on the Spot, in which students are given a set of unrelated words (approximately five) and a very short time (90 seconds) to create a poem, help students embrace improvisation and rapid idea generation. By limiting the thinking time, learners are encouraged to rely on intuition and creativity, rather than overthinking or self-editing, which can often inhibit original expression (Richards, 2010). As an illustration, a student given the words *moon, sandwich, bicycle, whisper* and *rainbow* could quickly compose a playful rhythmic stanza that links these unrelated elements in inventive ways. This exercise both captures students' attention and illustrates how time limits and word constrains can spark, rather than restrict creative thinking (Elbow, 1998).

Additionally, exercises that enhance spontaneous writing support the development of fluency and expressive skills, as students learn to trust their instincts and produce ideas under time pressure. Such activities also decrease the fear of "getting it wrong", creating a safe space for experimentation with language, tone and rhythm (Lamott, 1994). By incorporating brief, timed creative exercises into writing instruction, educators can enhance students' ability to think flexibly, take creative risks and develop a playful relationship with words, which can translate into stronger and more inventive writing overall.

Engaging Students in Proposal Writing: Collaborative Community Solutions by Students

Developing a community-focused business proposal is an engaging group project designed to expose students to practical experience in professional and persuasive writing. In this project, learners collaborate to identify a social, environmental or community-related problem and propose a realistic and impactful solution. The activity fosters creativity, strategic thinking and critical problem-solving while enabling students to practice professional communication skills that are related to real-world contexts. By simulating the process of writing a business proposal, learners also cultivate an understanding of how to convey ideas persuasively to stakeholders and decision-makers.

For this project, students should write their proposals in a professional format, including key components such as a cover page, executive summary, problem statement, proposed solution, budget, timeline and team qualifications (the instructor poses a number of target questions for students to address). The problem statement section asks students to define a social issue (within their community) and justify its importance, while the proposed solution details actionable strategies and expected outcomes. Students should also estimate costs, outline resource needs and develop a clear application plan. Including team qualifications ensures that students reflect on their capacity and expertise in conducting proposed initiative.

Engaging in this project offers several learning benefits. To begin with, it reinforces persuasive writing skills, assisting students to learn to communicate ideas precisely and convincingly (Gerson & Gerson, 2017). In addition, it enhances collaboration, as students must work efficiently as a team to develop a coherent proposal and ensure that all members contribute meaningfully and equally. Finally, the project foster reflection on community needs and the design of initiatives with tangible, measurable impacts. This combination of skills—writing, planning, collaboration and problem-solving—prepares students for professional context in which proposals must be both creative and convincing (Oster & Cordo, 2014).

Conclusion

Writing is far more than the mechanical production of grammatically accurate sentences; it is a dynamic intellectual process through which individuals organize ideas, build meaning and communicate knowledge. As studies suggest, writing involves comprehensive cognitive, linguistic and metacognitive processes that develop through practice, reflection and revision. Accordingly, productive writing instruction should move beyond product-orient approaches and encourage engagement, creativity and purposeful communication.

The activities presented in this article showcase how the implementation of reflective, creative and analytical tasks can transform the writing classroom into a more interactive and learner-centered environment. Dialogue journals, sensory observation exercises, imaginative writing tasks, spontaneous poetry and collaborative proposal writing provide opportunities for students to examine the language, generate ideas and gain confidence in written expression. Through such meaningful activities, writing becomes not only an academic requirement, but also a medium for reflection, creativity, collaboration and critical thinking.

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Cross-Cultural Differences in Emoji-Based Emotional Expression: A Comparative Study of Japanese and American University Students

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Abstract

Emojis are commonly used to express emotions online, but their meanings can vary across cultures. This study examines how Japanese university students use emojis to represent emotions and compares their choices with those of U.S. students. A total of 91 Japanese and 141 American students selected emojis for 32 emotions taken from an English dialogue dataset (Rashkin et al., 2019). The results revealed clear cross-cultural differences, particularly for relational or context-dependent emotions such as *impressed, grateful, caring, lonely, disappointed,* and *terrified*. By contrast, some visually salient emotions, including *proud* and *confident*, were represented by similar emojis across both groups. Additionally, several emojis were used to represent multiple emotions, indicating that emoji meanings may overlap and are shaped by cultural context. These findings suggest that although certain emotional expressions exhibit cross-cultural similarity, emoji interpretation and usage remain embedded within culturally influenced communicative norms.

Keywords: cross-cultural communication, emoji interpretation, emotion representation

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Introduction

Emojis are not merely decorative elements; they are now an indispensable language feature in digital communication and are commonly used to express emotions, attitudes, and interpersonal stances. Originally developed in Japan in 1999 in connection with NTT DoCoMo's *i-mode* mobile Internet service, emojis were designed as small pictorial symbols to enhance the expressive capacity of text-based communication. Emojis function as pictograms that are embedded in written messages. More broadly, they belong to what some researchers term *graphicons*: a category that includes ASCII emoticons, stickers, and animated GIFs (Dickinson, 2020).

As emojis are visual symbols, they are often assumed to be easy for everyone to understand across languages. This assumption has led to the belief that the literal meanings of emojis are widely shared across languages and cultures (Zhou et al., 2024). However, studies of facial expressions have shown that visual signals are not always interpreted in the same manner. Cultural norms, social expectations, and differences in emotional expressions can shape people's understanding of these visual cues (Gendron et al., 2014; Matsumoto, 1990). Prior research suggests that emojis may function as a tool for enhancing communication while carrying the potential for misinterpretation.

In the context of digital communication, this raises a pertinent question of whether facial-expression emojis are interpreted in the same manner across cultures. Although facial-expression emojis can facilitate interpretation in text-only communication by compensating for the lack of prosody and nonverbal cues, they can hinder understanding when their emotional meanings are interpreted differently across cultural contexts.

The broader goal of this research is to elucidate how emojis are used and interpreted across cultures. As a preliminary step, this study explored the cross-cultural similarities and differences in both the frequency of emoji use in everyday situations and the interpretation of facial-expression emojis. By integrating theories of emotion universality, cultural display rules, and pragmatic marker research, this study situates emoji interpretation within broader debates in the emotion and digital communication fields. Rather than treat emojis as inherently universal visual symbols, this study examines how culturally shaped emotional norms influence emoji–emotion mappings across contexts. In doing so, it contributes to a more theoretically grounded understanding of emojis as culturally embedded communicative tools.

Facial Expressions and Cultural Interpretation

Research on facial expressions has long debated the extent to which emotions are universally expressed and recognized versus culturally shaped. Early work argued that a set of basic emotions—typically happiness, anger, fear, sadness, disgust, and surprise—are universally recognized across cultures (Ekman & Friesen, 1971). Cross-cultural studies have reported that individuals from both literate and relatively isolated pre-literate societies can reliably match facial expressions with emotional labels or situations, suggesting biologically rooted facial patterns. The findings indicate that people from both Western and non-Western cultures can identify basic emotions from facial expressions with more than mere guesswork.

Ekman et al.'s (1992) theoretical framework further distinguished basic emotions from a broader range of affective phenomena. Beyond basic emotions, Ekman et al. (1992) discussed related but conceptually distinct states, such as moods, which differ from emotions in terms of

duration, physiological patterns, and situations in use. They also differentiated emotions from affective traits, attitudes, and emotional disorders. Moreover, Ekman et al. (1992) introduced the notion of emotional plots, which involve more complex affective experiences embedded within specific situations or narrative structures. Similarly, emotional blends are distinguished by referring to instances in which two or more emotions co-occur. The basic emotion of enjoyment is described as a family of related positive states that encompass a wide range of pleasurable affective experiences. The idea of basic emotions is distinct from that of other affective states, and prior research has shown that basic emotions are universally recognizable across cultures.

Later research has challenged the position of universality by showing that although basic emotion categories may be shared, the perceived intensity and expression of emotions vary across cultures (Ekman et al., 1992). Cultural display rules play a significant role in shaping how and when emotions are expressed, particularly in social contexts (Matsumoto, 1990). For example, Matsumoto's (1990) comparison of American and Japanese participants showed that Americans tended to express emotions more openly toward close others whereas the Japanese participants were more likely to regulate their emotional expressions depending on the social distance, group harmony, and hierarchical relationships.

From this display-rule perspective, emotional expressions are grounded in biological universals but regulated by culturally learned norms regarding appropriateness. Cross-cultural comparisons, particularly between Japanese and American participants, have shown that spontaneous facial reactions tend to be similar when individuals are alone but diverge in social situations, with some cultures more likely to suppress or mask negative emotions.

Recent studies have challenged this strong claim of universality. Gendron et al. (2014) demonstrated that participants from remote cultural groups did not consistently sort or interpret facial expressions according to Western emotion categories, particularly when the experimental tasks lacked emotion labels or contextual cues. These findings suggest that emotion perception depends on not only facial information but also culturally learned concepts, language, and situational knowledge. Gendron et al. (2014) claimed that early research on universality may have been influenced by the way the experiment was conducted by implicitly imposing Western emotion categories.

From a developmental perspective, it is difficult to maintain strong claims of emotional universality. Lewis (2000) noted that although certain basic affective responses appear early and seem to be biologically grounded, emotional life does not remain fixed. Rather, emotions become increasingly differentiated as one's self-awareness and cognitive capacity develop. In this view, emotional processes are not merely acquired at birth but change over time through development and experience.

Lewis (2000) suggested that early affective reactions observed in infancy may be better described as biologically based action patterns rather than fully formed emotions. These patterns involve coordinated facial expressions, vocalizations, bodily movements, and physiological responses that function as adaptive regulatory mechanisms. Crucially, such responses are understood to be innate rather than learned.

As self-awareness and self-referential abilities emerge, typically around the middle of the third year of life, these early action patterns gradually develop into more complex emotional experiences. Initial reactions, such as pleasure or distress, are transformed into higher-order

self-evaluative emotions, including shame and pride. From this standpoint, emotions are not static categories present from birth but are psychological phenomena shaped by cognitive development and social interaction.

Lewis's framework also draws attention to the development of social emotions. For instance, gratitude has been described not as a simple affective reaction but rather as a cognitively mediated response requiring more advanced developmental capacities. McCullough et al. (2001) argued that dispositional gratitude is associated with empathy, prosocial tendencies, and cooperative behavior, suggesting a reliance on higher-order social-cognitive processes. Gratitude has also been interpreted as an adaptive mechanism involved in regulating social exchanges and responses to rewarding behavior.

Taken together, the developmental account implies that human emotions emerge through the ongoing interaction of biological traits, cognitive maturation, and socially and culturally structured experiences. Gradually, this process leads to increasingly diverse and differentiated emotional experiences.

Overall, research on facial expressions and emotions indicates that although some cross-cultural similarities exist, human emotions are shaped by cultural knowledge, social norms, and contextual factors. Therefore, understanding of the effect of facial expressions on emotions has shifted from universal models to approaches that recognize the interaction between biological constraints and culturally constructed meanings. This shift in understanding is especially important in the context of digital communication, where emotional meaning is often expressed through the visual symbols of emojis rather than through face-to-face interactions.

Symbols in Text-Based Communication and Emojis

In text-based communication, meaning is shaped by not only words but also symbols that guide interpretation. Symbols used in sentences are traditionally referred to as punctuation marks. This category can be extended to include emojis in digital contexts, with emojis viewed as an extension of punctuation in digital communications. Historically, punctuation developed not as an aspect of grammar but as a reading aid for oral performance; early writing systems lacked punctuation and relied on readers to infer pauses and meaning (Robins, 1997). One of the earliest systematic punctuation systems used dots to indicate different pause lengths when reading aloud (Parkes, 1993). As the pause placement affects the meaning, punctuation played an important role in interpretation.

As reading practices shifted toward silent reading in late antiquity and the Middle Ages, punctuation became more regular and was eventually standardized through printing technologies (Bischoff, 1990; Eisenstein, 1980; Saenger, 1997). In contemporary digital communication, emojis function in ways that resemble early rhetorical punctuation by guiding interpretation and signaling tone, stance, and pragmatic intent (Parkes, 1993). In this sense, emojis play a crucial role in meaning making in written communications. The discussion is whether such punctuation-like functions facilitate understanding across cultures or conversely introduce new sources of misinterpretation.

In digital communication, emojis serve important pragmatic functions; they help restore framing, protect irony, enable humor, and sustain cooperative interpretation in text-only environments where contextual cues are limited. Humor and irony heavily rely on shared expectations and framing, which are often absent in digital contexts where multiple discourse

types coexist (Seager, 2017). As interlocutors generally assume sincerity, irony requires clear interpretive cues. In face-to-face interactions, these cues are provided by prosody and facial expressions. However, such cues are largely missing in text-based communication (Grice, 1975; Seager, 2017).

From an emoji-as-punctuation perspective, an emoji functions as a pragmatic marker that guides how an utterance should be read, such as playfully or sarcastically, rather than contributing additional propositional content (Escouflaire, 2020; Seager, 2017; Zhou et al., 2024). For example, the sentence "Yeah, that's the best idea ever" can be interpreted as sincere or sarcastic depending on the context. When followed by an emoji, such as 😂, the intended humorous or sarcastic reading becomes clearer. In this manner, emojis reduce the likelihood of literal misinterpretation by clarifying the speaker's tone and stance, ultimately supporting smoother communication.

Research Questions

Given the cultural variability observed in facial expression interpretation, this study investigated whether similar differences emerge in the understanding of facial expression emojis between different cultures. The research questions were formulated based on the data collected from Japanese and American university students. The two groups were selected based on Matsumoto's (1990) cross-cultural research, which highlighted the differences between Eastern and Western cultural contexts in terms of emotional expression and interpretation.

- **RQ1:** Do Japanese and American university students differ in their daily use of emojis?
- **RQ2:** Do Japanese and American university students select the same emojis for representing the same emotions?

Methods

Participants

A survey was conducted to examine the patterns of emoji use and emotional interpretation among university students in Japan and the United States. The questionnaire asked the participants about their general emoji use and required them to select the emoji that best represented the given emotion words.

The participants consisted of 91 Japanese and 141 American university students. In the Japanese sample, approximately 73.6% and 26.4% of the participants identified as male and female, respectively. In the American sample, 57.4% identified as male and 41.8% as female.

Regarding academic background, 70.3% of the Japanese participants were Informatics majors and 29.7% were Engineering majors. In the American sample, 51.1% were Engineering majors and 45.4% were Informatics majors, with a few participants from other fields, such as Accountancy, Arts, Law, and the Social Sciences.

All Japanese participants were native Japanese speakers. In the American sample, 92.9% reported English as their native language whereas a small minority reported other native languages, such as Hindi.

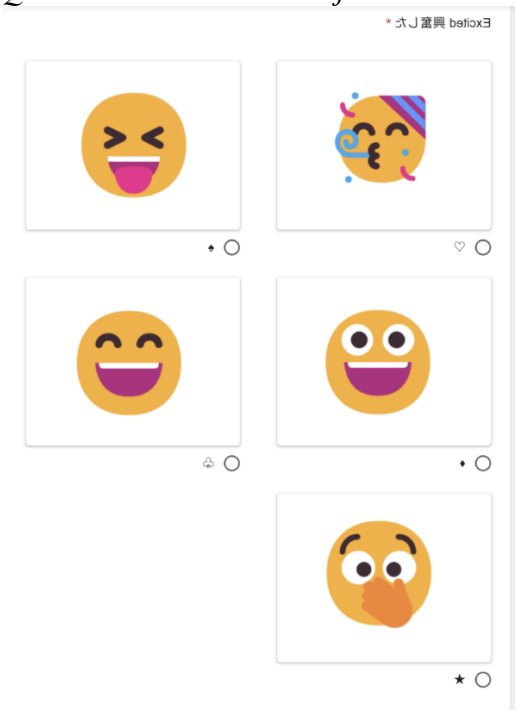
Materials and Procedure

Emotion categories were based on 32 emotions identified in prior research (Rashkin et al., 2019). Participants were presented with emotion labels in both Japanese and English and were asked to select the emoji that best represented each emotion.

This study used the Noto Color Emoji, an open-source emoji font developed by Google and used on the Android and ChromeOS platforms. Noto Color Emoji was selected for its simple and easily recognizable design. Only standard Unicode emoji characters were included, with ASCII emoticons, stickers, and other non-emoji symbols excluded. The questionnaire was administered online using Google Forms (Figure 1).

Figure 1

Questionnaire on the Emoji Choices Corresponding to the Emotion Words



Data Analysis

Emoji selection frequencies were calculated for each emotion category, including the sum of the differences in the percentages of emoji selections between Japanese and U.S. participants for each emotion. Then, the proportions of emoji choices were compared between the Japanese and American participant groups, with particular attention paid to both the similarities and differences in emoji–emotion mappings across cultures.

Results

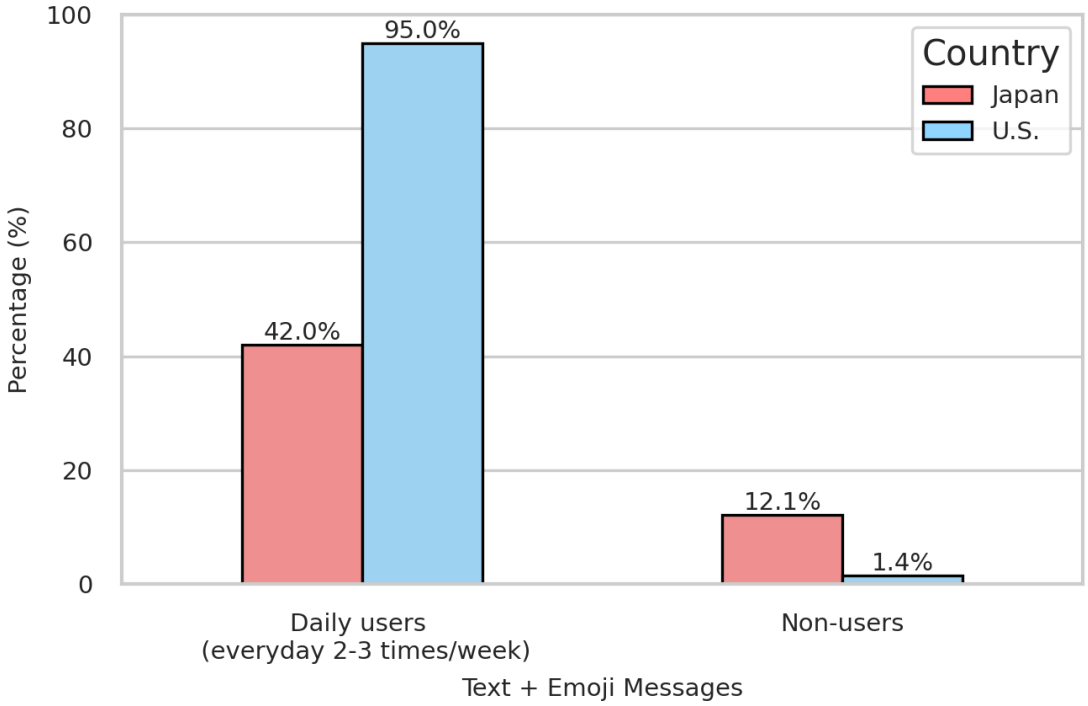
To address **RQ1**, patterns of daily emoji use between the two groups were compared. The results indicated clear cross-cultural differences in both the frequency and context of emojis used with text.

In the Japanese sample, only 42.0% of the participants reported using emojis with text on a daily basis (defined as every day to two or three times per week) whereas 12.1% reported rarely

using them. By contrast, emoji and text use were substantially more frequent among the American participants. In the American sample, 95.0% reported using emojis together with text daily (Figure 2).

Figure 2

Percentage of Students Using Text-and-Emoji Messages in Japan and the US



Regarding the usage context, the American participants most commonly used emojis in casual conversations. Emojis were also frequently employed when expressing gratitude, offering congratulations, making requests, and conveying both positive and negative emotions, with approximately 40% of the participants reporting emoji use in these contexts.

In the Japanese sample, emojis were primarily used in casual conversations and polite communicative contexts, such as thanking or apologizing. The use of emojis to express anger was notably rare and was reported by only 7.4% of the participants. Overall, these results indicate that emojis are used more frequently and across a wider range of communication contexts in everyday communication in the United States than in Japan.

To address RQ2, emoji selection patterns were compared across the emotion categories. Findings revealed that some emotions exhibited a strong cross-cultural overlap, with only minor differences between the Japanese and American samples. These included visually salient emotions, such as surprise, anticipation, feeling sentimental, and fear, for which the participants in both the cultures tended to select similar emojis.

By contrast, other emotions showed a clear divergence in emoji selection between the two groups. Clear differences were observed for relational or context-dependent emotions, including being impressed, grateful, caring, lonely, disappointed, and terrified.

Table 1
Differences in Emoji Selection Between Japanese and American Students

Emotion	Differences
Impressed	136.1
Grateful	119.1
Caring	116.9
Lonely	116.7
Disappointed	110.1
Terrified	109.5
Trusting	102.4
Devastated	101.6
Angry	92.4
Joyful	91.7
Guilty	88.9
Furious	85.1
Prepared	82.5
Apprehensive	77.7
Content	72.7
Embarrassed	71.9
Disgusted	71.6
Sad	69.4
Confident	69.2
Ashamed	67.9
Anxious	59.1
Proud	59
Excited	56.9
Hopeful	55.6
Annoyed	55.5
Jealous	43.1
Nostalgic	41.1
Afraid	39.2
Sentimental	36
Anticipating	33.2
Surprised	28.8

Table 1 presents the overall proportions of emoji selection differences between Japanese and American university students for each emotion, summarizing the differences in cross-cultural variation (percentage divergence in emoji selection). Emotions with visually salient features, such as surprise, anticipation, feeling sentimental, and fear, resulted in similar emoji choices in both Japan and the United States (Table 2). By contrast, relational and context-dependent emotions, including being impressed, grateful, caring, lonely, and disappointed, showed substantially different emoji selections across cultures (Table 3).

Table 2

Emoji Choices for Emotions With Small Differences Between the Japanese and American Participants

		♧	♦	♡	♠	☆
1	Surprised					
2	Anticipating					
3	Sentimental					
4	Afraid					
5	Nostalgic					
6	Jealous					
7	Annoyed					
8	Hopeful					
9	Excited					
10	Proud					
11	Anxious					
12	Ashamed					
13	Confident					
14	Sad					

Table 3

Emoji Choices for Emotions With Large Differences Between the Japanese and American Participants

		♧	♦	♡	♠	☆
1	Impressed					
2	Grateful					
3	Caring					
4	Lonely					
5	Disappointed					
6	Terrified					
7	Trusting					
8	Devastated					
9	Angry					
10	Joyful					
11	Furious					

Discussion

Regarding RQ1, the results suggest that Japanese and American students differ in not only the frequency of emoji use but also the social role that emojis play in communication. Among Japanese students, emoji use appears to be more sensitive to context and interpersonal relationships, aligning with the norms of politeness and relational adjustment. By contrast, American students tend to use emojis more routinely, incorporating them into everyday self-expression and conversational flow. These differences can also be viewed in relation to culture-based norms governing emotional expression, which appear to extend into online communication (Matsumoto, 1990; Zhou et al., 2024). Matsumoto (1990) noted that Japanese and American communicative styles differ in how emotions are displayed, a distinction that may help account for the observed patterns of emoji use. For instance, Japanese students are more likely to use emojis to maintain politeness and preserve smooth interpersonal relationships. Given that text alone often lacks clear pragmatic cues (Seager, 2017), emojis can function as markers that soften the tone or signal friendliness. In the Japanese social context, where being perceived as rude can have significant social consequences, individuals may be particularly attentive to how their messages are interpreted and displayed. Additionally, the gender imbalance in the Japanese sample, which included a higher proportion of male participants, may have influenced the results as communication styles can vary across genders. Overall, although emojis are used in both cultural contexts, the results indicate clear differences in usage frequency and function in online exchange.

For RQ2, emotions that are visually salient showed relatively high cross-cultural agreement. This pattern is consistent with prior research, suggesting that certain facial expressions are widely recognized across cultures (Ekman & Friesen, 1971). By comparison, emojis linked to more relationally grounded emotions, such as politeness or gratitude, demonstrated greater variability. Such differences likely reflect the influence of culturally shaped social norms and interpersonal expectations (Gendron et al., 2014).

More broadly, the degree of cross-cultural divergence varies according to the emotion type. Emotions associated with visually salient or biologically grounded basic responses tended to produce smaller differences whereas socially and cognitively mediated emotions showed greater variation. This interpretation aligns with developmental accounts of emotion (Lewis, 2000), which emphasize that whereas some affective responses emerge early and are biologically rooted, more complex social emotions develop through cognitive maturation and social experiences. Consequently, these later-developing emotions may be more susceptible to cultural shaping.

Overall, the findings support the view that even expressions often assumed to be universal may be subject to cultural interpretation. This appears to apply to not only facial expressions but also emojis as symbolic representations of emotions.

Conclusion

The study findings indicate that cultural differences shape not only how frequently emojis are used but also how they function in communication. Japanese university students tend to use emojis to convey positive emotions and ensure politeness, particularly in contexts such as requests, expressions of gratitude, and celebratory interactions. Emoji use also strongly depends on relational and contextual factors, including interlocutor sensitivity.

By contrast, American university students reported more frequent emoji use, often employing emojis as standalone messages. Emojis were used to express a broader emotional range, including negative emotions, with comparatively less hesitation.

Differences between the groups were especially pronounced for relational or context-dependent emotions, such as feeling impressed or being grateful, for which the participants selected different emojis across cultures. Conversely, visually salient emotions, including surprise and fear, showed greater cross-cultural similarity, suggesting the presence of shared visual cues in emotion recognition.

Collectively, these findings suggest that although certain emotional expressions may exhibit cross-cultural similarities, emoji interpretation and usage remain embedded within culturally shaped communicative norms. Nevertheless, the limitations should be acknowledged. The sample exhibited a gender imbalance, which may have influenced emoji usage patterns, as emoji use can vary by gender.

The present study contributes to cross-cultural research by linking emoji interpretation to broader theoretical discussions of emotion universality and cultural display rules. By demonstrating that visually salient emotions show greater cross-cultural agreement whereas socially mediated emotions exhibit stronger divergence, the findings extend emotion research into the domain of digital communication. Emojis should be understood not merely as pictorial icons but as culturally situated pragmatic resources. Therefore, emojis cannot be assumed to function as a universally transparent representation of emotion, and greater attention to cultural variability in their use and interpretation is needed in digital communication research.

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Declaration of Generative AI and AI-Assisted Technologies in the Writing Process

The author declares that Grammarly, an AI-assisted writing software, was used in proofreading and refining the language used in the manuscript. The usage was limited to correcting grammatical and spelling errors and rephrasing statements for accuracy and clarity. The ideas, design, procedures, findings, analyses, and discussion are originally written and derived from careful and systematic conduct of the research.

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University Students' Art-Making on International Migration: A New Pedagogical Approach for Global Citizenship Education

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Abstract

Global citizenship education is increasingly playing a significant role in encouraging young people to become responsible global agents and work collaboratively towards a sustainable world. This paper proposes a new model of integrating arts-based pedagogy into global citizenship education, which can be applied to various schools. The United Nations Educational, Scientific and Cultural Organization (UNESCO) (2023) released the "Recommendation on Education for Peace and Human Rights, International Understanding, Cooperation, Fundamental Freedoms, Global Citizenship and Sustainable Development" and suggested that teachers elaborate pedagogical approaches and students advance learning projects based on it. Referring to UNESCO (2023), from April to July 2025, a group of eleven university students studying intercultural communication in Kumamoto, Japan and the researcher collaborated and developed an arts-based project exploring the massive migration of people from Kumamoto to North America between the 19th and the 20th century. It resulted into the production of a short film connecting the migrant ancestors and the descendants beyond the borders. Applying the concept of "borderlands" discussed by Anzaldúa (1987), this study demonstrates the effectiveness of art-making such as photographing and filmmaking in cultivating young people's intercultural understanding and transforming themselves to be active global citizens. It has become obvious from a combination of open-ended surveys and interviews that art-making in the classroom elevates the students' critical, analytical, and creative thinking skills and deepens their understanding of intercultural connections.

Keywords: art-making, global competence, migration, university students

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Introduction

Global citizenship education is increasingly playing a significant role in encouraging young people to become responsible global agents and work collaboratively towards a sustainable world. In this trend, the United Nations Educational, Scientific and Cultural Organization (UNESCO) (2023) released the "Recommendation on Education for Peace and Human Rights, International Understanding, Cooperation, Fundamental Freedoms, Global Citizenship and Sustainable Development." This latest version aims at:

> ensuring all people, throughout their life, are equipped and empowered with the knowledge, skills, including social and emotional skills, values, attitudes and behaviours needed for effective participation in democratic decision-making processes, economic empowerment, awareness-raising and individual and collective actions at community, local, national, regional and global levels that advance peace and promote international understanding, cooperation, poverty eradication and tolerance, in order to ensure the full enjoyment of human rights, fundamental freedoms, global citizenship and sustainable development through education. (UNESCO, 2023, p. 6)

UNESCO (2023) suggests that teachers elaborate pedagogical approaches and students advance learning projects based on the Recommendation. Promoting young people's global citizenship and elevating their global competence are closely intertwined. According to the Organisation for Economic Co-operation and Development (OECD, 2018), global competence is defined as:

> the capacity to examine local, global and intercultural issues, to understand and appreciate the perspectives and world views of others, to engage in open, appropriate and effective interactions with people from different cultures, and to act for collective well-being and sustainable development. (p. 7)

OECD (2018) indicates that the following four factors constitute global competence:

1. the capacity to examine issues and situations of local, global and cultural significance (e.g. poverty, economic interdependence, migration, inequality, environmental risks, conflicts, cultural differences and stereotypes);
2. the capacity to understand and appreciate different perspectives and world views;
3. the ability to establish positive interactions with people of different national, ethnic, religious, social or cultural backgrounds or gender; and
4. the capacity and disposition to take constructive action toward sustainable development and collective well-being. (pp. 7–8)

Some scholars have pointed out the benefits of applying arts-based pedagogy in cultivating young people's global citizenship and global competence (Juntunen & Partti, 2022; Mansilla & Jackson, 2023). For instance, Mansilla and Jackson provide the "Global Competence Matrix for the Arts" and list these four crucial criteria in arts education:

> Students use the arts to investigate the world beyond their immediate environment.
> Students use the arts to recognize their own and others' perspectives.
> Students communicate their ideas effectively with diverse audiences using art.
> Students use the arts to translate their ideas and findings into appropriate actions to improve conditions. (2023, p. 144)

Demonstrating the advantages of implementing artistic practices that are "… collaborative, taking place through painting, object crafting, or group acting, as well as applied non-verbal communication through voice, gesture, and movement" (p. 5), Juntunen and Partti (2022) proclaim thus:

> Global citizenship cannot be obtained merely by means of cognition or sense-making, but by means of emotions, sensory, and bodily experiences. In the arts education context, this kind of understanding can be viewed in terms of an 'encounter' with the arts. (p. 14)

Furthermore, there is a recognition that international migration can be a key topic for enhancing global citizenship and global competence. The Recommendation "… fully aligns with the 2030 Agenda for Sustainable Development" (UNESCO, 2024, p. 5), and the Agenda "… recognizes for the first time the contribution of migration to sustainable development. Migration is a cross-cutting issue in the 2030 Agenda, relevant to all of the Sustainable Development Goals (SDGs)" (Global Migration Data Portal, 2025, para. 1). Mansilla and Jackson (2023) affirm this point:

> Preparing our youth to participate successfully in a diverse world requires providing them with multiple opportunities to experience and reflect on what happens when people from different cultures meet, whether in their neighborhood, classroom, or virtually. We need to come to understand migration as a shared human experience past, present, and future …. (p. 12)

Hence, this paper places importance on art-making such as photographing and filmmaking focusing on international migration. How does art-making on the theme of international migration foster university students' global competence so that they can become active global citizens?

Conceptual Framework

To examine this question, I apply the concept of the "mestiza" discussed by Anzaldúa (1987). Anzaldúa calls the in-between space transgressing the border between the United States and Mexico "a borderland." Anzaldúa (1987) remarks: "A borderland is a vague and undetermined place created by the emotional residue of an unnatural boundary. It is in a constant state of transition" (p. 25). Borrowing Anzaldúa's argument to the border-crossing movement, we can say that the space inhabited by international migrants is a mestiza.

I have introduced art-making centering on the migratory movement of people from Kumamoto to Hawai'i between the 19th and the 20th century (Hara, 2024). In this paper, I direct attention to the Japanese emigration to Canada, in particular, Vancouver, British Columbia. According to Sunahara (2011), their migration has the following tendency: "Japanese people arrived in Canada in two major waves. The first generation of immigrants, called Issei, arrived between 1877 and 1928, and the second after 1967" (para. 1). Sunahara outlines their backgrounds and destinations:

> The Issei were usually young and literate. Most were from fishing and farming villages on the southern islands of Kyushu and Honshu …. Many settled in the 'Japantowns' or suburbs of Vancouver and Victoria, on farms in the Fraser Valley and in fishing villages, and pulp-mill and mining towns along the Pacific coast …. (2011, para. 4)

Focusing on Japantown on Powell Street in Vancouver, this paper considers that it functioned as a mestiza where the previously established borders came to be destabilized. It is an ever-shifting in-between space where the migrants' identities constantly change.

Methodology

From April to July 2025, a group of eleven university students studying intercultural communication in Kumamoto, Japan (Table 1) and I collaborated and developed an arts-based project concentrating on the Japanese emigration to Canada. It was composed of the following three phases.

Table 1
List of Students

Names as pseudonyms
Alana
Ari
Goki
Hanzo
Kii
Navia
Nova
Pam
Shibe
Vera
Wasabi

In Phase 1, the students explored the migratory movement of Japanese people to Canada by reading some historical materials released by the Nikkei National Museum & Cultural Centre (2026) in Canada.

In Phase 2, a movie *Vancouver no Asahi* (*The Vancouver Asahi*) was used as an educational visual aid to deepen the students' understanding of international migration. Its characters include Nikkei Nisei (e.g., Reggie Kasahara, Emmy Kasahara, Roy Naganishi, Frank Nojima, etc.) and Issei (e.g., Seiji Kasahara). As shown in the movie, playing baseball and watching matches are deeply rooted in their daily life there. Yarhi and Pellerin (2015) explain thus:

> Baseball was a central pastime among Vancouver's Japanese community and much of the action revolved around the Powell Street Grounds in the heart of Little Tokyo. As amateur teams were formed …, baseball became a social backdrop for Issei and Nisei (second-generation Japanese Canadian) residents. Many businesses were closed during games, which drew large crowds of fans who elevated Japanese Canadian ballplayers to hero status. (para. 6)

In addition, Yarhi and Pellerin describe the birth of a legendary baseball team:

> The Vancouver Asahi was officially formed in 1914 by local businessman Matsujiro Miyasaki. The team played out of the Powell Street Grounds (officially called Oppenheimer Park) in Vancouver's Downtown Eastside. The team's name means 'morning sun' and is similar to the translation of *Nihon* (Japanese for Japan), 'origin of the sun.' (2015, para. 7)

While watching the movie, the students practiced observation by paying attention to the Issei and Nisei's verbal and nonverbal communication. These two phases are connected and meaningful for the students' learning, as some express below:

> Navia: By reading the articles on Japanese Canadians, I was able to know some facts I had never known until now. After learning that history, I found it easier to understand the situations the characters were facing while watching the movie *Vancouver no Asahi*.

> Ari: Regarding the movie, I learned about the importance of sharing an activity. In the movie, baseball was a large factor connecting people interculturally and reducing discrimination. Additionally, the success story of Japanese baseball made me realize that constant efforts would lead people to success.

In Phase 3, the students reflected on what they learned through the previous phases and went photo-taking with their cellphone camera respectively. Then, they presented their pictures, titles, and intentions behind them and were engaged in group work to assemble the eleven pictures into a short film (Figures 1–13). This phase is also useful and enhances the students' thinking skills, as indicated thus:

> Nova: The most impressive thing was the group work. When I do something in class, I often think about it alone. In this class, I can share my opinion and deepen my thought with my classmates. Doing something together as a group was a great experience.

Figure 1

Opening of the Film. © The Intercultural Communication Laboratory, PUK, 2025

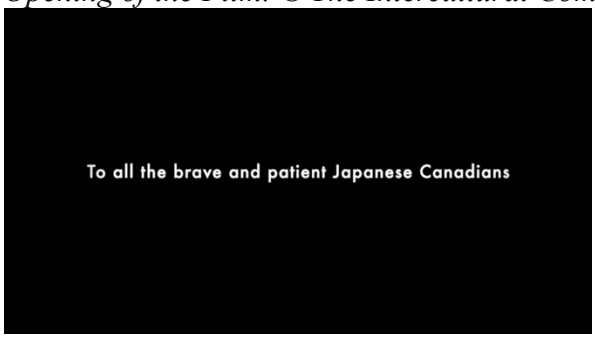


Figure 2

Shot 1 © The Intercultural Communication Laboratory, PUK, 2025



Figure 3

Shot 2 © The Intercultural Communication Laboratory, PUK, 2025



Figure 4

Shot 3 © The Intercultural Communication Laboratory, PUK, 2025



Figure 5

Shot 4 © The Intercultural Communication Laboratory, PUK, 2025

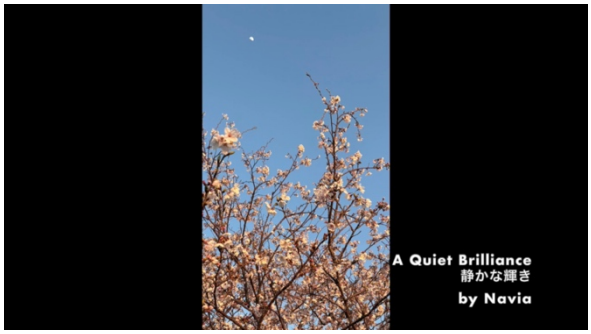


Figure 6
Shot 5 © The Intercultural Communication Laboratory, PUK, 2025

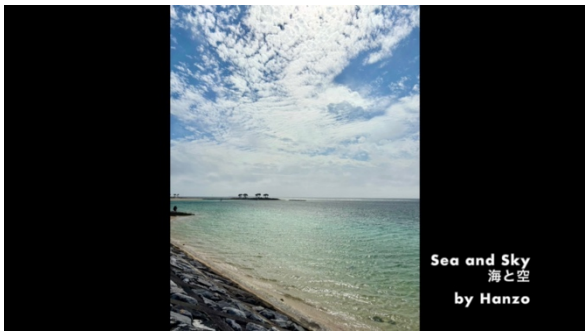


Figure 7
Shot 6 © The Intercultural Communication Laboratory, PUK, 2025



Figure 8
Shot 7 © The Intercultural Communication Laboratory, PUK, 2025



Figure 9
Shot 8 © The Intercultural Communication Laboratory, PUK, 2025



Figure 10
Shot 9 © The Intercultural Communication Laboratory, PUK, 2025



Figure 11
Shot 10 © The Intercultural Communication Laboratory, PUK, 2025

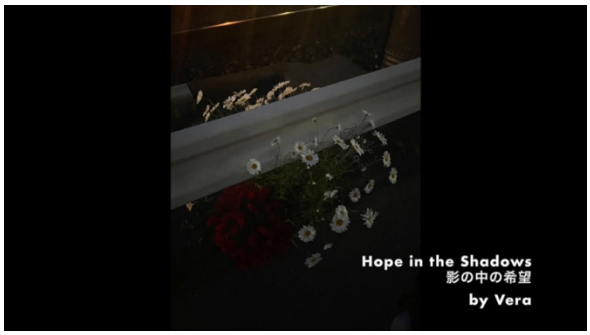


Figure 12
Shot 11 © The Intercultural Communication Laboratory, PUK, 2025



Figure 13
Closing of the Film © The Intercultural Communication Laboratory, PUK, 2025



A group of Ari, Nova, Vera, and Wasabi elucidate how the eleven pictures are arranged to show a state of being in flux:

> We focus on the shifts of daily lives and seasons, starting with the picture of the sunrise and finishing with the picture of the night sky. Furthermore, the world's connections can be expressed by showing how connected the sky and the sea are. Seasonal shifts explain the uniqueness seen in only specific seasons. For example, cherry blossoms are seen in spring, and fireworks are for summer events. In this way, the order we arrange could illustrate the changes of daily lives and seasons on the earth.

The students' pictures were accompanied by the researcher's humming of a song "Take Me Out to the Ball Game" (Meeker, 1908) in the short film. It was performed without using languages such as English and Japanese. In this way, both the photo arrangement and the humming imply the case of the migrants living in Vancouver's Japantown as a mestiza where their identities constantly change.

Pictures Forming *Kumamoto-Canada Project 2025*

The eleven pictures were assembled into *Kumamoto-Canada Project 2025*. The student photographers describe the key ideas in their visual works respectively:

> Pam: I took a photo of the morning sun and a view of Kumamoto City. I titled this photo 'Rising Sun (Asahi)' because I think there is a similarity between the sun and the Vancouver Asahi, a Japanese-Canadian baseball team. The sun is our hope, and our life has been supported by the sun. In the same way, from the movie, we can see that the Vancouver Asahi was the great hope of many Japanese-Canadian people and gave them courage. I want to show this photo to all team members of the Vancouver Asahi. I will tell them that they are the hope of many people, and their achievement has been known today.

> Ari: In this picture, the main subjects are a baseball cap and a ball symbolizing the sport that united the Japanese-Canadian players in the film *The Vancouver Asahi*. I titled this picture 'Our Stage, Then and Now' to connect the story of the film with Japanese heritage. The ball represents the spirit of the Japanese-Canadian baseball team, and the theater symbolizes tradition and pride. The Asahi players played not just to win, but to show strength and dignity as immigrants in Canada. The [theater] building in the picture was built in 1910 in my hometown Yamaga during the Meiji era and has been a symbol of local culture. I chose it to reflect the deep connection between Japanese identity and community.

> Kii: In my picture, plum blossoms are depicted. I took this picture in Dazaifu, Fukuoka. This was taken in Dazaifu, but plum blossoms also bloom in Canada. You can often see them in parks in cities like Vancouver. In the movie *The Vancouver Asahi*, the main character's patience and perseverance were beautifully portrayed. I want to tell Emmy that if she stays graceful and patient like plum trees, good things will come her way.

> Navia: This picture shows the moon and cherry trees. There are many cherry trees in Oppenheimer Park on Powell Street where many Japanese Canadians lived. In addition, no matter where we are on earth, there is only one visible moon, so this picture has a message that Japan and Canada are connected. I especially want to show this photo to Reggie. I put this title because the moon and cherry trees have a quiet presence and shine. I would like to tell Reggie that his efforts for the Asahi team are as shining and beautiful as this picture.

Hanzo: This photo shows the sea and sky of Okinawa. I give this title because I want you to see the beautiful sea and sky in this picture. I hope to address that there are such beautiful sceneries in the world. I want to tell the message that Canada and Japan are connected through the sea and sky. We are connected by the same sea and sky.

Wasabi: This is a photo of beautiful fireworks in the night sky. I took it during a summer festival in Yatsushiro. I chose the title 'Fireworks in the Night Sky' because the bright colors shine through the darkness, just like lights of hope in hard times. Fireworks are a big part of Japanese summer culture. Families and friends gather to watch them, wearing *yukata* and enjoying food from *yatai*. It's a time when people feel close to each other and appreciate tradition. I would like to show this picture to Reggie Kasahara. In the film, he faces discrimination and hardships in Canada, but he always stays strong and keeps playing baseball with passion. I believe this photo would encourage him and remind him that there are lights, even in dark times, if we keep looking up and believing in tomorrow.

Alana: Autumn leaves, some green trees and leaves are depicted in my picture. I put this title because when we focus on the autumn leaves and view from the left side, it looks like a big maple leaf seen in the Maple Leaf flag and Canadian emblem. I'd like to address two common points between Japan and Canada. Firstly, the shape of maple leaf and Japanese autumn leaves (*momiji*) are so similar. Secondly, people in both countries cherish nature, as I learned that there were many cherry blossoms in Oppenheimer Park. I want to show my picture to Seiji Kasahara and tell him to remember not only cherry blossoms in Canada but also Japanese autumn leaves. This is because he treasured Japan so much to such a degree that he sent his money to Japan.

Goki: This is a bridge constructed in my village. It is called the New Minamiaso Bridge. This bridge is a sightseeing spot now. Many foreign people come to see it. This bridge not only connects a road to another road but also connects people to people. I want to address that there are many bridges connecting people to people in the world compared to the past. The bridge is the Internet. It enables us to contact other countries' people anytime. I want to show this picture to everyone in the film and tell that there are still problems. But now, people can connect with each other easily by an invisible bridge.

Nova: This is a photo taken from inside the plane. The sea and the sky are large and wide. However, they are connected to one another. Also, the sky and the sea are blue. Even if the location is different, they are connected with the same color. So, I think we can be one without being divided. In the movie, people's passion for sports was not limited to race. I think that even if we have different nationalities, genders, or places of residence, we are all connected under the same sky.

Vera: This picture shows white daisies and red flowers blooming next to a guardrail, with railroad tracks in the background and the overall darkness of night. Despite the darkness, the flowers are quietly shining with life and color. I put this title because the flowers represent hope and strength, blooming even in an unexpected place. The message I want to tell is that hope and beauty can be found even in the midst of difficulties. I want to show this picture to Reggie and Roy. They both tried to keep the team's spirit alive during hard times. Therefore, I would like to convey through this picture that their fight was not in vain.

> Shibe: The photo I took and chose for this project shows the starry sky over Oguni in Kumamoto Prefecture. I've titled it 'One Sky, Different Perspectives' because, although we all look up at the same sky, what we actually see (e.g., cloud patterns, stars, and weather) differs completely between Japan and Canada. In fact, there's a 16-hour time difference with Vancouver, so when it's morning in Japan, it's still the dead of night there. I believe this idea also applies to how people view the world. Even when we appear to be looking at the same thing, our environment, timing, and many other factors shape our perspectives in unique ways.

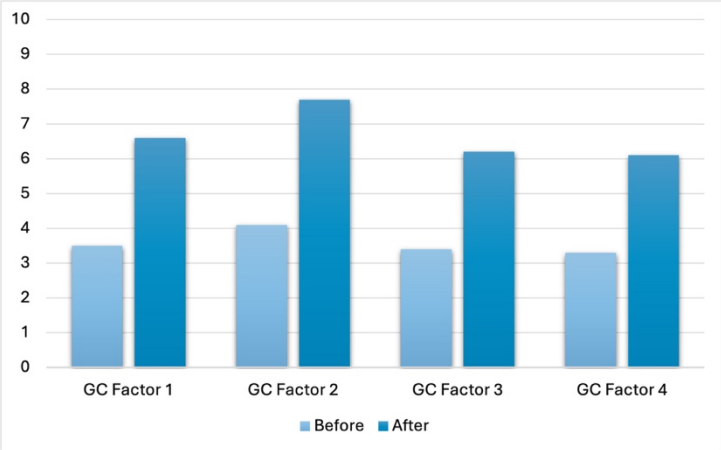
In this way, it is clear from their comments that the students have grasped the living conditions of the migrants, and some of them feel empathy with the Issei and Nisei characters in the movie.

Discussion

The results from the open-ended surveys and interviews show that the arts-based project concentrating on the Japanese emigration to Canada enables the students to advance the four factors of global competence defined by OECD (2018). They conducted a self-assessment evaluating the level of global competence by using a measure from 0 to 10, with 0 being the lowest and 10 being the highest. Figure 14 illustrates the average score for each factor of global competence (GC Factors 1–4) before and after engaging in this project.

Figure 14

Global Competence Factors 1–4



It becomes obvious here that all the four factors of global competence have improved among the students. First, the level of "1. the capacity to examine issues and situations of local, global and cultural significance (e.g. poverty, economic interdependence, migration, inequality, environmental risks, conflicts, cultural differences and stereotypes)" (OECD, 2018, pp. 7–8) has risen from 3.5 to 6.6. The student photographers indicate that engaging in the arts-based project has enhanced their critical thinking and analytical skills:

> Kii: I believed I had already understood the global issues such as poverty, migration, and inequality, but I didn't have the capacity to examine. I can examine the global issues more than before, so I think the level is up.

> Alana: I only knew and searched about the issues, situations, and cultural differences. In April, I hadn't heard the four skills of global competence. I feel my global competence has improved since April because I have done not only searching into them

> but also thinking and considered what would be the better way to connect them and lead our daily life.

Secondly, the level of "2. the capacity to understand and appreciate different perspectives and world views" (OECD, 2018, p. 8) has soared from 4.1 to 7.7. While creating a variety of self-expression opportunities, the arts-based project fosters tolerance among the students:

> Vera: In the photo project, there were a lot of photos, thoughts, and worldviews. We respected each other's opinion and were able to complete the project.

> Hanzo: Before the project, I could only see things from my own perspective. However, I have learned that there are many people in the world, and that there are as many points of view and ideas as there are people.

Thirdly, the level of "3. the ability to establish positive interactions with people of different national, ethnic, religious, social or cultural backgrounds or gender" (OECD, 2018, p. 8) has increased from 3.4 to 6.2. The Issei and Nisei characters in the movie set a good example for the students to develop this ability:

> Nova: I watched the movie *Vancouver no Asahi*, and I was very impressed by how hard work could move people's hearts, regardless of their country or race.

In addition, some students are eager to develop this ability further by joining internship programs overseas:

> Navia: I feel like I understood people from different cultures, but I know there's still more to learn. I have few opportunities to communicate with other people from overseas, so I'm going to go to Malaysia in August, and I will try to talk with various people.

> Pam: Firstly, I'm not good at communicating with other people. I realized that one of the causes of this was the lack of knowledge about other cultures. Through this project, I gained knowledge and a way of thinking. However, the lack of experience is also my issue. When I go to Australia, I will try to improve this ability.

Finally, the level of "4. the capacity and disposition to take constructive action toward sustainable development and collective well-being" (OECD, 2018, p. 8) has climbed from 3.3 to 6.1. As seen in their comments, the students have a better and clearer vision of the fourth factor of global competence by participating in the arts-based project:

> Goki: I didn't know about this skill before taking part in it. I can understand this skill and find it in myself by this project.

> Shibe: Until the photo project was completed, I hadn't given much thought to issues affecting society as a whole such as sustainability and public welfare, but through discussions about people from various backgrounds, I believe that I have gained the ability to see the overview from a broader perspective than I had before.

> Wasabi: This project made me think about how we can use communication, art, and cooperation to bring people together and share important messages. I realized that even small creative actions can contribute to more connected and understanding societies.

Cooperation pointed out by Wasabi is part of the project and key to advancing the students' critical, analytical, and creative thinking skills. Ari affirms this point as follows:

> Ari: In the photo project, cooperating with my classmates was a positive opportunity for me since in the process of deciding on a photo order, we kind of made stories or narratives to convince the audience how we are connected without national borders and how important it is to have global competence.

In this way, it has become obvious that the arts-based project improves all the four factors of global competence among the student photographers. Collective art-making centering on the Japanese emigration to Canada encourages the participants to become active global agents and communicate their message to the audience through their created short film.

Conclusion

This paper has attached importance to art-making such as photographing and filmmaking on the theme of international migration. Based on the "Recommendation on Education for Peace and Human Rights, International Understanding, Cooperation, Fundamental Freedoms, Global Citizenship and Sustainable Development" (UNESCO, 2023), I, the researcher/teacher, elaborated a pedagogical approach by integrating arts-based pedagogy into global citizenship education, and the university students advanced their learning project. The arts-based project concentrating on the Japanese emigration to Canada between the 19th and the 20th century has invited the eleven students to read some historical materials released by the Nikkei National Museum & Cultural Centre (2026), discuss their thoughts, observe while watching *Vancouver no Asahi* (*The Vancouver Asahi*), reflect on what they learned, take a picture, present it, and cooperate to assemble all the pictures into a short film. Through these phases, they have grasped the living conditions of the migrants, and some of them feel empathy with the Issei and Nisei characters in the movie. The results from the open-ended surveys and interviews show that engaging in the arts-based project enables the students to advance the four factors of global competence defined by OECD (2018). In *Kumamoto-Canada Project 2025*, the eleven pictures are arranged to show a state of being in flux. Borrowing Anzaldúa's argument, this paper has considered the migrants' Japantown in Vancouver as a mestiza where the previously established borders come to be destabilized. It is an ever-shifting in-between space where their identities constantly change. Collective art-making concentrating on the Japanese emigration to Canada helps the students to become active global agents, and the created short film generates another mestiza where their message is communicated to the audience beyond the borders.

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Fostering Competitive PhD Talent Through Interdisciplinary Graduate Education: A Case Study From a Japanese National University

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Abstract

In Japan, doctoral enrollment has been declining due to financial pressures and uncertain career paths. Limited demand from primary employers, including universities and industry, contributes significantly to the mismatch between PhD graduates and available opportunities. Beyond expertise, doctoral graduates require the ability to identify and address societal challenges, integrate knowledge across disciplines, and act proactively to succeed across diverse career paths. This paper elaborates on a university-wide interdisciplinary graduate program implemented at a Japanese national university, targeting graduate students through diverse offerings and events aimed at fostering competitive PhD talent by bridging academia and society. Our case study showcases the background and design of this well-rounded education, reviews implementation outcomes over the past decade, and evaluates its impact on cultivating interdisciplinary talent within Japan's higher education context. This program offers a variety of components designed to address social challenges and explore diverse career pathways across academia, industry, and government. Key initiatives include original interdisciplinary courses, project-based learning opportunities, group and individual practical activities, career development seminars, sustained career workshops, and interdisciplinary innovation retreats. These efforts not only enhance the employability of doctoral graduates and foster competitive PhD talent capable of adapting to the rapidly evolving demands of society and industry, but also strengthen connections among academia, industry, community, and government, thereby fostering a dynamic ecosystem in which knowledge creation, social innovation, and practical solutions can flourish. By combining diverse perspectives and resources, we aim to foster competitive talent and generate broader societal impact, while offering actionable insights for other HEIs.

Keywords: competitive PhD talent, interdisciplinary graduate education, integration of knowledge with society, career paths, Japanese university

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Introduction

The concept of a competitive PhD requires careful definition and reconsideration in light of changing academic and professional landscapes. Equally important is the question of how doctoral education can effectively foster graduates who are able to thrive in diverse and dynamic career environments. This paper addresses these issues by examining the definition of a competitive PhD and exploring strategies for cultivating such doctoral graduates.

In many countries, the number of PhD graduates now exceeds the number of available academic positions, rendering access to professorships increasingly competitive (OECD, 2024). As a result, universities are under growing pressure to reconsider the purpose and structure of doctoral education and to ensure that graduates are equipped with knowledge and skills applicable to a broad range of career pathways beyond academia (OECD, 2021). The reform of doctoral education has therefore become a central topic in higher education research (Nerad, 2020). Scholars have highlighted the diversification of doctoral candidates' motivations, which range from intellectual curiosity and personal development to more pragmatic, career-oriented goals (Gardner, 2008; Guerin et al., 2015; Horta et al., 2024; Skakni, 2018). These changing motivations further underscore the need to align doctoral training with evolving professional landscapes.

In the Japanese context, doctoral education has been characterized by a strong research-oriented culture that often overshadows teaching and learning components within PhD programs (Kimura & Yoneda, 2011). Moreover, the narrow specialization of doctoral research may reduce graduates' attractiveness to industry employers, raising concerns about employability outside academia. Consequently, increasing attention has been paid to skills development and the transferability of doctoral competencies (Jackson & Michelson, 2015; Mantai & Marrone, 2022). The value of the PhD has been examined not only in terms of disciplinary expertise but also in relation to the acquisition of transferable skills and their applicability across diverse professional contexts (Edge & Munro, 2015; Haapakorpi, 2017; Hayter & Parker, 2019).

Graduate employability is of critical importance to professions and industries, many of which are facing significant talent shortages that constrain organizational and sector-wide productivity. Beyond economic contributions, higher education institutions are also expected to cultivate socially responsible and globally engaged citizens (Bennett, 2019). Within this context, interdisciplinary research has been recognized as particularly beneficial for doctoral and higher-degree students. Engaging in interdisciplinary inquiry broadens intellectual perspectives, fosters versatile skill development, and prepares graduates for diverse career trajectories (Rana et al., 2025; Vanstone et al., 2013). Employers likewise value the integrative thinking and problem-solving capacities associated with interdisciplinary training (Miller & Boix-Mansilla, 2004).

In addition to formal academic training, extra- and co-curricular activities play an important role in enhancing employability. Such activities contribute to the expansion of social and professional networks, support career planning, and facilitate the development of transferable skills (Buckley & Lee, 2021; Dickinson et al., 2021; Jackson & Bridgstock, 2021; Jackson & Cameron, 2025; Jackson & Tomlinson, 2022). At the same time, attention must be given to doctoral students' well-being. A substantial body of research has reported high levels of stress (Kernan et al., 2011; Virtanen et al., 2017; Wyatt & Oswalt, 2013), mental health concerns such as depression (Hyun et al., 2006; Pallos et al., 2005), and even physical health symptoms

(Juniper et al., 2012; Kernan et al., 2011; Pallos et al., 2005) among doctoral students. These findings highlight the importance of adopting a holistic approach to doctoral education that integrates employability, skills development, interdisciplinary engagement, and student well-being.

PhD Education in Japan's Higher Education Context

In Japan, the number of individuals pursuing doctoral degrees has shown a long-term decline. Although enrollment in doctoral programs has exhibited a modest recovery over the past two years, the overall trend between 2003 and 2022 remained downward (Shuji Kawagishi, 2025). Within this context, academic careers have become less attractive due to uncertain professional prospects (Arimoto et al., 2019), a factor that may discourage highly capable students from advancing to doctoral study. The long-standing instability of academic career pathways in Japan has also been noted as influencing doctoral candidates' motivations and progression decisions (Yoshioka-Kobayashi & Shibayama, 2023). One contributing factor to the decline appears to be intensifying competition for academic positions alongside the widespread prevalence of fixed-term and precarious contracts at Japanese universities (Huang, 2024).

Figure 1

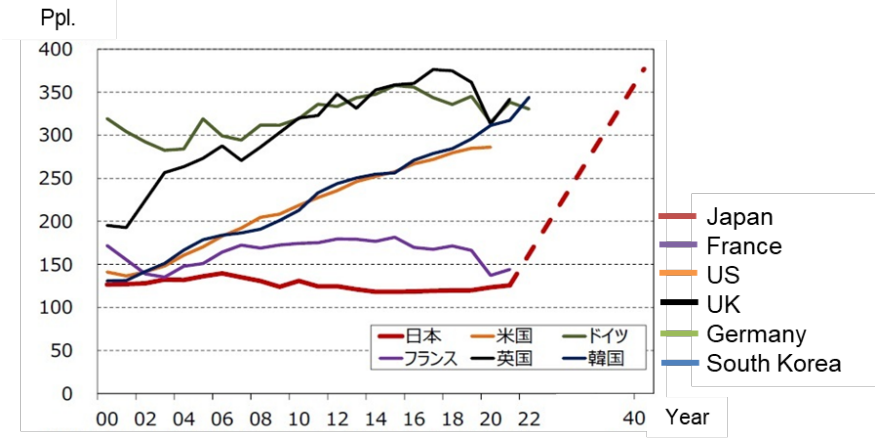
Number of Students Enrolling in Doctoral Programs



Source: Shuji Kawagishi, 2025

Figure 2

Doctorate Holders per Million People

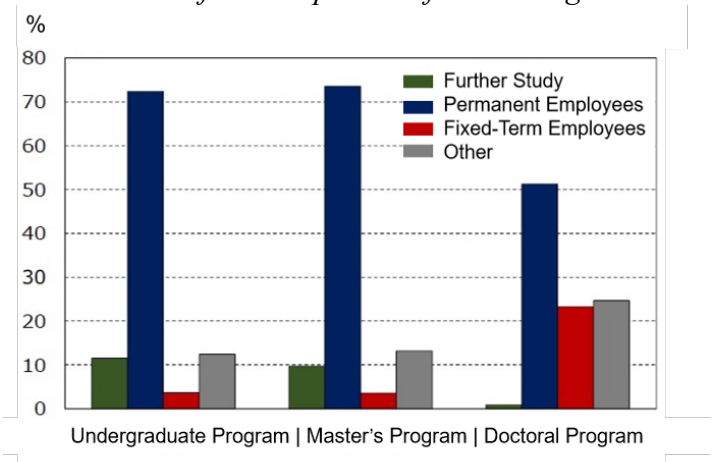


Source: Shuji Kawagishi, 2025

Financial considerations further compound this situation. Students' economic circumstances during their studies, combined with uncertainty regarding future career trajectories, constitute major deterrents to doctoral enrollment. Moreover, compared with graduates holding undergraduate or master's degrees, doctoral degree holders face a substantially higher incidence of fixed-term employment, reinforcing perceptions of instability associated with the PhD pathway (Shuji Kawagishi, 2025). Together, these structural and economic factors help explain the sustained decline in doctoral participation in Japan.

Figure 3

Career Paths After Completion of Each Program



Source: Shuji Kawagishi, 2025

Admission to doctoral programs typically prioritizes applicants' disciplinary foundations, research competence, critical thinking abilities, and strong research motivation. While these attributes remain essential for undertaking advanced scholarly work, they are no longer sufficient to ensure that graduates can successfully navigate increasingly diverse and competitive career landscapes after completing their PhDs. The evolving expectations placed upon doctoral degree holders, both within and beyond academia, require a broader set of competencies, including transferable skills, professional adaptability, and career self-management capacities.

This situation raises a fundamental question for doctoral education: what should doctoral training entail in order to prepare candidates more effectively for their future trajectories? More specifically, how do particular components of doctoral programs contribute to the development of essential skills and to the strengthening of graduates' self-efficacy regarding their career pathways? Addressing these questions is crucial for rethinking the design and purpose of contemporary doctoral education.

Case Study

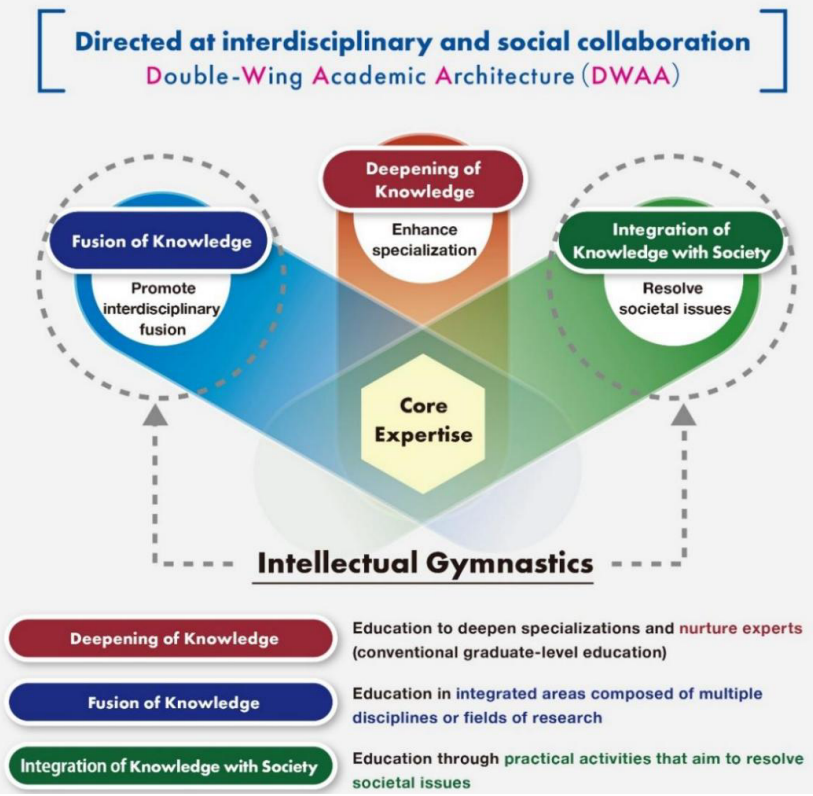
This study is guided by two central research questions. First, it seeks to identify the skills and competencies that enable PhD graduates to remain competitive in contemporary labor markets across both academic and non-academic sectors. Second, it examines how doctoral education and training processes can effectively cultivate such competitiveness, with particular attention to program structures, learning experiences, and developmental opportunities that support the formation of well-rounded, adaptable researchers. Together, these questions aim to clarify not only what makes a PhD graduate competitive, but also how doctoral programs can systematically foster the capacities required for sustainable and successful career trajectories.

Program Framework and Core Skills for Competitive PhD Graduates

Since 2021, the University of Osaka has been promoting the Double-Wing Academic Architecture (DWAA), an advanced graduate education system focused on interdisciplinary and social collaboration. Its goal is to nurture doctoral professionals who can create social innovations across many fields, not limited to academia. DWAA is composed of three areas: Deepening of Knowledge, Fusion of Knowledge, and Integration of Knowledge with Society. In addition to developing expert knowledge, the system expands education in two new directions predicated on the acquisition of core expertise. Graduate degree holders are expected to tackle problems with flexibility and a broad worldview, collaborate with diverse stakeholders, and leverage their core expertise as they more broadly and deeply apply their graduate school education.

Figure 4

Structure of Graduate Education at the University of Osaka—Double-Wing Academic Architecture (DWAA)



Source: https://itgp.osaka-u.ac.jp/en/systems/dwaa/

The Cross-Boundary Innovation Program (CBI Program), launched in 2012, is a comprehensive interdisciplinary graduate initiative designed to address complex social challenges through cross-sector collaboration. The program brings together graduate students and faculty members from all graduate schools of the University of Osaka under the unifying theme of solving societal issues. It offers coursework and project-based learning opportunities to students from both the humanities and the sciences, thereby fostering dialogue and cooperation across disciplinary boundaries. Through these activities, the program seeks to cultivate a new type of doctoral talent capable of contributing beyond narrow areas of specialization and prepared for diverse career pathways in academia, industry, and government. The CBI Program operates in conjunction with the Fellowship for Integration of Knowledge with Society, a fellowship scheme provided by the Japan Science and Technology Agency

(JST). This fellowship supports doctoral students in integrating scientific expertise with societal knowledge by providing research grants and financial assistance. Together, these initiatives promote interdisciplinary competence, social engagement, and practical problem-solving skills, enabling doctoral candidates to pursue innovative research while developing capacities applicable to a broad range of professional contexts.

Table 1

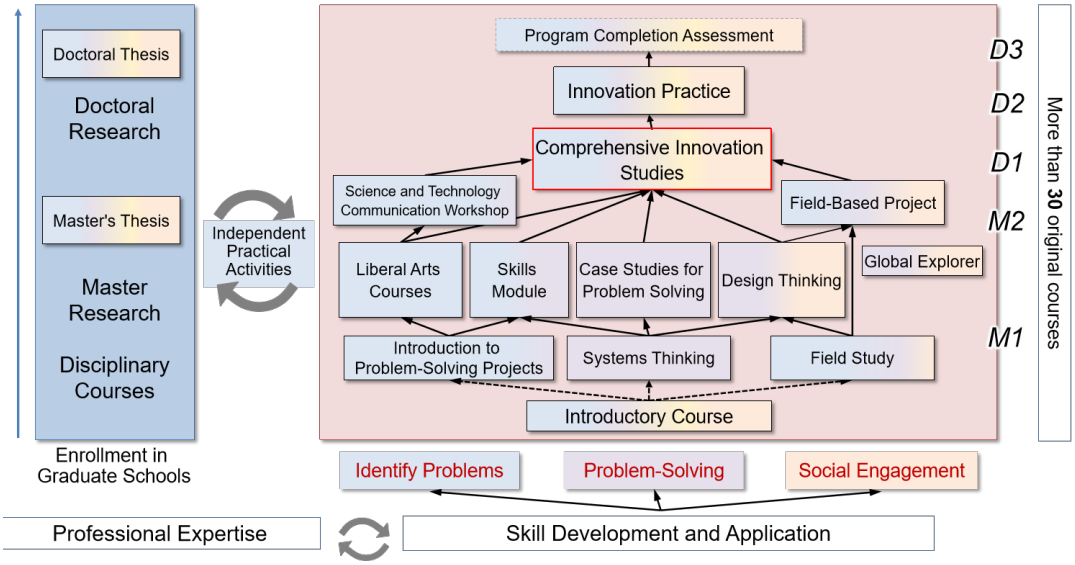
Student Affiliations (2012–2025 AY)

Graduate School	Number	Percentage
Human Sciences	42	20.00%
Engineering	38	18.00%
Humanities	33	15.70%
Medicine	21	10.00%
Sciences	18	8.60%
International Public Policy	10	5.10%
Biosciences	10	4.70%
Pharmaceutical Sciences	10	4.70%
Informatics	8	3.80%
Engineering Science	7	3.30%
Law and Politics	6	2.90%
Economics	5	2.30%
Dentistry	2	0.90%
	210	100%

From 2012 to the 2025 academic year, more than 200 graduate students from all graduate schools have participated in the program, covering a wide range of disciplines, including Human Sciences, Engineering, Humanities, Medicine, Sciences, International Public Policy, Biosciences, Pharmaceutical Sciences, Informatics, Law and Politics, Engineering Science, Economics, and Dentistry. Faculty members from all graduate schools, with diverse backgrounds, are also involved in program management and teaching.

Figure 5

Curriculum of CBI Program



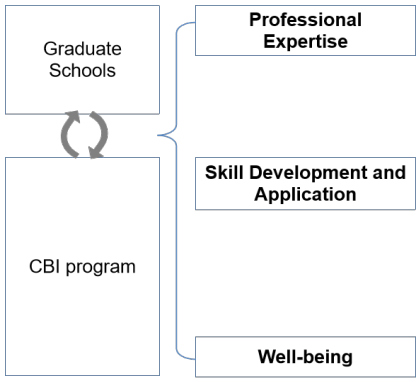
Source: https://www.cbi.osaka-u.ac.jp/teaching/feature/

The program offers more than 30 original courses, long-term project-based learning opportunities, and a combination of group and independent activities. Through these components, students develop competencies in problem identification and problem solving, as well as the capacity for meaningful social engagement. By working beyond the boundaries of their own specializations, participants are encouraged to cultivate innovative and integrative thinking. Key features of the program include workshops and project-based learning initiatives that bring together students from diverse academic backgrounds and different stages of study, enabling constructive dialogue and collaborative learning. In addition, overseas experiences and collaborative projects with companies and government agencies provide opportunities for students to address real-world social issues in practical contexts.

While students primarily acquire advanced disciplinary knowledge within their respective graduate schools, the CBI program places particular emphasis on transferable skill development and real-world application. Through sustained participation, students strengthen their ability to identify complex challenges, design and implement solutions, and engage effectively with society. At the same time, interdisciplinary collaboration throughout the program further promotes innovative thinking by encouraging students to transcend traditional academic boundaries.

Figure 6

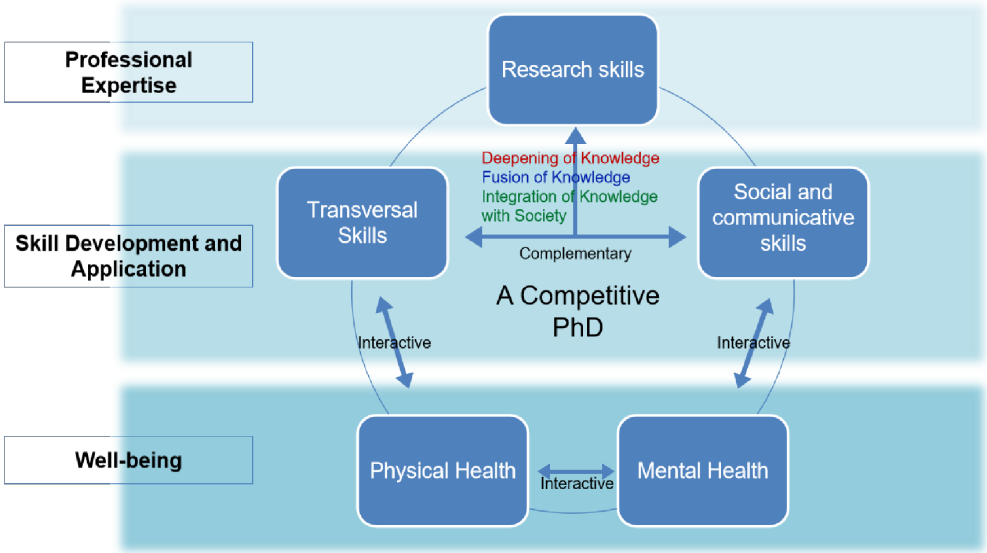
Skills Contributing to Competitive PhD Graduates



In terms of skill development and practical application, the program provides students with opportunities not only to acquire knowledge but also to apply what they have learned through practice and real-world engagement. Emphasis is placed on experiential learning, whereby students perform tasks, participate in authentic activities, and develop competencies through hands-on experience. In this sense, learning occurs through doing, and skills are cultivated through repeated practice in practical contexts.

Alongside the development of professional expertise and transferable skills, the program also places strong emphasis on students' physical and mental well-being. These three dimensions, disciplinary knowledge, practical competence, and well-being, are regarded as mutually reinforcing foundations for sustainable development. Together, they enable students to respond to real-world challenges both reactively and proactively, while enhancing their capacity to adapt to the uncertainties of a rapidly changing global environment.

Figure 7
Interactive and Complementary Functions of Skills in Developing a Competitive PhD Graduate



These three core elements were further organized into five key components within the program framework. Physical and mental well-being constitute the foundational layer, upon which all other competencies are built. Rather than functioning independently, these skills interact dynamically and complement one another, collectively contributing to the development of a competitive and resilient PhD graduate equipped for diverse professional contexts.

Given that most doctoral students encounter significant academic and personal challenges during their studies, physical and mental strength is regarded as essential for sustaining long-term engagement and success. A strong foundation in well-being supports students' capacity to recover from setbacks, maintain motivation, and demonstrate resilience in the face of uncertainty. In this way, well-being not only underpins academic achievement but also enhances adaptability and long-term professional growth.

Cultivating Competitiveness Through Doctoral Education and Training Processes

To address the second research question—how to foster competitive PhD graduates—this study draws attention to the role of structured learning experiences beyond conventional disciplinary training. Previous research has demonstrated that extra- and co-curricular activities enhance graduate employability by expanding social and professional networks, supporting career planning (Jackson & Bridgstock, 2021; Jackson & Tomlinson, 2022), and facilitating the development of transferable skills (Buckley & Lee, 2021; Dickinson et al., 2021; Jackson & Cameron, 2025). These findings suggest that doctoral education should extend beyond formal coursework and research supervision to incorporate broader developmental opportunities.

Table 2
A Staged Interdisciplinary Graduate Education Model

	Curricular programs	Co-curricular programs	Extra-curricular programs
Individual Work	e.g. Interdisciplinary course, PBL courses	e.g. Brownbag Seminar, Forum (Domestic / International (Joint International and Interdisciplinary Forum)), Overseas Travel Support	e.g. Cross-Boundary Practical Activities, Career Development Seminars
Group Work	e.g. Field Project, Comprehensive Innovation Studies (PBL)		e.g. Group work support, Cross-Boundary Practical Activities, Career Development Seminars, Life-Skill Training Camp
Upgraded Individual Work	e.g. Independent Practical Activities (Innovation Practice)		

In this context, we have developed a staged interdisciplinary graduate education model that systematically integrates curricular, co-curricular, and extra-curricular components. The model is organized into three progressive phases, individual work, group work, and upgraded individual work. Across these phases, students engage in diverse project-based learning courses and activities designed to cultivate interdisciplinary collaboration, practical problem-solving abilities, and reflective integration of learning outcomes. This staged structure enables students to gradually expand their competencies, first by strengthening individual expertise, then by engaging in collaborative inquiry, and finally by refining and advancing their individual capacities at a higher level of integration.

Applied Practices in the CBI Program

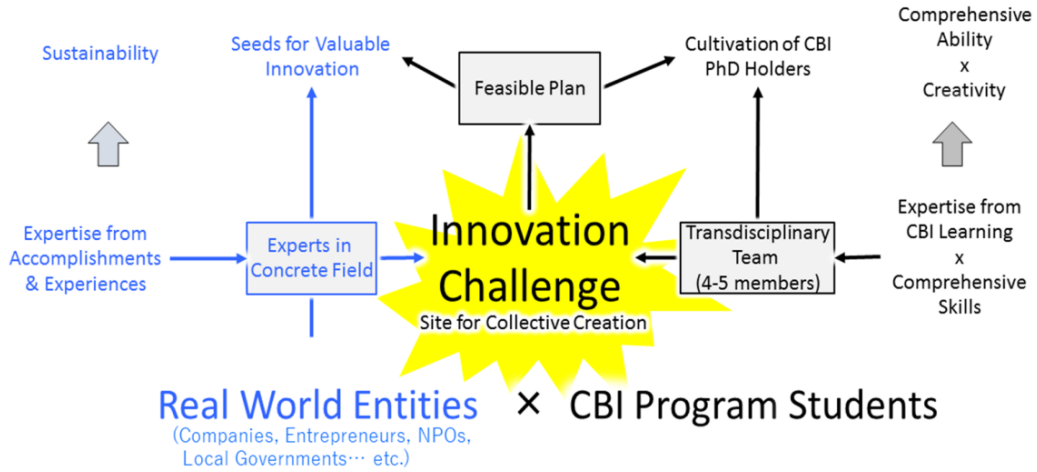
In the following sections, we introduce several practical cases to demonstrate the concrete implementation of the staged interdisciplinary graduate education model.

Project-Based Learning (PBL) Courses

As a core component of the program, Project-Based Learning (PBL) courses integrate both individual and group work across curricular and co-curricular settings. A representative initiative is the long-term PBL course *Comprehensive Innovation Studies*, which extends over approximately ten months and is designed to promote sustained engagement with complex societal challenges.

In this course, interdisciplinary teams composed of students from the humanities and the sciences collaborate to address real-world social issues. Through continuous communication and iterative collaboration with diverse stakeholders, including community members, industry partners, and public-sector representatives, students engage in problem identification, needs analysis, solution design, and proposal development. The extended duration of the project allows participants to refine their ideas through feedback and reflection, thereby strengthening both analytical rigor and practical applicability. The overall objective is to develop feasible and socially meaningful solutions that demonstrate the capacity of doctoral students to contribute constructively to society beyond the boundaries of their respective disciplines.

Figure 8
Comprehensive Innovation Studies



Life-Skill Training Camp

As part of the extra-curricular component of the program, the "Life-Skill Training Camp" is designed to strengthen students' foundational competencies for personal and professional resilience. Life skills are defined as the abilities required to deal constructively and effectively with the demands and challenges of everyday life (WHO, 1997). These include decision-making, problem-solving, creative and critical thinking, effective communication, interpersonal skills, self-awareness, empathy, coping with emotions, and coping with stress.

Research on elite athletes suggests that they possess highly developed life skills that enable them to withstand negative external influences, positively reframe challenges, and push beyond perceived physical and psychological limits. Drawing on these athlete-developed competencies, the CBI program incorporates residential, sport-based training designed to foster life skill acquisition and strengthen team building. Through structured physical activities, reflective exercises, and collaborative tasks, students enhance resilience, emotional regulation, communication, and mutual trust. In this way, the program situates life skill development as a practical and embodied process that supports both individual growth and collective cohesion.

Career Development Seminars

The Career Development Seminars constitute an important extra-curricular component of the program, combining individual reflection with group-based learning activities. These seminars are designed to enhance doctoral students' preparedness for diverse career pathways by strengthening transferable skills and informed decision-making capacities. In particular, students develop the ability to analyze and integrate perspectives from multiple sectors, thereby supporting flexible and strategic career planning in rapidly changing professional environments.

A strengths-based approach is emphasized throughout the seminars. Participants are guided to reflect on their individual strengths, core values, and long-term career aspirations as doctoral candidates operating within an interdisciplinary context. This process of structured self-assessment supports greater self-awareness and clearer professional direction. In addition, the seminars provide foundational knowledge of labour laws and workplace-related issues, including employment conditions and risks such as overwork, thereby equipping students with essential awareness for sustainable career development.

Given the increasing globalization of career trajectories, the seminars also address international career pathways. Particular emphasis is placed on cross-cultural understanding and effective communication, enabling students to navigate diverse professional contexts and to contribute successfully within the global community.

Independent Practical Activities (Innovation Practice)

Independent Practical Activities, referred to as Innovation Practice, represent the upgraded individual phase of the program. These activities are student-designed projects that integrate co-curricular and extra-curricular learning, enabling participants to extend and apply their academic and professional competencies in authentic social contexts. Under faculty guidance, students design and implement projects that translate their interdisciplinary learning into concrete forms of social engagement.

Through initiatives such as volunteering, internships, collaborative research, and field-based projects, students actively apply acquired knowledge and skills in real-world settings. These experiences promote independent initiative, practical problem-solving, and reflective learning, while reinforcing the connection between doctoral education and societal needs. Since 2015, more than 70 students have participated in this initiative, collaborating with universities, research institutes, NPOs, companies, and government agencies. This sustained engagement demonstrates the program's commitment to experiential learning and to fostering socially responsive and professionally competitive PhD graduates.

Career Paths of Graduates

The career trajectories of program graduates indicate positive outcomes in terms of doctoral employability. Over half of the graduates, 51%, entered employment in the private sector. This proportion is substantially higher than the national average for PhD holders in Japan, which stands at 34% according to a 2023 Cabinet Office survey. Notably, many of these graduates pursued non-research positions, including general administrative and strategic roles, suggesting that they were able to transfer their doctoral competencies beyond narrowly defined research functions.

At the same time, strong outcomes were also observed among those who pursued academic careers. Of the 22 students who expressed the intention to enter academia, 18 (81.8%) secured full-time positions as university faculty members or researchers. The remaining four graduates are active as Japan Society for the Promotion of Science Postdoctoral Fellows, part-time researchers, or in comparable research-oriented roles. These results indicate that the program supports diverse career aspirations while maintaining strong academic competitiveness.

Doctoral employability has been conceptualized as the combination of knowledge, skills, attributes, social resources, and personal agency that enables doctorate holders to obtain, sustain, and advance in meaningful work, whether inside or outside academia (Jackson & Michelson, 2015; Pham, 2023). From this perspective, the outcomes of the program suggest that it has effectively fostered competitive and adaptable PhD graduates capable of navigating multiple professional pathways. In this sense, the program's integrated and staged educational model has demonstrably contributed to enhancing doctoral employability.

Challenges

Despite its positive outcomes, the program faces several challenges. First, integrating multiple disciplines into a coherent educational framework renders curriculum design inherently complex. Continuous adjustments are required to balance disciplinary depth with interdisciplinary breadth, ensure internal coherence across courses and activities, and respond effectively to evolving student needs and societal demands. Maintaining this balance remains an ongoing process of refinement and coordination.

Second, evaluating interdisciplinary learning presents methodological and pedagogical difficulties. Assessment must capture not only disciplinary knowledge acquisition but also the development of cross-cutting competencies such as critical thinking, integrative analysis, and collaborative skills. Designing valid and reliable evaluation mechanisms for such multidimensional learning outcomes is demanding. Accordingly, continuous improvement depends heavily on systematic feedback and iterative revision of teaching and learning activities.

Students themselves encounter practical and academic challenges throughout the program. Managing interdisciplinary projects alongside the rigorous demands of their primary doctoral research requires careful time and workload management. In addition, collaboration with peers from diverse academic backgrounds can present communication barriers, differences in epistemological assumptions, and contrasting methodological approaches. While such tensions may initially create difficulties, they also constitute valuable opportunities for interdisciplinary dialogue, mutual learning, and personal development.

Furthermore, broader structural and psychological challenges facing doctoral students must be acknowledged. Existing research has consistently reported high levels of stress (Kernan et al., 2011; Virtanen et al., 2017; Wyatt & Oswalt, 2013), mental health concerns such as depression (Hyun et al., 2006; Pallos et al., 2005), and significant physical health symptoms including upper respiratory infections (Juniper et al., 2012; Kernan et al., 2011; Pallos et al., 2005). In their social and personal lives, doctoral students also frequently report difficulties in maintaining relationships (Dabney & Tai, 2013; Wellington & Sikes, 2006) and participating in social activities (Juniper et al., 2012; Longfield et al., 2006), often due to limited time, financial constraints, and reduced motivation. These findings underscore the importance of sustaining institutional support systems that address not only academic development but also students' overall well-being.

Conclusion and Future Directions

There is a growing recognition of the need for specialized training and educational programs tailored to interdisciplinary research skills. Such training should extend beyond technical competencies to encompass emotional, social, cultural, and contextual dimensions of research practice (Menken & Keestra, 2016; Rana et al., 2025). Interdisciplinary doctoral education therefore requires a holistic approach that integrates cognitive development with interpersonal awareness and contextual sensitivity.

In response to these demands, we have implemented follow-up interviews with students to monitor their academic and professional development over time. In addition, several new initiatives have been launched to strengthen support for students' physical and mental well-being. As Sverdlik et al. (2018) argue, understanding doctoral students' physical,

psychological, and emotional well-being is essential for fully capturing the complexities and challenges of graduate education. Systematic attention to these dimensions allows institutions to design more responsive and sustainable support mechanisms.

Looking ahead, future efforts may focus on expanding initiatives that promote cross-cultural interaction and global learning opportunities. As interdisciplinary research within doctoral studies continues to evolve, academic institutions must adapt by enhancing their structural and pedagogical support systems. This may include establishing additional interdisciplinary platforms, integrating collaborative methodologies more explicitly into curricula, and providing targeted funding schemes, while simultaneously cultivating a culture that values collaboration and mutual learning (Lyall et al., 2013; Rana et al., 2025; Sun et al., 2021b; Vienni-Baptista et al., 2023).

At present, our program operates with a comprehensive support system that includes faculty and staff guidance, dedicated classrooms and interaction spaces, diverse course offerings and activity opportunities, collaboration with multiple external stakeholders, and financial grants. However, sustaining continuous and long-term support remains both a crucial component and an ongoing challenge. Ensuring the durability and adaptability of this support structure will be central to the program's future development and its continued contribution to fostering competitive and resilient PhD graduates.

Limitations and Future Work

This study is mainly a case description of a single program and therefore does not provide a fully systematic or comparative evaluation of implementation processes and outcomes. While the findings offer meaningful insights into program design and graduate trajectories, the descriptive nature of the study limits the generalizability of the conclusions.

Empirical evaluation remains limited, particularly in terms of comprehensive data collection, longitudinal tracking, and advanced analytical procedures. A more rigorous evidence base is needed to assess the effectiveness of the program in fostering interdisciplinary competencies, transferable skills, and long-term career development.

Future research will focus on establishing structured assessment frameworks and employing mixed-methods evaluation approaches. By integrating quantitative indicators with qualitative data, subsequent studies aim to strengthen the empirical foundation of the program and provide a more nuanced understanding of its impact on doctoral education and employability.

Declaration of Generative AI and AI-Assisted Technologies in the Writing Process

During the preparation of this manuscript, the authors used ChatGPT solely for proofreading and refining language, including correcting grammar, spelling, and rephrasing for clarity and accuracy. Apart from Grammarly, no other AI or AI-assisted tools were used to generate content. All ideas, study design, procedures, findings, analyses, and discussions are original and derived from the careful and systematic conduct of the research.

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Fostering Social Justice in Entrepreneurial Education Through the Instrumentation of Instructional Leadership in Secondary Schools

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Abstract

The traditional approach to instructional leadership in entrepreneurship education (EE) instruction has predominantly concentrated on business skills. Consequently, with this approach, schools risk reproducing individualistic or purely market-centric entrepreneurs that sideline civic purpose and social impact. This conventional model of instructional leadership tends to sustain and reinforce the exploitative tendencies inherent in capitalism. The purpose of this study is to investigate how instructional leaders can embed social justice principles in entrepreneurial education, thereby promoting equity, inclusivity, and fairness in teaching methods and curriculum delivery. The study employs Jack Mezirow's transformative learning theory to reconceptualize entrepreneurial education not merely as a means of imparting business skills but as a catalyst for societal and personal transformation culminating in a socially just society. Utilizing a conceptual framework and an integrative literature review methodology, the study synthesizes insights from relevant literature published between 2010 and 2025, sourced from Wiley, Scopus, ERIC, and Taylor and Francis online databases. The findings indicate that instructional leaders in schools lack the requisite understanding and expertise to effectively integrate social justice into entrepreneurship pedagogy. The study recommends that instructional leaders should be empowered to develop the competencies necessary to incorporate social justice into the pedagogy of entrepreneurial education, thereby fostering socially responsible instructional leadership and schools that are socially transformative. It is anticipated that these findings will inform both policy and practice where policies prioritise and address social inequalities, and entrepreneurship education is seen as a tool for nurturing values like fairness and equity.

Keywords: entrepreneurship education, instructional leadership, social justice, transformative learning theory

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Introduction

Over the last decade, entrepreneurship education (EE) has expanded across school systems and have moved beyond a narrow emphasis on firm formation. It has encompassed a broader set of competencies like creativity, agency, ethical judgment, and value creation for active citizenship and personal development (Bacigalupo et al., 2016; Göksen-Olgun et al., 2022; OECD, 2022). In European policy, the EntreComp framework codifies this wider scope by positioning entrepreneurship as a key competence for life, work, and democratic participation, rather than solely new-venture creation (Bacigalupo et al., 2016). Empirical syntheses focused on primary and secondary levels, reported that school-based EE increasingly adopts experiential pedagogies and community-oriented projects, though provision remains uneven across curricula and teacher preparation dimensions (Göksen-Olgun et al., 2022; OECD, 2022).

Entrepreneurship education is often lauded as a driver for reducing economic inequality by equipping learners with the ability to generate income and create employment opportunities (Brown, 2018). It has gained global importance (Ratten & Usmanij, 2021), relevance popularity because of its ability to promote economic well-being (Lee & Rodriguez-Pose, 2021). EE is considered to drive economic growth (Doran et al., 2018). Many countries, including South Africa, have incorporated entrepreneurship education into school curricula to advance social justice through economic equality (Aransyah et al., 2023; Barba-Sánchez & Atienza-Sahuquillo, 2016). However, despite the relevance of entrepreneurship education, South Africa still faces persistent high youth unemployment and social unrest. The current Curriculum and Assessment Policy Statements (CAPS) incorporates entrepreneurship content in a limited and fragmented manner, often confined to isolated subjects like Economic and Management Science (EMS) (Du Toit & Kempen, 2020).

This paper positions economic equality and fairness as crucial aspects of social justice, highlighting entrepreneurship as a potential solution for reducing unemployment and creating opportunities for income generation. While traditional entrepreneurship education has focused primarily on business skill, which gives rise to economic value, some concerned scholars advocate for a broader framing under the term entrepreneurial learning or entrepreneurial education (Lackéus et al., 2016; Schoeniger et al., 2021). Entrepreneurial learning emphasizes self-directed learning and an entrepreneurial mindset, where learners actively create value not only for themselves but also for others (Du Toit, 2023).

Despite the growing recognition of entrepreneurship education (EE) as a critical component of secondary schooling, a significant gap persists in integrating social justice into its design and delivery. Much of EE remains oriented toward economic goals such as self-employment, profit-making, and competitiveness, often neglecting broader social and ethical dimensions (Göksen-Olgun et al., 2022; OECD, 2022). This narrow emphasis risks reinforcing existing inequalities by privileging market-oriented outcomes over equity, inclusivity, and community well-being. As UNESCO (2020) notes, education systems that do not explicitly address inclusion and equity perpetuate barriers for marginalized learners, undermining the transformative potential of EE.

One factor contributing to this gap is the limited scope of traditional instructional leadership approaches. Instructional leadership has been consistently linked to student achievement (Grissom et al., 2021), yet in many contexts, school leaders focus on managerial or technical functions such as compliance, resource management, and performance monitoring at the expense of promoting equity-oriented pedagogical practices (Khalifa et al., 2016; UNESCO,

2025). While instructional leaders play a crucial role in shaping the teaching and learning environment, evidence indicates that many remain underprepared to support teachers in embedding social justice into curriculum and pedagogy (Wallace Foundation, 2023). This results in a mismatch between the transformative aims of EE and the leadership practices guiding its implementation.

Given these limitations, there is an urgent need to reimagine entrepreneurial education as more than the acquisition of business skills. Grounding EE in social justice principles can foster critical reflection, civic engagement, and inclusive value creation, preparing learners not only to succeed economically but also to contribute meaningfully to equitable social transformation (Bacigalupo et al., 2016; Mezirow, 2000; UNESCO, 2025). This requires instructional leaders who are equipped with the knowledge, dispositions, and competencies to guide educators in adopting pedagogical approaches that advance fairness, inclusivity, and equity. Without this shift, EE risks entrenching exploitative practices rather than becoming a catalyst for societal change. Hence, this study aims to explore the role of instructional leadership in promoting social justice principles in entrepreneurship education in secondary schools, with a focus on fostering equity, inclusivity, and fairness in teaching and learning.

Research Questions

1. How can instructional leadership facilitate equity, inclusivity and fairness within entrepreneurial education?
2. What strategies can be used to empower instructional leaders with the competencies needed to guide teachers in incorporating social justice into entrepreneurship teaching and learning?

Conceptual and Theoretical Framework

Entrepreneurship Education

Entrepreneurial education (EE) emerged from a business subject niche to an educational paradigm positioned to advance knowledge, attitudes, skills and behaviour linked with innovation and entrepreneurship. Its focus has been broadened from merely focusing on new business creation to embrace a wider scope of competencies applicable in social and personal life (Mwasalwiba, 2010). The European Commission (2021) asserts that entrepreneurial learning is the ability of an individual to act upon ideas and opportunities to create value for others, be it social, cultural or financial. The goal of EE is to enable learners acquire entrepreneurial abilities, a combination of attitude, information and varied skills (Ndofirepi, 2020). Contemporary literature increasingly emphasises the gap between entrepreneurial education content and the practical needs of African societies to foster equality, inclusiveness and fairness in their entrepreneurial activities, which would decolonise the exploitative tendencies inherent in capitalism. Olutuase et al. (2023) buttress the need to reconsider the present entrepreneurship models to enhance an entrepreneurial mindset that is adaptable and innovative to the local market needs of the African community. At its core, entrepreneurial education aims to equip learners to navigate organisational complexities, make informed market decisions, and enhance sustainable growth (Theofanous et al., 2024). By embracing inclusivity, fairness and equality as a foundational principle, business schools have the opportunity to not only teach future leaders business skills and profit maximisation, but also to promote the civic and social impact of businesses.

Instructional Leadership in Entrepreneurship Education

Leadership for learning has predominantly gained global recognition since the 80s and has increasingly been associated with instructional leadership (Enebe et al., 2025; Hallinger, 2015). Glickman et al. (2017) attributed principals' leadership to effective instructional management and accentuate that principals' managerial disposition affects learners through instructional organisation and school climate. Similarly, Neumerski et al., (2018) alluded that instructional leadership of the principal is a committed engagement in the professional development of teachers and constant improvement of the instructional programme. Internationally, it is argued that school leaders rank teacher development, collaborative planning and curriculum mediation as determinants of how innovations such as EE are enacted and interpreted at the classroom level (Organisation for Economic Co-operation and Development [OECD], 2020; United Nations Educational, Scientific and Cultural Organization [UNESCO], 2025). Although many principals promote varied teaching and learning practices, some literature reviews on school leadership highlighted a continual gap in justice and equity-oriented capabilities, with unequal competencies to develop preparatory programs (Grissom et al., 2021; Jackson, 2024; Wallace Foundation, 2023). This persistent gap is important for EE, especially when it is framed solely as a business skills, schools risk reproducing individualistic or purely market-centric logics that undermine social impact and civic responsibilities (Bacigalupo et al., 2016), as compared to when leadership portrays entrepreneurship as learning to create value for others, which opens space to equity, inclusiveness and community-engaged pedagogies (Göksen-Olgun et al., 2022). This review looked at school leadership that are socially responsive, the type that fights systemic injustice and inequalities through EE.

Social Justice in Education

Social justice in education is an educational endeavour with clear implications in developing inclusive and equitable educational ecosystems where every learner thrives (Chaaban et al., 2025). This phenomenon concerns the redistribution of resources and opportunities, acknowledgement of different identities and participation in decision-making that all learners experience equal access, belonging and achievement (Khalifa et al., 2016). The Global Monitoring highlights that inclusion involves more than access, to entail transforming day-to-day instruction, examinations, and school culture to tackle structural challenges experienced by marginalised groups (UNESCO, 2020). Guiding teachers to question pedagogy and curriculum by instructional leaders, creates a community that imbibe culturally responsive practices that align professional learning and assessment with the goals of equity (Thomson & Hillman, 2020). Through Mezirow's transformative learning theory, entrepreneurial learning can become a platform where learners courageously scrutinise conventions on society and economy, and embrace new ways of value creation that foster collective well-being and equity (Bacigalupo et al., 2016; Mezirow, 2000). This study, therefore, examines how instructional leaders can support EE teachers to incorporate the principles of social justice in the design and facilitation of entrepreneurial learning in secondary schools, so that it functions not only as business skill acquisition but as a fulcrum for personal and community transformation.

Theoretical Framework

This study is underpinned by transformative learning theory (TLT) by Jack Mezirow (1997), which opined that learning goes beyond the acquisition of knowledge and requires tangible transformation in how individuals understand their social world and themselves. Mezirow (1997, 2000) portrays that transformative learning occurs as learners reflect critically on

perceived assumptions, often brought about by disorienting information, which leads to perception transformation. TLT involves interrogating existing ideologies, participating in intellectual discourse, and imbibing equitable, inclusive and integrative worldviews. Here, learning is connected to personal growth and social transformation, rather than being just cognitive.

TLT can be instrumental to entrepreneurial education, as it provides a framework for recreating the purpose of education. Instructional leaders have traditionally been criticised for narrowing the scope of EE to business skills, competition, and profit-making, thus replicating the capitalist logic (Göksen-Olgun et al., 2022; OECD, 2022). The prevalence of such dominant capitalist logic perpetuates systemic inequality and marginalisation, rather than consolidating inclusivity and ethics. However, when sought through the lens of TLT, EE can potentially serve as a framework for promoting learners' reflection on cultural, social and economic well-being that reimagines entrepreneurial practices of community engagement, fairness and social justice (Bacigalupo et al., 2016). The transformative learning approach exposes learners to question age-long systemic structures and to understand entrepreneurship as not only for economic ventures but also as a means to contend with societal injustices.

More so, this theory is pertinent when discussing the issue of social justice, whose mandate is to dismantle systemic barriers and ensure access, equity and consideration for marginalised learners (Khalifa et al., 2016; UNESCO, 2020). Importantly, instructional leaders are instrumental in promoting a school atmosphere where transformative learning can be nurtured. As demonstrated by Grissom et al. (2021), effective instructional leadership is as paramount as classroom teaching in influencing learners' performance. On the contrary, school leadership that is narrowed to administrative and managerial practices risks sidelining the bigger social dimension of schooling. For instructional leadership to embed transformative learning would require training them with the capabilities to guide entrepreneurship teachers in inculcating fairness, equity and inclusivity into instruction. Drawing on TLT, it is fundamental for instructional leaders to assist teachers in fashioning entrepreneurial learning experiences that would inspire learners to critique dominant assumptions, participate in mind-transforming dialogue and create responsive entrepreneurial solutions. Embedding TLT in EE will potentially catalyse social transformation through aligning social justice principles with entrepreneurial learning. In this study, we used TLT to articulate how instructional leadership can encourage teachers to adapt inclusive and equitable entrepreneurial practices in secondary schools.

Methodology

Integrative Literature Review (ILR)

The study is grounded in the ILR approach. Data was gathered from different sources to buttress and understand the topic of interest (Torraco, 2016). ILR is different from a typical systematic literature review that synthesises existing knowledge, ILR is a multifaceted approach to gathering data. It also differs from PRISMA as it gathers data from varied sources, including peer-reviewed and non-peer-reviewed journal articles, government gazette, policy documents and relevant documents in the public domain (Nedeljko et al., 2023). ILR is also known for its hallmark in clarifying grey areas and identifying gaps in a research niche (Boote & Beile, 2005).

Rationale

The rationale for choosing ILR for this study is because of the complexities surrounding embedding social justice in entrepreneurial learning by instructional leaders. ILR is prominent in making sense of complex ideas such as the transitioning from a traditional approach to entrepreneurial learning marked by mere business skills and capitalism to an approach defined by inclusivity, equity and fairness. Dhollande et al. (2021) observed that this approach makes provision for a structured framework that synthesises varied literature and identifies main themes. ILR is suitable for this study as it gives an understanding of the various ways in which instructional leadership could avert the risk of reproducing purely market-centred entrepreneur (Bacigalupo et al., 2016). Instructional leadership, on one hand, stresses the use of effective teaching methods. While on the other hand, social justice practices urge instructional leaders to include culturally responsive and inclusive instruction that connects content respectfully and equitably with the variety of languages and cultures (Shaked, 2023).

ILR is suitable for this study as it gives a wholesome understanding of strategies which instructional leaders could implement to promote social justice in the entrepreneurship classroom. It facilitates the synthesis of literature on fostering social justice in entrepreneurial learning through the instrumentation of instructional leadership. Torraco ILR model was adopted out of the many forms of ILR because we want to create an actionable model for instructional leaders to advance social justice in entrepreneurial education. Torraco (2005, 2016) specifically states this idea:

> Synthesising the literature means that the review weaves the streams of research together to focus on the core issues rather than simply reporting on previous literature. Synthesis is not a data dump. It is a creative process that generates a new model, conceptual framework, or other unique conception informed by the author's intimate knowledge of the topic. (2005, p. 362)

Five Steps Approach by Torraco to ILR

This study adopted Torraco's (2016) five-step model to conduct an ILR. These steps include a. problem formulation, b. literature search, c. data evaluation, d. data analysis, and e. presentation/writing. Using this model, we synthesised existing literature and theoretical ideas by using the following steps. The study began with mapping out the study's objectives. Following, we conducted a literature search on Wiley, Scopus, ERIC, and Taylor and Francis online databases and grey literature from the Department of Basic Education gazette, Republic of South Africa, thereby having a dual perspective of reviewed and grey literature (Bramer et al., 2017; Ewald et al., 2022; Harari et al., 2020) on fostering social justice in entrepreneurial education by instructional leadership.

Here are some of the keywords used during our search to identify relevant literature: "social justice", "social justice in the education classroom", "entrepreneurial learning", "entrepreneurship education in secondary schools", "instructional leadership", "inclusive education". The combination of the above keywords was done for the respective database using Boolean operators, for instance, "OR" and "AND" to ensure that important literature was curated for the study (Gusenbauer & Haddaway, 2020). We synthesised and added studies that examined social justice in teaching and learning and instructional leadership in entrepreneurship education.

Inclusion and Exclusion Criteria

In ILR, part of its requirement is the establishment of inclusion and exclusion criteria in the study to ensure that only relevant literature is included. The publication year of the included articles was between 2010 and 2025. The inclusion criteria included studies that explored social justice, inclusivity, and equity in the classroom, and the role of instructional leadership in facilitating entrepreneurial learning. In addition to peer-reviewed articles, we included government gazettes and policy documents. More so, in our exclusion criteria, we excluded studies that did not explore social justice, equity and inclusion in the classroom, and not within the said years. Also, studies in entrepreneurial education and instructional leadership that fell before 2015 were excluded from the study.

Mitigation of Bias and Ensuring Quality Assurance

Bias mitigation and quality assurance were achieved through triangulation (Meydan & Akkas, 2024). The researchers used independent perspectives to screen studies. We compared our findings, discussed any differences, and reached an agreement on what should and shouldn't be part of the current study. This helped to balance individual interpretations and subjectivities. The study incorporated electronic systematic database searches (Finfgeld-Connett & Johnson, 2013), reflexive activities to understand alternative perspectives (Barrett et al., 2020), and used critical appraisal instruments (Critical Appraisal Skills Programme, 2018). We equally maintained an unbiased view of the aim of the study by adding grey literature, for instance, the government gazette, policy documents, and other valuable resources in the public domain. These documents were equally fact-checked rigorously to ensure alignment with the study's focus.

Findings and Discussion

This section presents the study's findings and places them in the existing body of literature. These findings are presented in accordance with the two research questions of the study; how can instructional leadership facilitate equity, inclusivity and fairness within entrepreneurial education?, and what strategies can be used to empower instructional leaders with the competencies needed to guide teachers in incorporating social justice into entrepreneurship teaching and learning?

Facilitation of Equity, Inclusivity and Fairness by Instructional Leadership

Instructional leadership is critical in the educational system, as it contributes meaningfully to promoting learners' achievement and education quality generally. Instructional leaders are pivotal in the educational system as they are charged with the task of establishing an academic vision, enhancing a collaborative culture among teachers, and employing data to foster instructional decisions (Akomodi, 2025). This leadership is not only to oversee educational activities but also to create an atmosphere that breeds development and professional growth among teachers. Enebe et al. (2025) observe that this leadership approach entails setting clear goals, teacher support, and fostering a collaborative environment that facilitates overall learner and school outcomes.

This leadership plays a prominent role in enhancing inclusivity, equity and fairness in entrepreneurial education through shaping pedagogical approaches, curriculum choices, school culture and resource allocation (Munna, 2023). Importantly, leaders encourage inclusive

entrepreneurship learning by inculcating visions grounded in human rights principles and fairness (Du Toit, 2023). UNESCO (2017) assert that entrepreneurship learning becomes essential to the backgrounds, diverse experiences and aspirations of learners when equity is included in a programme's goals and curriculum. Instructional leaders, in this way, enable entrepreneurial education to be taught not merely as a business development course, but largely as a means for community engagement and social empowerment. McCarthy-Kettledas et al. (2024) stress that entrepreneurial learning is a self-directed approach, that encourages learners to imbibe entrepreneurial mindsets than being taught narrowly to be an entrepreneur with the aim of starting a business. The goal of this learning extends to promoting value creation for others and exposes learners to partake in social justice (Schoeniger et al., 2021).

Similarly, entrepreneurial learning offers opportunities which are beyond economic outcomes to incorporate cultural, social and environmental outcomes (Lackéus et al., 2016). The two first outcomes (cultural and social) can be harnessed by instructional leaders to facilitate equity, inclusivity, and fairness. Instructional leaders can help preserve cultural assets, and indigenous knowledge, which contributes to inclusion and unity in areas such as creative industries and tourism, than treating this solely as economic venture. Providing guidance to teachers to critique curriculum and pedagogy fosters community of learners that embrace culturally responsive practices that are in tandem with the goals of equity (Thomson & Hillman, 2020). Looking at Mezirow's transformative learning theory, entrepreneurial learning can form a pedestal for learner to critique societal conventions on economy and imbibe new dimensions of value creation that promote equity, inclusivity and general well-being (Bacigalupo et al., 2016; Mezirow, 2000). On the other hand, Hlady-Rispal and Servantie (2016) opine that social value arises when entrepreneurial learning addresses social problems and prioritizes social missions over profit. The goal of social entrepreneurship is to reduce systemic inequalities and foster change which aligns with the aim of social justice (Duncan-Horner et al., 2022). In sum, entrepreneurial learning can be repositioned as a path to collective good and societal transformation through instructional leadership.

Strategies for Instructional Leaders to Empower Teachers to Incorporate Social Justice in Entrepreneurial Learning

Empowering instructional leaders with the skills essential to guide teachers to embed social justice into entrepreneurial education requires intentional preparation, joint professional learning, and reflective practice. Salient to this development is equity-driven training and socially just leadership practices. Leaders' understanding of how inequalities shape learners' outcomes and cultural responsiveness help them to support teachers in addressing these inequalities within entrepreneurial curricula (Theoharis, 2007). This preparation position leaders to model justice-oriented and reflective dispositions required to guide teachers effectively.

Moreso, deepening leaders' understanding of entrepreneurial pedagogies is another strategy that lends itself to social justice integration. Pedagogies such as experiential and problem-based learning are central to entrepreneurial education (Lee & Rodrigues, 2021). The understanding of these pedagogies can assist instructional leaders to mentor teachers to design projects that not only develop business skills but promotes community engagement and critical awareness. In support of this, collaborative learning communities would provide structured opportunities for leaders and teachers to analyse equity concerns, examine classroom practices and co-develop teaching units that embed social justice. Formation of this type of communities foster

collective capacity and distributed leadership which is paramount in promoting and sustaining social justice (Bertrand & Rodela, 2018).

Finally, reflective tools can also boost instructional leaders' effectiveness in justice-oriented guidance. Critical incidents analysis, equity audits and bias checklists offer structured ways for leaders to investigate assumptions and recognise in what ways inequities surface in school programs (DeMatthews, 2018). As leaders take on reflective practices, they are most prepared to foster same reflection among teachers, ensuring that instructional decisions align with the principles of equity, fairness and inclusivity. Meanwhile, entrepreneurial education involves varied socioeconomic and cultural backgrounds in which leaders must have firm understanding in culturally responsive pedagogy. Gay (2018) asserts that training assist leaders to support teachers in designing culturally entrepreneurial settings that promote learners' lived experiences and identities.

Conclusion and Recommendation

This study examined social justice in entrepreneurial education through the instrumentation of instructional leadership in secondary schools. The findings highlight the importance of embedding social justice in the teaching and learning of entrepreneurial education for foster inclusivity, equity and fairness. Entrepreneurship education had been taught merely for the acquisition of business skills and competition mindset which have perpetuated inequality. The study contributes to practice, policy and body of knowledge by devising ways for instructional leaders to facilitate social justice in entrepreneurial education through culturally responsive pedagogies and professional training of teachers. The insights gained from this study hold promise for shaping future educational and leadership training programmes. We recommend that instructional leaders, policy makers and school boards recognise the importance of embedding social justice into entrepreneurial education curriculum and pedagogy, preparing learners not only to succeed economically but also to contribute meaningfully to equitable social transformation.

Limitations

The main limitation of this study is its reliance on secondary data and theoretical constructs, hence, conceptual in nature. This methodological construct might limit our understanding of how social justice could play out in schools and how instructional leaders embed it in the curriculum and pedagogy. Additionally, since the context of the study is South Africa, it might be necessary to carry out this study in other cultural or policy environments. The study employed Mezirow's transformative learning theory as its sole theoretical lens. While this theory is suitable for the study, it may not adequately provide answers for institutional, structural, and political constraints that shape instructional leadership practices in schools. As a result, other theoretical perspectives may provide contrasting or complementary explanations of how social justice is integrated in entrepreneurial education.

Suggestions for Future Studies

Based on the above limitations, future research could consider an empirical validation of this research across school environments to assess its real-world effectiveness and practicality. Qualitative, quantitative and mixed methods designs are needed to further understand how instructional leaders enact social justice in entrepreneurial education in a real school setting. Similarly, studies across different national or regional contexts would promote understanding

of how policy frameworks, socio-economic, and cultural values impart the integration of social justice into entrepreneurial education. Additionally, further studies could use alternative theories, such as critical pedagogy, social justice leadership theory or human capital and capabilities theories, to deepen understanding of structural inequalities and ethical dimension of entrepreneurial education.

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Instructional Design in Community-Based Digital Learning Ecosystems: A Developmental Research Case Study in Product Innovation

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Abstract

The increasing prevalence of virtual learning environments and digital ecosystems necessitates a broader approach to instructional design—one that extends beyond traditional learning processes and integrates recent advances in artificial intelligence (AI) and virtual reality (VR) technologies. This paper proposes a framework for instructional design that supports the development and implementation of innovative learning solutions within digital learning ecosystems. Using a developmental research methodology, we build upon an existing learning prototype designed for a community-based course on cross-border product innovation between China and Europe. Data collection includes literature review, stakeholder interviews, and focus group discussions to identify opportunities and challenges for improving the prototype. Insights from these activities inform collaborative design workshops with experts and stakeholders to co-develop features that leverage the affordances of digital learning ecosystems, particularly for enhancing personalisation, feedback, and learner engagement. The prototype is subsequently tested in an authentic learning environment using mixed methods including surveys, learning analytics, and observation. The resulting multi-level instructional design framework addresses key dimensions including curriculum design, project management, and technology integration. Findings highlight the importance of pedagogy-driven design, instructional strategies, and the synchronisation of learning activities within community-based digital ecosystems. The study provides practical guidance for instructional designers and practitioners seeking to implement technology-enhanced learning solutions in higher education contexts.

Keywords: instructional design, digital learning ecosystems, developmental research, product innovation

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Introduction

Digital technologies have significantly reshaped higher education by transforming how teaching, learning, and assessment are organised. The growing adoption of online platforms, collaborative tools, and immersive technologies has accelerated the emergence of virtual learning environments and digital learning ecosystems. Digital technologies—including cloud computing, mobile devices, enterprise systems, social media, and collaborative platforms—are now widely integrated into learning environments and enable new forms of interaction and collaboration between students, educators, and industry partners. These developments require instructional designers to reconsider traditional approaches to course design and pedagogical practice. In parallel, advances in artificial intelligence (AI) and virtual reality (VR) provide new opportunities to personalise learning experiences, support immersive simulations, and facilitate complex collaborative learning scenarios. However, integrating these technologies into effective learning environments requires a structured instructional design approach that aligns pedagogical objectives, learning activities, and technological affordances.

The concept of digital learning ecosystems represents an evolution from traditional learning management systems (LMS). Within such ecosystems, learning increasingly occurs through community-based interactions, where students collaborate with peers, educators, and industry partners to solve real-world problems. Earlier systems were often closed platforms with limited flexibility and interoperability. In contrast, digital learning ecosystems emphasise open architectures, integration of multiple technologies, and dynamic interactions between stakeholders.

AI and VR technologies further extend the possibilities of digital learning ecosystems by enabling immersive learning experiences and personalised learning support. However, these technologies also introduce new design challenges, including the need for appropriate instructional strategies, cost considerations, and institutional readiness.

Literature Review

Several recent studies highlight how digital tools increasingly influence teaching and learning processes in higher education, with long-lasting effects on educational delivery and student engagement. Scholars in technology-enhanced learning argue that higher education systems are undergoing a generational shift in which static LMS environments are gradually replaced by open and evolving ecosystems that integrate multiple services and platforms. They claim that these ecosystems should combine educational technologies, social networks, collaborative tools, and external knowledge sources to support a more flexible and learner-centred educational experience. Previous studies have evidenced that this approach is particularly relevant for interdisciplinary and innovation-oriented courses, where learning outcomes depend on collective knowledge creation and interaction among stakeholders.

Research Objectives

Designing effective learning experiences within such ecosystems requires new instructional frameworks capable of coordinating multiple actors, technologies, and learning processes.Our research, therefore, proposes an instructional design framework for community-based digital learning ecosystems, based on the development and evaluation of a learning prototype designed for a course on cross-border product innovation between China and Europe.

Research Methodology

To address this challenge, this study adopts a developmental research methodology, sometimes referred to as developmental action research. This approach involves the iterative design, implementation, and evaluation of a learning prototype in order to generate practical knowledge and refine theoretical frameworks. Developmental research is particularly suitable for investigating complex educational innovations because it allows researchers to experiment with prototypes, gather feedback from stakeholders, and continuously improve the learning design through iterative cycles of evaluation and refinement. The research process consists of several stages: (1) Literature review examining instructional design frameworks, digital learning ecosystems, and emerging AI- and VR-based learning technologies; (2) Stakeholder interviews involving educators, students, and industry participants to identify expectations and practical challenges. (3) Focus group discussions aimed at exploring opportunities for improving the learning prototype. (4) Collaborative design workshops, where experts and stakeholders co-develop features and activities that enhance learner engagement and personalisation. (5) Prototype testing within an authentic learning environment, using mixed research methods including surveys, learning analytics, and observational techniques. Through these steps, the study seeks to identify key design principles and develop a practical framework for instructional design within digital learning ecosystems.

Learning Prototype

The experimental prototype examined in this study is a community-based learning environment focused on cross-border product innovation between China and Europe. The learning experience creates in this environment brings together students, SMEs, and service providers to explore collaborative innovation processes. The learning design is structured around four main phases, each supporting the co-creation of knowledge among participants, while leveraging interactive tools that enable collaboration between SMEs and service providers involved in the development of cross-border trade. It is expected that such a learning solution facilitates value creation by enabling collaborative knowledge exchange between firms and external partners. In particular, co-creation activities in the learning design should encourage participatory engagement among stakeholders and support more informed decision-making during joint innovation projects. Digital technologies—including mobile applications, cloud computing, e-commerce platforms, and collaborative tools—play a critical role in supporting these interactions and enabling flexible learning processes.

Research Insights

Based on insights from the prototype and the developmental research process, the study proposes a multi-level instructional design framework for digital learning ecosystems. The framework integrates three core dimensions.

Pedagogy-Driven Design

Pedagogical principles remain central to the design of digital learning environments. Technology should support clearly defined instructional strategies rather than dictate the learning process. Effective design requires alignment between learning objectives, instructional activities, and assessment methods. Personalised learning pathways are particularly important within digital ecosystems. Adaptive technologies and AI tools can support personalised feedback, customised learning trajectories, and data-driven learning analytics.

Technological Interoperability

Digital learning ecosystems rely on the integration of multiple technological components, including LMS platforms, collaborative tools, analytics systems, and immersive technologies. Interoperability between these systems is essential to ensure seamless user experiences and efficient data flows. Open architectures and modular infrastructures can facilitate integration and allow institutions to incorporate emerging technologies such as VR simulations and AI-based conversational agents. However, effective implementation therefore depends on balancing pedagogical innovation with technological feasibility and organisational capacity.

Community-Based Learning Management

Community engagement is a defining feature of digital learning ecosystems. Instructional design should therefore include mechanisms to support collaboration among learners, educators, and external stakeholders. Community management functions—including discussion forums, collaborative projects, and knowledge-sharing platforms—enable continuous interaction and promote collective knowledge creation.

Conclusion

This study proposes a practical instructional design framework for community-based digital learning ecosystems. Using a developmental research methodology, the research builds upon a prototype learning environment and systematically evaluates its design through stakeholder engagement and empirical testing. The resulting framework emphasises three key principles: pedagogy-driven design, technological interoperability, and community-based learning management. These elements collectively support the creation of innovative learning environments that integrate emerging technologies while maintaining strong pedagogical foundations.

The research findings suggest that instructional design for digital learning ecosystems requires a broader perspective than traditional course design. Instead of focusing solely on classroom activities, designers must consider the interaction between pedagogical strategies, technological infrastructure, and community dynamics.

By providing actionable guidance for instructional designers and educators, the study contributes to ongoing discussions on how digital ecosystems can transform higher education and enable more collaborative, personalised, and technology-enhanced learning experiences.

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Communicative Inhibitions as a Cultural Lens: Rethinking Student Silence Beyond Anxiety

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Abstract

What causes some students to stay quiet even though they might have something valuable to contribute? This study proposes the communicative inhibition of the foreign language classroom anxiety (FLCA) framework to shed light on student silence. FLCA has long been recognized as a barrier to participation in classroom activities, yet classroom silence is often considered an anxious response. This response of silence, we argue, is the result of something much broader: culture. Inhibition, as we explain, is self-restraint because of worrying about offending, maintaining social harmony, or social rejection. This explanation is much broader than simply anxiety, which is an emotional response to something. Inhibition relates to cultural rules that shape our interactions. A 33-question survey was administered to 145 Japanese, 68 Indonesian, and 98 Malaysian university students to determine why they often remain quiet in informal conversations. The results showed three main reasons for this silence: Social Sensitivity (being careful not to hurt feelings), Social Rejection (worrying about being judged), and Social Offense (wanting to avoid conflict). Japanese students emphasized Social Sensitivity more, while Indonesian and Malaysian students focused on Social Rejection. This suggests that silence in Japanese classrooms comes from cultural restraint rather than fear. Understanding this can help educators create more culturally sensitive teaching methods that encourage open communication in supportive environments.

Keywords: communicative inhibition, classroom silence, cross-cultural communication, foreign language learning

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Introduction

The question of why some students remain silent in classroom discussions, even when they may have valuable ideas to contribute, has long been a concern in educational research. One widely cited explanation is Foreign Language Classroom Anxiety (FLCA). Introduced by Horwitz et al. (1986), FLCA refers to a specific form of anxiety experienced when learning or using a second language. This type of anxiety can cause students to feel nervous, worry about negative evaluation, and hesitate to participate in classroom interactions. While this framework has been influential in explaining student silence, it may not fully capture the complexity of communicative behavior across all cultural contexts, particularly in many Asian societies, where silence may also reflect culturally appropriate social behavior.

To address this limitation, the present study introduces the concept of communicative inhibition as an alternative lens for understanding student silence. Whereas anxiety primarily refers to an internal emotional state, communicative inhibition emphasizes socially informed self-restraint in communication. Students may choose not to speak not only because of fear or nervousness, but also to maintain social harmony, avoid causing discomfort to others, or prevent social rejection. In cultural contexts where group harmony and interpersonal sensitivity are highly valued, silence may therefore represent adherence to social norms rather than a lack of confidence.

Understanding this distinction is particularly important in multilingual and multicultural educational settings. Some students may remain silent because they feel anxious about their language ability, while others may do so as a culturally appropriate communicative strategy. Recognizing these different motivations may help educators interpret classroom silence more accurately and develop teaching approaches that support diverse communicative styles (Cheng, 2000; Wong, 2004).

Literature Review

Recent research suggests that silence in educational settings should not be understood simply as an absence of speech, but rather as a culturally shaped communicative behavior. In many Asian educational contexts, silence may serve important social functions, such as maintaining interpersonal harmony, showing respect toward teachers or authority figures, and avoiding potential conflict. From this perspective, communicative restraint can be understood as a socially learned practice shaped by cultural norms governing appropriate interaction.

Existing studies have also highlighted the role of Foreign Language Classroom Anxiety (FLCA) in shaping student participation in language learning environments. FLCA has been widely used to explain why students may feel reluctant to speak in class due to fear of negative evaluation, communication apprehension, or concern about making mistakes (Horwitz et al., 1986). However, research also suggests that silence in classrooms cannot always be explained solely by anxiety. In some contexts, students may remain silent not because of fear, but because restraint aligns with culturally appropriate forms of communication (Cheng, 2000; Wong, 2004).

Previous research conducted in countries such as Japan, Indonesia, and Malaysia suggests that social expectations and cultural values may also influence students' willingness to speak. However, relatively few studies have examined communicative inhibition across these contexts using a shared methodological framework. To address this gap, the present study investigates

communicative inhibition among university students in Japan, Indonesia, and Malaysia using a common questionnaire and comparative analysis. Specifically, the study examines the general characteristics of communicative inhibition among students in these three contexts and explores how these patterns may reflect culturally ingrained values and social norms that shape communication behavior.

Methodology

Questionnaire Survey

Data was collected using the Inhibition Survey Questionnaire developed by Wyatt et al. (1996). The instrument consists of 33 items designed to assess reasons why individuals may withhold sincere opinions across a variety of social and communicative contexts. The first four items of the questionnaire are shown in Table 1, while the complete list of items is provided in Appendix A.

Each item was rated on a 10-point Likert scale, ranging from 1 (strongly disagree) to 10 (strongly agree). The instructions accompanying the questionnaire indicated that higher scores reflected stronger agreement with the statement and, therefore, a higher level of communicative inhibition.

Table 1
Sample Items From the Inhibition Survey Questionnaire

Item	Statement
Q1	Saying what is on your mind may harm or damage other people.
Q2	Speaking your mind may hurt the feelings of those you care for.
Q3	You want to be polite.
Q4	You like everything to go smoothly.

Participants

Participants were undergraduate students from universities in Japan, Indonesia, and Malaysia.

The Japanese sample consisted of 145 students recruited from universities located in the Tokyo and Kansai regions. Most participants were enrolled in engineering-related programs.

The Indonesian sample included 68 undergraduate students majoring in Marketing Management at the State Polytechnic of Malang.

The Malaysian sample consisted of 98 undergraduate students from QUEST International University in Ipoh, Perak, Malaysia. These participants were enrolled in compulsory English-language courses and represented several academic programs, including pharmacy, medicine, business and management, social sciences, and science and technology.

Procedure

The survey was administered online using Google Forms. Participants accessed the questionnaire via a URL and password. The landing page explained that participation was voluntary and anonymous and that no personally identifying information (e.g., names or email

addresses) would be collected. After providing informed consent, participants reported their gender and age range and then completed the Inhibition Survey Questionnaire. Data were collected in 2023.

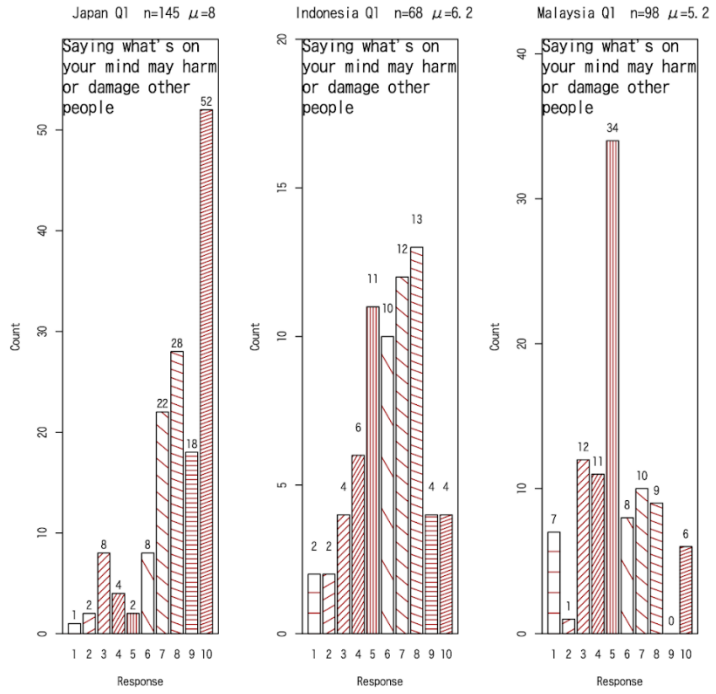
Results and Analysis

Data Screening

All questionnaire items were set as mandatory; however, due to an administrative error, responses to Items 16 and 31 were not correctly recorded for participants in Japan and Indonesia. As a result, subsequent analyses were conducted using the remaining 31 items.

Figure 1 displays a bar graph of raw responses for Item 1. Descriptive statistics for all items are reported in Appendix B.

Figure 1
Bar Graphs for Q1 Showing Results From Each Country



Descriptive Statistics and Reliability

Mean total inhibition scores were calculated for each country. To facilitate comparison with Wyatt et al. (1996), scores were computed using a maximum possible total of 310. The descriptive statistics for each country are presented in Table 2.

Table 2
Expression Inhibition by Country

Country	Mean	S.D.	N
Indonesia	183	44.1	68
Japan	162	42.5	145
Malaysia	159	35.8	98

Table 3
Expression Inhibition by Country and Gender

Country	Gender	Mean	S.D.	N
Indonesia	Female	182.4	47.6	41
Indonesia	Male	184.0	39.0	27
Japan	Female	172.8	44.2	64
Japan	Male	154.7	38.9	80
Malaysia	Female	160.0	32.6	62
Malaysia	Male	158.5	42.3	34

Internal consistency of the questionnaire was high (Cronbach's $\alpha = .91$, $n = 311$). Shapiro–Wilk tests indicated no evidence of non-normality for any country ($W > .98$, $p > .05$).

Country and Gender Comparisons (ANOVA)

A two-way ANOVA was conducted with Country and Gender as factors. The results are shown in Table 4.

Table 4
Two-Way Anova by Country and Gender

Source	Df	Sum Sq	Mean Sq	F value	p value
Country	2	26	13.20	7.71	0.00054 ***
Gender	1	6	6.02	3.51	0.06188
Country × Gender	2	6	3.12	1.82	0.16404
Residuals	302	517	1.71	—	—

The analysis revealed a significant main effect of country on inhibition scores, $F(2, 302) = 7.71$, $p < .001$. Neither the main effect of gender nor the country × gender interaction reached

statistical significance at the .05 level. The effect size for the country was small but meaningful ($\eta^2 = .05$).

Post-hoc comparisons using Tukey's HSD test (95% family-wise confidence level) indicated that inhibition scores in Indonesia were significantly higher than those in Japan and Malaysia. At the same time, no significant difference was observed between Japan and Malaysia (see Table 5).

Table 5
Post-Hoc Comparisons by Country (Tukey Hsd Test)

Comparison	Mean Difference	Lower CI	Upper CI	p value
Japan – Indonesia	−0.671	−1.128	−0.215	0.002
Malaysia – Indonesia	−0.764	−1.254	−0.274	0.001
Malaysia – Japan	−0.093	−0.499	0.314	0.853

ANOVA: Individual Comparisons

To examine cross-cultural differences at the item level, one-way analyses of variance (ANOVAs) were conducted for each of the 31 questionnaire items. After applying the Benjamini–Hochberg false discovery rate (FDR) correction, 21 items showed statistically significant differences across the three countries, while the remaining 10 did not. A summary of the pairwise comparisons is presented in Table 6, and detailed item-level statistics are reported in Appendix B.

Table 6
Summary of Significant Item-Level Differences Between Countries

Country Comparison	Overall Mean Comparison	Higher Country	Number of Items	Lower Country	Number of Items
Japan – Indonesia	162 < 183	Japan	5	Indonesia	15
Japan – Malaysia	162 > 159	Japan	6	Malaysia	6
Malaysia – Indonesia	159 < 183	Malaysia	0	Indonesia	10

Exploratory Factor Analysis

Given the substantial cultural differences observed in earlier analyses and the low factor congruence across regions, exploratory factor analyses (EFA) were conducted separately for each country. This approach allowed the identification of country-specific structures of opinion inhibition without imposing assumptions of structural equivalence.

The Kaiser–Meyer–Olkin (KMO) measure indicated adequate sampling adequacy (KMO = .80), and Bartlett's test of sphericity was highly significant, supporting the suitability of the data for factor analysis. However, the determinant of the correlation matrix was initially too small to permit reliable factor extraction. To address this issue, items that did not reach statistical significance or showed p-values greater than .005 in the individual one-way ANOVAs were removed. After this adjustment, acceptable determinant values (> .00001) were obtained for each country.

Inspection of scree plots, parallel analysis, and Very Simple Structure (VSS) criteria suggested that a four-factor solution was appropriate for each dataset. Since the latent dimensions of opinion inhibition were expected to correlate, the analyses employed minimum residual estimation with oblimin rotation. Model fit was evaluated using the root mean square of residuals (RMSR) and off-diagonal fit indices, which indicated satisfactory model fit for all three countries (Table 7).

Factor loadings greater than .50 are presented in Tables 8–10, while factor diagrams showing loadings greater than .30 are provided in Appendix C.

Table 7
Model Fit Indices for Exploratory Factor Analyses

Country	Factors	RMSR	Off-Diagonal Fit
Indonesia	4	0.05	0.99
Japan	4	0.05	0.97
Malaysia	4	0.05	0.97

Table 8
Factor Loadings for Indonesia (Loadings ≥ .50)

Item	MR1	MR2	MR3	MR4
Q12	0.510			
Q15	0.531			
Q29	0.667			
Q33	0.851			
Q1		0.738		
Q2		0.927		
Q5			0.780	
Q6			0.780	
Q22			0.507	

Item	MR1	MR2	MR3	MR4
Q23				0.663
Q32				0.669

Table 9

Factor Loadings for Japan (Loadings ≥ .50)

Item	MR1	MR2	MR3	MR4
Q1	0.856			
Q2	0.950			
Q6	0.554			
Q32		0.738		
Q33		0.550		
Q18			0.812	
Q5				0.565
Q21				0.840
Q23				0.600

Table 10

Factor Loadings for Malaysia (Loadings ≥ .50)

Item	MR1	MR2	MR3	MR4
Q5	0.738			
Q6	0.615			
Q21	0.575			
Q23	0.619			
Q18		0.512		
Q27		0.713		
Q32		0.748		
Q1			0.801	
Q2			0.904	

Item	MR1	MR2	MR3	MR4
Q15				0.519
Q22				0.827

Although a four-factor structure emerged across all three countries, item loadings varied across datasets, suggesting culturally specific configurations of communicative inhibition.

Cross-Cultural Interpretation of Factors

Although factor structures varied across countries, three common dimensions emerged: social sensitivity, social rejection, and social offense. Social sensitivity reflects concern about hurting others' feelings (e.g., Q1, Q2, Q6), while social rejection relates to fear of negative evaluation or exclusion (e.g., Q17, Q18, Q27). Social offense captures concerns about legal or institutional consequences (e.g., Q5, Q21, Q23). Together, these dimensions represent distinct motivations underlying communicative inhibition in social contexts.

Table 11

Factor Comparison Between Three Countries (Cut = 0.5)

Japan 4 factors

Factor		
F1	Q1	Saying what's on your mind may harm or damage other people
Social sensitivity	Q2	Speaking your mind may hurt the feelings of those you care for
	Q6	Your language could be offensive to other people.
F2	Q17	People may think you don't know what you're talking about.
Social rejection	Q18	People you admire and respect may not approve of you.
F3	Q12	Your opinions could be offensive to other people.
	Q13	You may be misunderstood.
F4	Q5	You could be sued.
Social offence	Q21	You may be arrested for your opinions.

Indonesia 4 factors

Factor		
F1	Q12	Your opinions could be offensive to other people.
Social rejection	Q15	You don't want to get involved.
	Q29	God may punish you for what you say.
	Q33	People may think you are not 'cool' (or not 'with it').
F2	Q1	Saying what's on your mind may harm or damage other people
Social sensitivity	Q2	Speaking your mind may hurt the feelings of those you care for
F3	Q5	You could be sued.
Social offence	Q6	Your language could be offensive to other people.
	Q22	It's not worth the effort.
F4	Q23	Police or government authorities may monitor your conversation.
	Q32	You don't want people to think you are 'odd' or 'different.'

Malaysia 4 factors

Factor		
F1	Q5	You could be sued.
Social offence	Q6	Your language could be offensive to other people.
	Q21	You may be arrested for your opinions.
	Q23	Police or government authorities may monitor your conversation.
F2	Q18	People you admire and respect may not approve of you.
	Q27	People you want to be like may reject you.
Social rejection	Q32	You don't want people to think you are 'odd' or 'different.'
F3	Q1	Saying what's on your mind may harm or damage other people
Social sensitivity	Q2	Speaking your mind may hurt the feelings of those you care for
F4	Q15	You don't want to get involved.
	Q22	It's not worth the effort.

As summarized in Table 11, the relative ordering of these factors varied across countries. In Japan, the primary factor corresponded to social sensitivity, followed by two factors related to social rejection, while social offense emerged as the fourth factor. In Indonesia, the first factor reflected social rejection, followed by social sensitivity and social offense. In Malaysia, social offense emerged as the primary factor, followed by social rejection and social sensitivity. A fourth factor also appeared in the Indonesian and Malaysian analyses; however, its interpretation was less clear and may reflect context-specific patterns of communicative restraint.

Discussion

Interpretation of Cross-Cultural Differences

Indonesia

In Indonesia, communicative inhibition appears to be shaped by a combination of social rejection, social offense, and social sensitivity. The results suggest that Indonesian respondents regulate their speech not only out of concern for others' feelings but also due to awareness of social evaluation and potential institutional consequences. In cultural contexts, behavior is often guided by others' expectations and evaluations (Markus & Kitayama, 1991). As a result, individuals may carefully consider how their words affect relationships and social standing.

Concerns about social offenses were also relatively strong among Indonesian participants. This pattern may be interpreted in light of Indonesia's historical experience with authoritarian governance. During the New Order period (1966–1998), political expression was tightly controlled, and criticism of authority could lead to serious consequences (Aspinall, 2005). Although democratic reforms have expanded freedom of expression, a pattern of communicative caution may persist as part of collective social memory.

Cultural values emphasizing social harmony also help contextualize these findings. The concept of *rukun*, referring to the maintenance of harmonious social relationships, has long been recognized as a central moral value in Indonesian society (Geertz, 1961). Within such a framework, individuals may regulate their speech to avoid disrupting group cohesion. Religious and moral considerations may further shape communication, as public discourse in Indonesia is often informed by ethical and religious norms that guide appropriate social behavior (Hefner, 2000).

Taken together, the Indonesian findings suggest that communicative inhibition reflects culturally embedded norms emphasizing relational harmony, social evaluation, and awareness of authority. In classroom contexts, particularly when communicating in a foreign language, these considerations may contribute to cautious participation rather than a lack of engagement. While Indonesian communicative inhibition appears strongly influenced by hierarchical awareness and historical caution toward authority, patterns observed in Malaysia reflect a somewhat different configuration shaped by multicultural interaction and educational context.

Malaysia

The findings indicate that Malaysian respondents demonstrated communicative inhibition, albeit at lower levels than Japanese and Indonesian students. Social sensitivity, Social Offence, and social rejection emerged as the most salient dimensions. These patterns can be interpreted within Malaysia's sociocultural and educational context.

Malaysia is commonly characterised as a high-context, collectivist society, where indirect communication and relational harmony are prioritized (Hall, 1976; Hofstede, 2011). In such contexts, individuals are expected to attend carefully to contextual and relational cues. This orientation may heighten social sensitivity, as students monitor their speech to avoid misunderstandings or disruptions to group cohesion. In evaluative classroom environments, these norms may manifest as cautious or restrained participation.

Malaysia's multicultural and multiethnic composition may further encourage communicative caution. As a plural society comprising Malay, Chinese, Indian, and indigenous communities, interaction frequently occurs across ethnic and religious lines (Shamsul, 2001). In such contexts, speakers may exercise restraint to avoid offending, especially when discussing socially sensitive topics. Collectivist orientations and the prioritization of harmony over confrontation may reinforce concerns about Social Offence and rejection (Hofstede, 2011; Ting-Toomey, 1988). Respect for hierarchy and authority also remains socially salient, potentially discouraging open disagreement with instructors in public academic settings (Hofstede, 2011).

Linguistic factors may additionally contribute to inhibition. Although English is widely used in Malaysian higher education, it is not the first language for many students. Communicating in a second language can increase self-monitoring and communication anxiety, particularly in evaluative contexts (McCroskey, 1977). This dynamic suggests that inhibition may reflect not only cultural norms but also language-related performance concerns.

Religious and normative values, particularly among Malay-Muslim students, may further encourage modesty and restraint in public expression (Abdullah, 1996). However, the comparatively lower inhibition observed in Malaysia may reflect broader exposure to multilingual education and sustained intercultural interaction, which can foster communicative adaptability within diverse settings.

Overall, communicative inhibition among Malaysian students appears to reflect culturally situated norms emphasizing harmony, respect, and face management rather than communicative deficiency.

In contrast to the multicultural dynamics shaping communicative restraint in Malaysia, the Japanese pattern appears more firmly rooted in long-standing cultural norms emphasizing interpersonal harmony and sensitivity to others' feelings.

Japan

In Japan, social sensitivity emerged as the most influential factor inhibiting speech. Item Q2, "Speaking your mind may hurt the feelings of those you care for," ranked highest, followed by Q3, "You want to be polite," and Q1, "Saying what is on your mind may harm or damage other people." These findings indicate that Japanese respondents are primarily concerned with avoiding emotional harm and maintaining interpersonal harmony. In contrast, Q23, "Police or government authorities may monitor your conversation," ranked lowest in Japan but second highest in Indonesia and Malaysia. This cross-national contrast suggests that institutional or legal concerns play a comparatively minor role in communicative restraint among Japanese participants. Rather, inhibition appears to be shaped predominantly by relational considerations.

This tendency may be interpreted in light of Japan's cultural, social, and historical context. The emphasis on social harmony can be traced back to early state formation. In 604 CE, Prince Shōtoku promulgated the Seventeen-Article Constitution, a moral framework for governance whose first article advocates harmony and the avoidance of conflict. Although originally directed at governing elites, this principle of *wa* (harmony) has been widely interpreted as a foundational cultural norm that continues to shape Japanese social interaction. Over time, the

prioritization of harmony has become deeply embedded in social expectations and moral education.

Comparative findings further clarify this pattern. Wyatt et al. (1996) report that among Arab participants, fear of divine punishment (Q29) was a central inhibiting factor, highlighting the regulatory role of religious belief. In Japan, by contrast, secular moral norms—particularly the maintenance of social harmony—appear to serve as the primary regulatory mechanism. From early childhood through secondary education, students socialize through both formal instruction and collective activities that emphasize cooperation, empathy, and group cohesion. Consequently, individuals may unconsciously prioritize others' feelings and the preservation of harmonious relationships when deciding whether to speak.

Postwar socioeconomic developments have further reinforced this orientation. Rapid economic growth generated material prosperity, after which greater emphasis was placed on relational and psychological well-being. Experiences of natural disasters and economic downturns have also reinforced the importance of mutual support and collective resilience (Ministry of Land, Infrastructure, Transport and Tourism, 2019). These societal experiences may have deepened sensitivity to interpersonal relationships as a foundation of social stability.

Geographical and political conditions provide additional context. As an island nation with limited experience of foreign rule, Japan has maintained considerable sociopolitical continuity, apart from the post–World War II occupation period. This continuity has contributed to a relatively homogeneous and group-oriented society in which shared norms regulate behavior. Moreover, prolonged political stability and the absence of severe internal conflict in the postwar era may explain why concerns about governmental monitoring exert comparatively little influence on communicative restraint.

In conclusion, the prominence of social sensitivity as the primary inhibiting factor in Japan reflects the interaction of historical values, moral education, socioeconomic experience, and political stability. Communicative inhibition in the Japanese context is therefore best understood as a culturally embedded orientation that prioritizes relational harmony.

Overall, the findings suggest that communicative inhibition reflects culturally specific patterns across the three countries. In Japan, restraint in communication appears to be primarily guided by concerns for interpersonal harmony. In Malaysia, communicative caution is shaped by multicultural interaction and sensitivity to contextual differences. In Indonesia, inhibition reflects a combination of relational awareness and historical caution toward authority.

Theoretical and Pedagogical Implications

Beyond Anxiety: Rethinking Classroom Silence as Communicative Inhibition

The findings suggest that classroom silence cannot be explained solely through Foreign Language Classroom Anxiety (FLCA). While previous research has linked silence to fear of negative evaluation and low confidence (Horwitz et al., 1986; MacIntyre & Gardner, 1991), the present study highlights the role of culturally grounded communicative inhibition.

Unlike anxiety as an internal emotional state, inhibition reflects socially informed self-restraint. The dimensions identified—social sensitivity, social rejection, and social offense—indicate

that students regulate their speech not only due to anxiety but also in response to concerns about relational harmony, social evaluation, and institutional expectations.

Cross-cultural differences further support this interpretation. In Japan, inhibition is closely tied to interpersonal harmony; in Indonesia, it reflects both relational awareness and sensitivity to authority; and in Malaysia, it is shaped by multicultural interaction and contextual sensitivity. These patterns suggest that silence may function as a culturally appropriate communicative strategy rather than merely a sign of psychological discomfort.

This perspective broadens the interpretation of classroom silence beyond deficit-oriented views, positioning it instead as part of culturally shaped communication practices.

Classroom Implications

The findings of this study also have practical implications for language teaching and classroom interaction. If communicative inhibition is partly rooted in cultural norms, educators should be cautious about interpreting student silence as merely disengagement or a lack of preparation. In some cases, silence may reflect students' efforts to maintain politeness, avoid disrupting group harmony, or prevent potential embarrassment for themselves or others.

Teachers working in multicultural or international classrooms may therefore benefit from creating communicative environments that reduce the perceived social risk of speaking. Strategies such as small-group discussions, collaborative tasks, and supportive feedback can help lower the interpersonal pressure associated with public speaking. These approaches may allow students to participate more comfortably while still respecting culturally shaped communication preferences.

In addition, teachers may consider explicitly discussing participation norms with students. Clarifying that mistakes are acceptable and that diverse perspectives are valued can help create a classroom climate where speaking is perceived as safe rather than socially risky. At the same time, participation policies must remain culturally sensitive and not unintentionally penalize students whose communicative styles emphasize restraint.

Overall, understanding communicative inhibition as both a cultural and psychological phenomenon can help educators interpret classroom silence more accurately. Rather than assuming a single universal explanation, teachers can recognize that participation patterns are shaped by a combination of language proficiency, individual confidence, and culturally informed communication norms.

Limitations

Several limitations should be acknowledged. First, the questionnaire measured general communicative inhibition rather than classroom-specific behavior, so its direct relationship to foreign language learning contexts should be interpreted with caution. Future research could examine classroom inhibition more directly.

Second, the study relied on self-reported data, which may not fully reflect actual communicative behavior. Observational or mixed-method approaches could provide a more comprehensive understanding.

Third, differences in academic backgrounds across the three countries' samples may have influenced communication patterns and classroom expectations.

Finally, the findings are limited to Japan, Indonesia, and Malaysia and cannot be generalized to all cultural contexts.

Despite these limitations, this study provides an initial step toward understanding communicative inhibition as a culturally embedded phenomenon and highlights the importance of considering sociocultural factors in interpreting classroom silence.

Conclusion

This study examined communicative inhibition across Japan, Indonesia, and Malaysia and found that student silence reflects culturally shaped communication patterns rather than solely foreign language anxiety. Japanese students emphasize interpersonal harmony, Malaysian students navigate multicultural sensitivity, and Indonesian students balance relational awareness with caution toward authority. These findings highlight the importance of interpreting classroom silence within its sociocultural context. Understanding communicative inhibition can help educators foster more inclusive and supportive learning environments.

Declaration of Generative AI and AI-Assisted Technologies in the Writing Process

The authors used AI-assisted tools solely for language editing and formatting. All research content, analysis, and conclusions are the original work of the authors.

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Appendices

Appendix A

Items From the Inhibition Survey Questionnaire (Wyatt et al., 1996)

The questionnaire used in this study consists of 33 items designed to measure reasons why individuals may refrain from expressing sincere opinions in social contexts. Participants rated each item on a **10-point Likert scale** ranging from **1 (strongly disagree) to 10 (strongly agree)**.

Item	Statement
Q1	Saying what is on your mind may harm or damage other people.
Q2	Speaking your mind may hurt the feelings of those you care for.
Q3	You want to be polite.
Q4	You like for everything to go smoothly.
Q5	You could be sued.
Q6	Your language could be offensive to other people.
Q7	People may misunderstand what you mean.
Q8	Someone might take what you say the wrong way.
Q9	Others may think you are rude.
Q10	People may become upset with you.
Q11	You may create tension in the conversation.
Q12	People may become angry with you.
Q13	You may damage relationships with others.
Q14	Others may disagree strongly with you.
Q15	Someone might challenge your opinion.
Q16	People may criticize you.
Q17	People may think you do not know what you are talking about.
Q18	People you admire and respect may not approve of you.
Q19	You may appear disrespectful.
Q20	People may judge you negatively.

Item	Statement
Q21	You may be arrested for your opinions.
Q22	Authorities may take action against you.
Q23	Police or government authorities may monitor your conversation.
Q24	Someone may report what you said.
Q25	Your words may be used against you.
Q26	You may face institutional consequences.
Q27	People you want to be like may reject you.
Q28	You may be excluded from a group.
Q29	Others may punish you socially.
Q30	You may lose opportunities because of what you say.
Q31	You may regret what you say later.
Q32	Someone might misinterpret your intention.
Q33	Expressing your opinion may create conflict.

Appendix B

Pairwise Country Comparisons of Mean Inhibition Scores (Anova Results)

Detailed statistical results for the 31 item-level analyses of variance (ANOVAs) conducted in this study are provided in this appendix. These analyses examined cross-cultural differences in communicative inhibition for each questionnaire item across the three national samples.

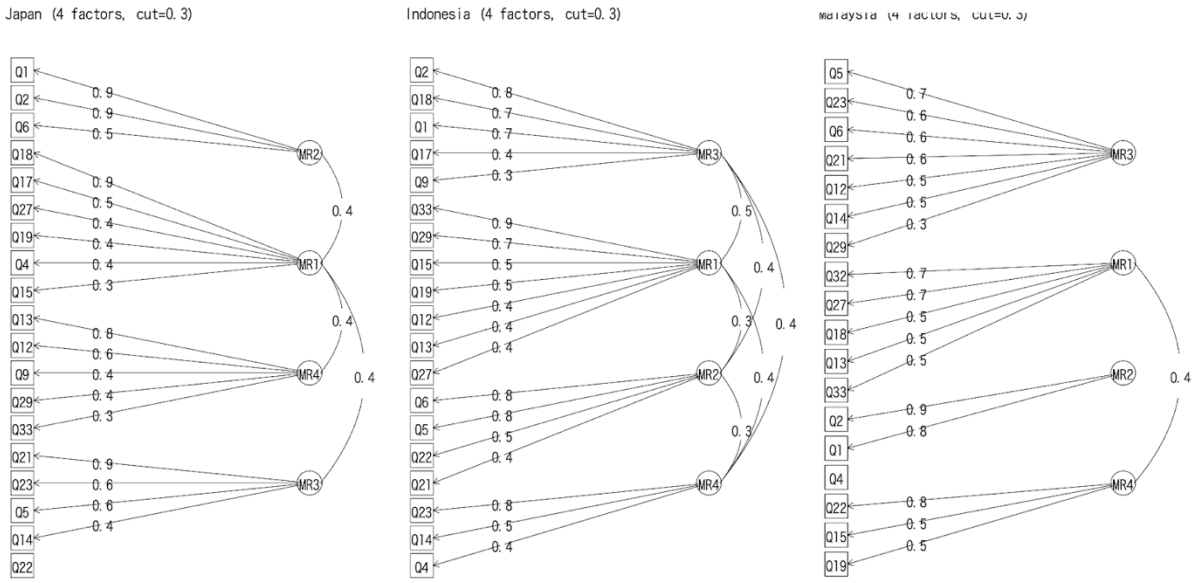
The Benjamini–Hochberg false discovery rate (FDR) correction was applied to control for multiple comparisons. After correction, 21 items showed statistically significant differences among the three countries, while 10 did not.

ANOVA	Averages				Ind <-> Jap				Mal <-> Jap				Mal <-> Ind				
	Qn	Jap	Ind	Mal	Ind<->Jap	diff	p-val	Sig.	Mal <-> Japan	diff	p-val	Sig	Mal<-> Ind	diff	p-val	Sig.	Question
1	Q01	8.02	6.19	5.19	Ind < Jap	-1.83	0.0000	***	Mal < Jap	-2.83	0.0000	***	Mal < Ind	-1.00	0.0108	*	Saying what's on your mind may harm or damage other people
2	Q02	8.11	6.15	5.59	Ind < Jap	-1.96	0.0000	***	Mal < Jap	-2.52	0.0000	***	Mal < Ind	-0.56	0.2584		Speaking your mind may hurt the feelings of those you care for
3	Q03	8.08	8.10	8.15	Ind < Jap	-0.16	0.8396		Mal < Jap	-0.50	0.1276		Mal < Ind	-0.34	0.5222		You want to be polite.
4	Q04	6.79	5.25	3.89	Ind > Jap	1.32	0.0001	***	Mal > Jap	1.37	0.0000	***	Mal > Ind	0.05	0.9876		You like for everything to go smoothly.
5	Q05	3.26	6.06	4.38	Ind > Jap	1.99	0.0000	***	Mal > Jap	0.63	0.1153		Mal < Ind	-1.36	0.0013	**	You could be sued.
6	Q06	7.38	6.74	5.56	Ind < Jap	-1.32	0.0003	***	Mal < Jap	-3.00	0.0000	***	Mal < Ind	-1.68	0.0000	***	Your language could be offensive to other people.
7	Q07	3.80	6.06	5.24	Ind > Jap	0.55	0.2904		Mal < Jap	-0.24	0.7459		Mal < Ind	-0.79	0.1126		You may be hit or physically harmed.
8	Q08	7.02	4.79	5.65	Ind > Jap	0.71	0.1246		Mal > Jap	0.17	0.8550		Mal < Ind	-0.54	0.3519		You like to avoid arguments.
9	Q09	5.63	7.28	4.51	Ind > Jap	1.10	0.0065	**	Mal < Jap	-0.07	0.9713		Mal < Ind	-1.17	0.0069	**	What you say may be taken out of context or misquoted.
10	Q10	4.01	5.29	5.64	Ind > Jap	0.86	0.0404	*	Mal > Jap	0.74	0.0506		Mal < Ind	-0.12	0.9438		Your teacher may make things difficult for you.
11	Q11	5.83	6.25	5.19	Ind > Jap	0.03	0.9976		Mal < Jap	-0.46	0.3702		Mal < Ind	-0.49	0.4674		What you say may come back to haunt you.
12	Q12	6.61	5.74	4.95	Ind < Jap	-0.55	0.2209		Mal < Jap	-1.37	0.0000	***	Mal < Ind	-0.81	0.0612		Your opinions could be offensive to other people.
13	Q13	6.54	6.00	4.85	Ind < Jap	-1.74	0.0000	***	Mal < Jap	-0.88	0.0163	*	Mal > Ind	0.86	0.0681		You may be misunderstood.
14	Q14	4.01	5.75	3.48	Ind > Jap	3.27	0.0000	***	Mal > Jap	0.50	0.2365		Mal < Ind	-2.77	0.0000	***	You may not get ahead in the school work.
15	Q15	7.53	5.19	4.87	Ind < Jap	-2.24	0.0000	***	Mal < Jap	-1.89	0.0000	***	Mal > Ind	0.35	0.6180		You don't want to get involved.
17	Q17	5.07	6.15	3.53	Ind > Jap	1.18	0.0038	**	Mal > Jap	0.12	0.9215		Mal < Ind	-1.06	0.0200	*	People may think you don't know what you're talking about.
18	Q18	4.35	5.46	4.90	Ind > Jap	1.38	0.0003	***	Mal > Jap	0.60	0.1406		Mal < Ind	-0.79	0.0974		People you admire and respect may not approve of you.
19	Q19	4.54	5.43	4.09	Ind > Jap	1.46	0.0004	***	Mal > Jap	0.30	0.6355		Mal < Ind	-1.15	0.0121	*	A spouse, relative or close friend is listening and would not approve of what you say.
20	Q20	5.42	5.69	5.05	Ind < Jap	-0.58	0.2775		Mal < Jap	-0.04	0.9911		Mal > Ind	0.54	0.3847		You are uncomfortable expressing an unpopular viewpoint.
21	Q21	2.03	6.19	5.19	Ind > Jap	3.72	0.0000	***	Mal > Jap	1.45	0.0000	***	Mal < Ind	-2.27	0.0000	***	You may be arrested for your opinions.
22	Q22	3.74	6.15	5.59	Ind > Jap	1.45	0.0006	***	Mal > Jap	1.13	0.0032	**	Mal < Ind	-0.32	0.7141		It's not worth the effort.
23	Q23	1.48	8.10	8.15	Ind > Jap	4.67	0.0000	***	Mal > Jap	2.05	0.0000	***	Mal < Ind	-2.62	0.0000	***	Police or government authorities may monitor your conversation.
24	Q24	5.13	5.25	3.89	Ind < Jap	-0.28	0.7687		Mal < Jap	-0.07	0.9792		Mal > Ind	0.21	0.8798		You want everybody to like you.
25	Q25	4.97	6.06	4.38	Ind > Jap	0.73	0.1511		Mal < Jap	-0.12	0.9375		Mal < Ind	-0.84	0.1094		You may make a fool out of your-self.
26	Q26	6.09	6.74	5.56	Ind < Jap	-0.27	0.7623		Mal < Jap	-0.37	0.5253		Mal < Ind	-0.10	0.9679		You are shy.
27	Q27	4.02	6.06	5.24	Ind > Jap	1.44	0.0003	***	Mal > Jap	0.88	0.0212	*	Mal < Ind	-0.56	0.3364		People you want to be like may reject you.
28	Q28	4.84	4.79	5.65	Ind > Jap	0.81	0.0804		Mal > Jap	0.02	0.9988		Mal < Ind	-0.79	0.1215		Your opinions aren't really important.
29	Q29	4.06	7.28	4.51	Ind > Jap	1.37	0.0010	***	Mal > Jap	0.04	0.9935		Mal < Ind	-1.33	0.0032	**	God may punish you for what you say.
30	Q30	5.00	5.29	5.64	Ind > Jap	0.66	0.1748		Mal < Jap	-0.12	0.9265		Mal < Ind	-0.78	0.1202		You are reluctant to express a minority viewpoint.
32	Q32	4.61	6.25	5.19	Ind > Jap	1.64	0.0001	***	Mal > Jap	0.85	0.0410	*	Mal < Ind	-0.79	0.1444		You don't want people to think you are 'odd' or 'different.'
33	Q33	4.28	5.74	4.95	Ind > Jap	1.42	0.0007	***	Mal > Jap	0.78	0.0602		Mal < Ind	-0.64	0.2647		People may think you are not 'cool' (or not 'with it').

Appendix C

Factor Diagrams for Exploratory Factor Analysis

Appendix C presents factor diagrams from the exploratory factor analyses conducted for Japan, Indonesia, and Malaysia. The diagrams show loadings greater than .30 and illustrate the relationships between questionnaire items and latent factors across countries.



Reclaiming Voice: Student Ownership in AI-Assisted Academic Writing in an EMI Context

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Abstract

As generative AI tools become more common in student writing, teachers in English-medium instruction (EMI) contexts are facing new questions about authorship and ownership. While AI can produce writing that appears academically appropriate, it is not clear how students understand their role when working with AI-generated text. This study examines how multilingual undergraduate students define and assert ownership when comparing and revising AI output. The data come from a four-day mini-term course in China where students compared their own writing with AI versions, revised AI sentences, and reflected on what authorship means in AI-assisted writing. Using Ivanič and Camps' (2001) framework of textual, ideational, and interpersonal positioning, the study analyzes how students' revision choices align with their written reflections on ownership. The findings show that students most often define ownership as making deliberate rhetorical decisions, particularly about tone and intention. Revisions related to audience and stance were the clearest indicators of ownership. The study suggests that structured comparison and revision tasks can help students develop a stronger sense of voice and agency when using AI.

Keywords: AI-assisted writing, authorial voice, student ownership, EMI, rhetorical positioning

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Introduction

Generative AI tools are now widely used in student writing. Many students rely on AI to generate drafts, improve language, or help them meet academic expectations. While these tools can support writing development, they also raise important questions about authorship and ownership. This is particularly relevant in English-medium instruction (EMI) contexts, where multilingual students are writing in a second or additional language while also developing their academic identities.

Research in second language writing has long argued that voice is not simply personal expression but develops through the rhetorical choices writers make in their texts (Ivanič & Camps, 2001). Writers represent themselves through style, ideas, and stance toward readers. In EMI contexts, students must often balance institutional academic norms with their own linguistic and cultural identities (Tardy, 2012). When AI produces text, it becomes important to ask how students understand their own role in shaping that text.

Research Questions

This study examines how students evaluate AI-generated writing and how they define authorship when revising AI-assisted text. The study addresses the following research questions:

1. How do students assert ownership of AI-assisted writing when comparing their own writing with AI-generated text?
2. What factors influence how students express their individual voice (such as tone, ideas, and stance toward readers) when revising AI-generated writing?

This study explores these questions by examining how multilingual undergraduate students define and assert ownership when comparing and revising AI-generated writing. Rather than assuming that AI reduces student voice, the study examines how students decide when an AI-assisted text becomes their own.

Literature Review

Ivanič and Camps (2001) describe voice as self-representation in writing, shaped through three forms of positioning; textual, ideational, and interpersonal. *Textual positioning* refers to how writers present themselves through stylistic and structural choices. *Ideational positioning* involves alignment with ideas, beliefs, or lived experience. *Interpersonal positioning* concerns how writers manage stance and their relationship with readers. This framework emphasizes that voice emerges through rhetorical choices writers make in response to context rather than as a fixed personal quality.

This understanding of voice as socially constructed has been reinforced in later research on second language writing. Studies show that voice develops through rhetorical choices shaped by genre, disciplinary expectations, and awareness of audience (Matsuda & Tardy, 2007). Later work has further emphasized how voice is constructed and interpreted within academic contexts (Tardy, 2012). Rather than being a purely personal trait, voice reflects how writers position themselves within particular writing situations. In EMI settings, multilingual writers often negotiate tensions between sounding “academic” and sounding authentic (Canagarajah, 2015). Writing therefore becomes a space where identity, authority, and institutional expectations intersect.

These tensions have become particularly visible with the emergence of generative AI tools in writing. With the rise of Gen-AI capable of producing coherent academic texts, new debates have emerged about authorship, agency, and originality. Some research argues that AI complicates traditional understandings of originality because it can generate fluent text that resembles academic writing (Kasneci et al., 2023). However, comparison and revision tasks may encourage students to critically evaluate and reshape generated text rather than accept it uncritically. Research on AI-supported writing has also suggested that interacting with AI-generated text can prompt students to reflect more carefully on their own rhetorical choices during revision (Mollick & Mollick, 2023).

Recent discussions have suggested that authorship in AI-assisted writing may depend on how writers evaluate and revise AI-generated text rather than simply accepting it (Mollick & Mollick, 2023). However, empirical research examining how students themselves define ownership when working with AI remains limited. In particular, little research has examined whether students' stated definitions of authorship align with the revision choices they make when comparing their own writing with AI-generated text. This study contributes to this discussion by analyzing how students define authorship and whether those definitions correspond with the revision decisions they make when evaluating AI-generated writing.

Methodology

This study was conducted in a four-day mini-term course[1] titled *Discovering Your Voice with AI* at a Sino-American university in China operating under an English-medium instruction (EMI) model. Sixteen multilingual undergraduate students participated, the majority of whom were Chinese L1 speakers. The course was designed to encourage critical engagement with AI through structured comparison, revision, and reflection activities.

The data consist of three written classroom tasks. In Lesson 1, students wrote a descriptive paragraph and then generated an AI version using the same prompt. They completed a structured comparison identifying similarities and differences between the two texts. In Lesson 2, students selected AI-generated sentences and explained what they would keep, change, or reject, providing written reasons for their decisions. In Lesson 4, students wrote short reflections defining authorship and ownership in AI-assisted writing. All data were written responses produced during class.

The analysis used deductive (eg. Elo & Kyngäs, 2008) coding based on Ivanič and Camps' (2001) framework of textual, ideational, and interpersonal positioning. Students' written explanations of their revision decisions were treated as the primary unit of analysis and coded according to these three categories. Coding focused on how students explained the choices they made when comparing their own writing with AI-generated text. Ownership was not defined in advance by the researcher; instead, students' Lesson 4 reflections were analyzed to understand how they conceptualized authorship.

Comparing these reflections with the revision explanations from Lessons 1 and 2 allowed for triangulation between students' stated definitions of ownership and their revision practices when evaluating AI-generated writing.

[1] Mini-terms at Duke Kunshan University are short, intensive courses held between regular semesters, typically lasting four days; undergraduate students are required to complete a mini-term at some point during their degree.

Results

Across tasks, students most frequently described ownership in terms of the revision choices they made rather than who produced the first version of the text. The analysis below shows how these revision decisions appeared across textual, ideational, and interpersonal positioning.

Defining Ownership

Students' revision explanations were analyzed using the three positioning categories proposed by Ivanič and Camps (2001); textual, ideational, and interpersonal. Most students defined ownership as having control over the final version of the text. They described authorship as deciding what to keep, what to change, and how the writing should sound. Ownership was rarely described as simply correcting grammar. Instead, students emphasized intention, tone, and meaning. These definitions indicate that students viewed authorship as an active process of shaping the text rather than solely producing the initial version.

Textual Positioning

In the Lesson 1 comparison task, students frequently evaluated stylistic features of the AI-generated text. Some students rejected descriptions that sounded "like a greeting card," suggesting that the phrasing did not match how they wanted the experience to be represented. In other cases, students commented that although certain phrases were appealing, much of the generated text "did not sound right." These responses reflect textual positioning because students were evaluating tone, phrasing, and stylistic appropriateness.

Ideational Positioning

Students sometimes rejected AI content because it did not accurately represent the meaning they intended to express. For example, one student noted that a sentence "captures the return feeling" and reflects the sense of "same routines." Comments such as these suggest that students evaluated whether the ideas in the AI-generated text aligned with their own experiences or intended message. When students added details or clarified meaning, they were asserting ideational positioning by aligning the ideas in the text with their own perspectives.

Interpersonal Positioning

Interpersonal positioning appeared when students revised AI-generated sentences to better reflect how they wanted to present themselves to readers. In the Lesson 2 revision task, students sometimes modified wording that felt overly expressive or did not match the tone they wanted to convey. These revisions involved adjusting stance and reader engagement rather than simply changing individual words or sentences.

Alignment Between Ownership Definitions and Revision Practices

When compared with Lesson 4 reflections, students who defined ownership in terms of expressing their own intention or meaning were also those who most consistently made tone-related revisions in earlier tasks. This pattern suggests a connection between how students conceptualized authorship and the types of revision decisions they made when evaluating AI-generated writing.

Together, these findings indicate that students often viewed authorship not as producing the initial draft but as actively shaping the final version of the text through revision decisions involving style, meaning, and audience awareness.

Discussion

The findings suggest that students mainly understood ownership as having control over how the final text is shaped rather than as writing completely independently from AI. This supprots Ivanič and Camps' (2001) argument that voice develops through the ways writers position themselves in their texts. In this study, students did not define authorship as producing writing without AI assistance. Instead, they described ownership as making choices about tone, meaning, and intention; specifically, the idea that voice is not removed when external discourse (e.g. Gen-AI assisted writing) is present. Rather, voice appears in how writers respond to and revise that discourse.

Textual positioning showed that students were highly aware of stylistic differences between their own writing and AI output. For example, some students focused on specific wording choices, noting that the AI version used "better word choices," while others preferred their own phrasing when the AI wording seemed unclear or overly complex. One student rejected a phrase such as "inexpensively acquired," commenting that it would be clearer to simply say "cheap." These comments suggest that students were evaluating how language choices affected clarity and tone. This reflects Matsuda and Tardy's (2007) argument that voice develops in relation to expectations about academic discourse. Students were not simply accepting AI wording but were actively evaluating whether it fit their intended style and meaning. This negotiation of language choice is consistent with research showing that writers construct voice through rhetorical decisions that shape how their identity is interpreted within academic contexts (Canagarajah, 2015; Tardy, 2012).

Ideational positioning appeared when students evaluated whether the ideas expressed in the AI-generated text aligned with what they intended to communicate. Some students commented that the AI description was "too generalized," suggesting that the content lacked the specificity they wanted to convey. Others rejected AI suggestions when they felt the meaning was inaccurate. For example, one student rejected a phrase such as "untouched football field," explaining that it was "inaccurate." These revisions show that ownership involved deciding what ideas were appropriate to include, not only how they were expressed.

Interpersonal positioning appeared when students considered how the text represented their feelings or stance toward the topic. Some students preferred AI phrasing when it better captured emotional tone. For instance, one student commented that the phrase "all my worries just fade away" felt "genuine and warm." In these moments, students were evaluating how the text positioned the writer in relation to the reader and the experience being described. This reflects Hyland's (2002) description of writing as involving stance-taking and audience awareness.

The findings also contribute to current discussions about AI and authorship. Rather than replacing student voice, the data suggest that structured comparison tasks can help students become more aware of their rhetorical choices. Mollick and Mollick (2023) suggest that authorship in AI-assisted writing may depend less on who produces the first version of a text and more on the choices writers make when revising it. The students in this study described ownership in very similar terms.

The EMI context may make this process even more noticeable. Students writing in a second language are already negotiating what counts as "academic" writing. AI-generated text that appears polished or expressive may initially seem authoritative, but comparison tasks encourage students to question that authority. When students explain why they revise AI sentences, they often articulate their own understanding of what academic voice should sound like.

Overall, these findings show that Ivanič and Camps' (2001) framework remains useful for understanding authorship in AI-assisted writing contexts. Even when AI generates part of the text, voice still develops through the rhetorical choices writers make. Ownership, in this sense, lies in how writers shape and revise the text rather than in who produced the first draft.

Pedagogical Implications

The tasks analyzed as part of this study suggest practical ways instructors can incorporate AI into writing instruction without reducing students' sense of authorship. In the first task, students wrote their own descriptive paragraph and then generated an AI version using the same prompt. Comparing the two texts helped students identify differences in tone, detail, and structure. This type of comparison encourages students to notice how voice emerges through rhetorical choices, which aligns with research showing that voice develops through stylistic and positional decisions rather than simply personal expression (Ivanič & Camps, 2001).

The second task required students to select AI-generated sentences and explain whether they would keep, change, or reject them. Requiring written justification encouraged students to reflect on why certain sentences did or did not represent their intended meaning. These types of revision decisions highlight students' agency in shaping the final text. Recent work on AI-assisted writing has suggested that AI can support learning when students critically evaluate and revise generated content rather than simply accepting it (Mollick & Mollick, 2023).

The final reflection task asked students to define authorship and ownership when working with AI. Many students described ownership as the ability to decide what the final text should say and how it should sound. Asking students to articulate this definition appeared to strengthen their awareness of their role in shaping the text. Reflection tasks have long been used in writing instruction to support metacognitive awareness of writing choices.

In EMI contexts, activities that combine comparison, revision, and reflection may therefore help students understand that academic voice develops through the choices writers make when responding to disciplinary expectations and communicating with readers. Using AI output as a text to evaluate and revise, rather than simply accept, may help students become more aware of tone, meaning, and audience in their writing.

Conclusion

This study examined how multilingual undergraduate students in an EMI context define and assert ownership when working with AI-generated text. Using Ivanič and Camps' (2001) framework of textual, ideational, and interpersonal positioning, the analysis showed that students most often understood ownership as the choices they made when revising AI output. Rather than focusing on who produced the first version of the text, students emphasized their role in deciding what to keep, change, or reject.

Across the dataset, interpersonal positioning, particularly decisions about tone and how the writer relates to the reader, appeared most closely connected to students' definitions of authorship. Students who described ownership as expressing their intention or meaning were also those who most often revised tone and stance in the AI-generated sentences.

Taken together, these findings suggest that students may view authorship less as producing text independently and more as having control over how a final text represents their ideas and voice. In AI-assisted writing contexts, ownership therefore appears to emerge through revision decisions rather than through the absence of AI input.

As generative AI becomes more common in academic writing, teaching approaches that emphasize comparison, revision, and reflection may help students better understand their role in shaping a text. Structured engagement with AI may therefore provide opportunities for students to think more carefully about tone, meaning, and audience in their writing.

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The Development of Science Activity Packages Learning on *The Basic Household Wastewater Management Methods* for Mathayomsuksa 1 Students

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Abstract

There were three Purposes of the study: 1) to development and identify educational quality of science activity packages learning on "The Basic Household Wastewater Management Methods" for Mathayomsuksa 1. (Grade 7) students to attain the efficiency index of 80/80. 2) to study learning outcomes; knowledge and science process skills of MS 1. Students by science activity packages learning. 3) to study attitude toward water resources of MS. 1. Students by science activity packages learning. and 4) to study the MS. 1 students' toward satisfaction in the science activity packages learning. The study was accomplished through two stages of operation; 1) development and quality evaluation of science activity packages learning by specialist science and environment education experimentation with a group of three students nine students and thirty students successively. 2) performing experimental teaching by employing the science activity packages learning with the sampling coming up with a group in one class (from 4 class of 40 MS.1 in the first semester of 2025 academic year of Sriboonyanon school) for 16 periods (50 minutes a period) for the experimental teaching. The results were as follows: 1. The science activity packages learning were at higher educational quality and efficiency index 82.65/83.84. 2. Learning outcomes of students exposed to instruction utilizing the developed science activity packages learning were found to be positive: 1) students' post-test scores on knowledge were significantly higher than their pre-test scores, 2) The students' post-test scores on science process skills were significantly higher than their pre-test scores ($p < .05$). 3) Students' post-test scores on attitude toward water resources designated as "good level." 4) Students' toward satisfaction in science activity packages learning were of a "high level."

Keywords: science activity packages learning, wastewater management, water resources

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Introduction

The water resource crisis in Thailand has reached a critical threshold, particularly within the Lower Chao Phraya Basin. As the nation's primary arterial waterway, the Chao Phraya River faces severe degradation due to rapid urbanization and inadequate waste management. According to the Pollution Control Department (2023), domestic wastewater discharge from households remains the predominant source of organic contamination. Scientific monitoring reveals that water quality in densely populated areas, such as Nonthaburi and Bangkok, frequently fails to meet the Surface Water Quality Standards (Class 3-4). Key indicators of this "invisible crisis" include Biochemical Oxygen Demand (BOD) levels exceeding the 4.0 mg/L threshold and Dissolved Oxygen (DO) levels occasionally plummeting below 2.0 mg/L a state detrimental to aquatic life. Furthermore, the high concentration of Oil and Grease from kitchen discharge creates surface films that obstruct gas exchange, further exacerbating the depletion of oxygen in the river and its connected canal networks (Pollution Control Department, 2024).

In response to these environmental challenges, the Ministry of Education (2023) has mandated a shift toward Competency-Based Education and Active Learning. The national strategy emphasizes "Green Education," aimed at cultivating students who possess Scientific Literacy the ability to apply scientific knowledge to real-world contexts. This aligns with the Institute for the Promotion of Teaching Science and Technology (IPST, 2017) guidelines, which promote Inquiry-Based Learning and the BCG (Bio-Circular-Green) Economy Model. Education is no longer confined to theoretical memorization; it is now a vehicle for sustainable development, encouraging students to act as "Change Agents" within their communities to mitigate local environmental impacts.

Sriboonyanon School is strategically located on the banks of the Chao Phraya River, where the students' daily lives are inextricably linked to the water. Many students reside in households situated along canals that discharge directly into the river. Despite their proximity to the problem, there is a significant gap in the students' practical ability to manage household wastewater. Traditional science laboratories often lack the "Context-Based" approach necessary to make learning relevant. To address this, the researcher developed the Science Activity Packages titled "The Basic Household Wastewater Management Methods" specifically for Grade 7 (Mathayomsuksa 1) students. This innovation leverages the school's unique location as a living laboratory to study the properties of matter and separation techniques through the lens of environmental preservation.

The developed curriculum bridges the gap between the Basic Education Core Curriculum (2017) and practical environmental stewardship. It consists of five specialized modules:

- Module 1 Water Quality Testing – Empirical analysis of pH, DO, TDS, and Grease levels to identify local contamination.
- Module 2 Sedimentation Techniques – Applying the principles of chemical and physical separation to clarify domestic wastewater.
- Module 3 Grease Trap Construction – Engineering simple, low-cost solutions to intercept oils at the source.
- Module 4 Bio-composting from Food Waste – Utilizing microbial action to reduce organic loads in accordance with biological treatment principles.
- Module 5 Project-based Solutions – Synthesizing skills to design sustainable wastewater management plans for the students' own homes and riverside communities.

The objective of this research is to develop and evaluate the efficiency of these Science Activity Packages to meet the 80/80 standard criterion. Beyond improving academic achievement, the study aims to enhance students' Scientific Process Skills and foster a deep sense of Environmental Awareness. By integrating the Ministry of Education's vision with the urgent need for Chao Phraya River conservation, this research provides a scalable model for community-based science education that promotes a sustainable future for Thailand's water resources

Research Goals

1. To development and identify educational quality of science activity packages learning on "*The Basic Household Wastewater Management Methods*" for Mathayomsuksa 1. (Grade 7) students to attain the efficiency index of 80/80.
2. To study learning outcomes; knowledge and science process skills of MS 1. Students by science activity packages learning.
3. To study attitude toward water resources of MS. 1. Students by science activity packages learning.
4. To study the MS. 1 students' toward satisfaction in the science activity packages learning.

Figure1

Students Measuring Dissolved Oxygen (Do) Levels in Canal Water

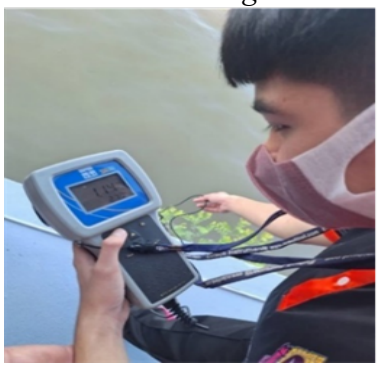


Figure 2

Students Measuring Tds, and PH Levels From Various Water Sources



Figure 3
Students Performing a Laboratory Activity Focused on Removing Suspended Substances From Water Through Physical Separation Techniques



Figure 4
Students Practicing the Construction of a Household Grease Trap Prototype



Figure 5
Students Engaged in a Collaborative Design Process for Domestic Wastewater Management



Methods

The study was accomplished in 8 steps: Development of the science activity packages learning on "*The Basic Household Wastewater Management Methods*" were divided into 5 Modules: 1) Water Quality Testing (DO, Oil and Grease, TDS, and pH), 2) Sedimentation Techniques, 3) Grease Trap Construction, 4) Bio-composting from Food Waste and 5) Project-based Solutions. The details are as follows:

1. Determination of the quality of the science activity packages learning by specialist science and environment education. A total of 3 people evaluated six areas: 1) Learning Outcomes, Contents 3) Using Language and Illustrations ,4) Learning Activities, 5) Experimental kit, and 6) Post-test. Each area was evaluated with one of the following ratings:

1.00–1.50 = very low
1.51–2.50 = low
2.51–3.50 = medium
3.51–4.50 = good
4.51–5.00 = very good.

2. The evaluation results of the science activity package were utilized to revise and enhance its quality. This iterative process incorporated expert feedback and recommendations until the evaluation scores reached a minimum threshold of "Good." Subsequently, the refined activity set was implemented for pilot testing with small groups of 3 and 9 students, respectively.
3. The developed science activity package underwent a field trial to determine its efficiency according to the established criteria prior to formal implementation. The procedure is outlined as follows:

   Participants and Setting – The efficiency test was conducted with 30 MS. 1 students at Sriboonyanon School during the first semester of the 2025 academic year.

   Efficiency Criteria (E_1/E_2) – The package was evaluated based on the 80/80 efficiency standard. Upon achieving this standard, the validated package was subsequently implemented for experimental instruction with the research sample.
4. Performance of experimental teaching by inviting a single sample group (sampled from 4 classes of 40 MS. 1 students, from Sriboonyanoon school during the first semester of the 2025 academic year, Nonthaburi, Thailand) for 16 periods (50 minutes a period).
5. Assessment of students' knowledge gained from learning in the science activity packages, which divides the assessment of the desired behavior into 4 areas: 1) knowledge (8 points), 2) comprehension (10 points), 3) Process of scientific inquiry (12 points), and 4) Application of scientific knowledge (10 points), total 40 points.
6. The assessment of students' scientific process skills acquired through the use of science activity packages. The evaluation is categorized into eight key areas, totaling 40 points: 1) Observation (3 points), 2) Measurement (4 points), 3) Using numbers/Calculation (5 points), 4) Classification (8 points), 5) Formulating hypotheses (6 points), 6) Data organization and communication (3 points), 7) Experimental skills (8 points), and 8) Data interpretation and conclusion (3 points).
7. The evaluation of students' attitudes toward the environment, acquired through science activity packages, is categorized into three key domains: 1) Environmental conservation awareness, 2) Environmental conservation behavior, and 3) Efficient resource utilization behavior. The assessment utilizes a 3-point scale (0 = Low, 1 = Moderate, 2 = High). The mastery criterion is established at a mean score of 2.00, representing the "High" level of environmental responsibility.
8. The assessment of student satisfaction toward the science activity packages is categorized into four key dimensions:1) Content Quality: Accuracy, clarity, and appropriateness of the subject matter,2) Learning Activities: Engagement, instructional flow, and student participation,3) Explanations and Illustrations: Clarity of instructions and the quality of visual aids ,and 4) Practical Application: The usefulness and real-world relevance of the knowledge gained. The satisfaction level is measured using a 5-point Likert Scale questionnaire is employed to measure satisfaction levels as follows: Evaluation of students' toward satisfaction in the science activity packages, through studying the in the science activity packages on "The Basic Household Wastewater Management Methods." Tests to measure toward satisfaction of the science activity packages used five levels, as follows:

   1.00 –1.50 = very low
   1.51–2.50 = low

2.51–3.50 = medium
3.51–4.50 = high
4.51–5.00 = highest

Results

The results of the research were as follows:

The quality of the science activity packages learning on "*The Basic Household Wastewater Management Methods*" were divided into five units: 1) Water Quality Testing (DO, Oil and Grease TDS, and pH) 2) Sedimentation Techniques 3) Grease Trap Construction 4) Bio-composting from Food Waste and 5) Project-based Solutions, by a total of three specialist science and environment education, who evaluated five areas: 1) contents, 2) using language and illustrations, 3) learning activities, 4) experimental kit and 5) post-test. The details are shows in Table 1.

Table 1
The Quality of the Science Activity Packages Learning on "The Basic Household Wastewater Management Methods," Evaluated by a Total of Three Specialist Science and Environment Education

Areas / **Units**	contents	using language and illustrations	learning activities	experimental kit	post-test	$\overline{X}$	Levels
Water Quality Testing	4.53	4.48	4.54	4.39	4.49	4.48	good
Sedimentation Techniques	4.53	4.46	4.56	4.61	4.49	4.53	very good
Grease Trap Construction	4.54	4.48	4.49	4.55	4.50	4.51	very good
Bio-composting from Food Waste	4.48	4.47	4.52	4.49	4.47	4.48	good
Project-based Solutions	4.50	4.52	4.49	4.50	4.49	4.50	good
Total average	very good 4.51	good 4.48	very good 4.52	good 4.50	good 4.48	**4.50**	**good**

Table 1 shows the average quality of the science activity packages learning on "*The Basic Household Wastewater Management Methods,*" evaluated by a total of three specialist science

and environment education. Quality was evaluated across five areas: contents, using language and illustrations, learning activities, experimental kit and post-test. The respective averages of each area were as follows: 4.51 very good, 4.48 good, 4.52 very good, 4.50 good, 4.48 good, while the total average across all areas was 4.50 good.

The efficiency of the science activity packages learning on "*The Basic Household Wastewater Management Methods*" were divided into 5 Modules: 1) Water Quality Testing (DO, Oil and Grease TDS, and pH) 2) Sedimentation Techniques 3) Grease Trap Construction 4) Bio-composting from Food Waste and 5) Project-based Solutions was evaluated based on the 80/80 criterion. The details are shows in Table 2.

Table 2
The Efficiency of the Science Activity Was Evaluated Based on the 80/80 Criterion

Testing	Module 1	Module 2	Module 3	Module 4	Module 5	Process Efficiency (E_1)	Product Efficiency (E_2)
During learning	83.24	81.54	83.21	82.83	82.43	82.65%	
Post-learning							83.84%

Table 2 shows the efficiency of the science activity packages was evaluated based on the 80/80 criterion. The results revealed that the process efficiency (E_1), derived from the average scores of the exercises within the packages, was 82.65%. The product efficiency (E_2), obtained from the post-learning achievement test, was 83.84%. Consequently, it can be concluded that the science activity packages met the established 82.65/83.84 efficiency standard, which exceeded the defined 80/80 criterion.

Achievement of learning outcomes among students who used the science activity packages learning on "*The Basic Household Wastewater Management Methods*" was assessed using the average pretest and post-test scores. The details of the results are shows in Table 3.

Table 3
The Comparison of the Achievement of Learning Outcomes Among Students Who Used the Science Activity Packages Learning on "The Basic Household Wastewater Management Methods," Assessed by Pre-test and Post-test

average score	n	$\bar{X}$	SD	df	t
pre-test	40	19.20	1.29	39	
post-test	40	21.82	1.48	39	10.36*

Table 3 shows the comparison of the average learning achievement scores of students who utilized the science activity packages on "*The Basic Household Wastewater Management Methods"* revealed a significant improvement. The analysis of pre-test and post-test data indicates that the post-test scores were higher than the pre-test scores at a statistical significance level of .05.

The achievement of learning outcomes with regard to science process skills in the science activity packages learning on "*The Basic Household Wastewater Management Methods*" was

assessed by comparing the average pretest and post-test scores. The details are shows in Table 4.

Table 4
The Comparison of the Average Achievement of Learning Outcomes, With Regard to Science Process Skills, Among Students in the Science Activity Packages Learning on "The Basic Household Wastewater Management Methods." This Was Assessed Using Pre-test and Post-test

average score	n	$\bar{X}$	SD	df	t
pre-test	40	21.28	3.89	39	
post-test	40	23.34	4.68	39	3.58*

Table 4 shows the study compared the average achievement of students' science process skills before and after the implementation of the science activity packages titled "The Basic Household Wastewater Management Methods." The statistical analysis revealed that the post-test scores were significantly higher than the pre-test scores at a .05 level of significance, indicating a substantial improvement in students' scientific competencies.

Evaluation of attitudes toward water resources among students learning in the science activity packages learning on "*The Basic Household Wastewater Management Methods.*" The details are shown in Table 5.

Table 5
The Average Post-test Score on Attitude Toward Environment Among Students Learning in the Science Activity Packages Learning on "The Basic Household Wastewater Management Methods"

average score	n	$\bar{X}$	SD	$\mu = 2$	df	t
post-test	40	2.48	0.89	2.00	39	2.26*

Table 5 shows the evaluation of students' attitudes toward the environment after engaging with the "*The Basic Household Wastewater Management Methods*" activity packages yielded a mean score of 2.48. This result is classified at a "high level," significantly exceeding the pre-determined criterion of 2.00 at a .05 level of significance. These findings suggest that the curriculum effectively fostered a positive environmental mindset among the learners.

Evaluation of students' satisfaction in the science activity packages learning on "*The Basic Household Wastewater Management Methods.*" The details are shown in Table 6.

Table 6
The Average Posttest Score of Students' Toward Satisfaction in the in the Science Activity Packages Learning on "The Basic Household Wastewater Management Methods"

average score	n	$\bar{X}$	SD	μ = 4	df	t	*p*
post-test	40	4.21	0.39	4.00	39	4.28*	.000

Table 6 shows the analysis of student satisfaction toward the "*The Basic Household Wastewater Management Methods*" activity packages revealed an average post-test score of 4.21, which is classified at a "high Level." This score significantly exceeded the pre-established criterion of 4.00 at a .05 level of significance, indicating that the instructional materials were well-received by the learners.

Conclusions

The results were as follows:

1. The science activity packages learning were at higher educational quality and efficiency index 82.65/83.84.
2. Learning outcomes of students exposed to instruction utilizing the developed science activity packages learning were found to be positive: 1) students' post-test scores on knowledge were significantly higher than their pre-test scores, 2) The students' post-test scores on science process skills were significantly higher than their pre-test scores ($p < .05$).
3. Students' post-test scores on attitude toward water resources designated as "good level."
4. Students' toward satisfaction in science activity packages learning were of a "high level."

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Declaration of Generative AI and AI-Assisted Technologies in the Writing Process

The author declares that Grammarly, an AI-assisted writing software, was used in proofreading and refining the language used in the manuscript. The usage was limited to correcting grammatical and spelling errors and rephrasing statements for accuracy and clarity. The author further declares that, apart from Grammarly, no other AI or AI-assisted technologies have been used to generate content in writing the manuscript. The ideas, design, procedures, findings, analyses, and discussion are originally written and derived from careful and systematic conduct of the research.

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The Effectiveness of Game-Based Learning in Enhancing Retail Management Skill: A Comparative Study of Board Game vs. Traditional Lecture for University Students

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Abstract

This study compares the effectiveness of a game-based learning (GBL) approach using the "MyShop" board game to standard lecture-based education when teaching retail management and the Quality Store System (QSS) to third-year university students. The study used a quasi-experimental approach, with an experimental group (Group A, N = 181) learning through the board game and a control group (Group B, N = 71) receiving traditional lectures. Pre- and post-tests were used to assess learning results over a 10-week period, and student satisfaction was also tested for the GBL group. The study found that both approaches resulted in substantial learning gains ($p < .05$), although the GBL group had a much higher mean learning gain (14.22) than the lecture-only group (9.27). Furthermore, students acknowledged high levels of enjoyment with the board game, emphasizing its usefulness in encouraging collaborative learning and critical thinking. The study concludes that including the "MyShop" board game into lectures is a substantially more effective pedagogical method than traditional lecturing alone, since it improves learning outcomes and student satisfaction in retail management education.

Keywords: board games, game-based learning, quality store system, retail management

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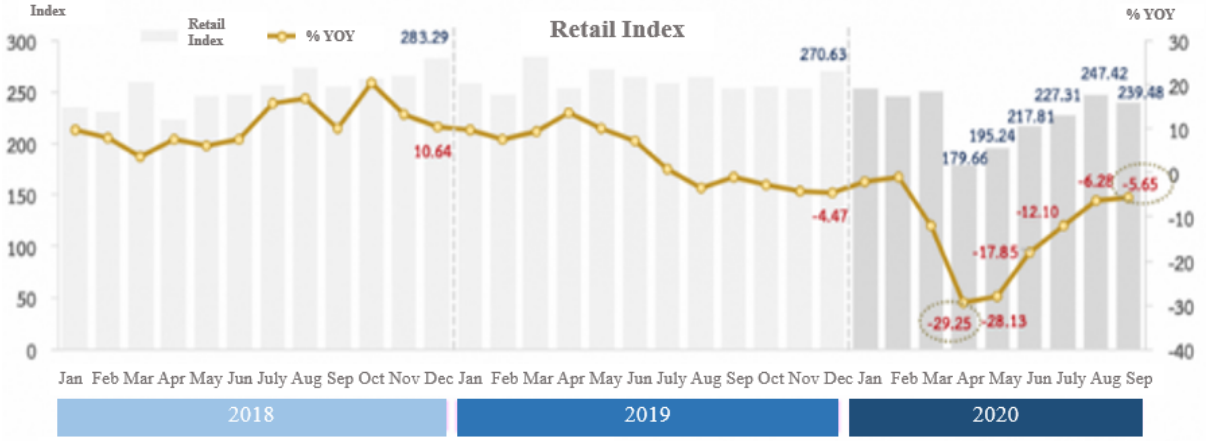
Introduction

The retail industry is a crucial engine of the Thai economy, contributing more than 2.8 trillion baht in 2020, or 15.7% of the country's GDP (Krungsri Research, 2024). Following agriculture and services, the industry is Thailand's third-largest employer. However, retail is a challenging business to manage. The retail sector is unpredictable and complicated, with businesses continually responding to quick changes in the economy, society, politics, epidemics, and consumer behavior. A clear example is the COVID-19 pandemic, which has pushed retail businesses to face a variety of difficult scenarios. As shown in Figure 1, Thailand's retail index fell as low as 29.25% in April 2020 (Bank of Thailand, 2021).

To ensure operational consistency and quality across multiple locations, large retail chain store, particularly convenience stores, use organized frameworks such as the Quality Store System (QSS). The QSS consists of seven basic elements: service (S), assortment (A), value (V), environment (E), quality (Q), cleanliness (C), and the quality management system (QMS), all of which are vital for ensuring smooth operations, improving the customer experience, and maintaining high service standards (CP All Public Company Limited, 2021). However, the instructional guides for store management and QSS included sophisticated and difficult-to-understand content. They required time for study, and staff members of branches lacked the incentive to learn on their own. This led to a lack of comprehension and difficulty in applying the knowledge in practice. Previously, branch personnel were usually trained using traditional methods such as lectures, practical training, and the distribution of manuals or online documentation for self-study. While these methods were effective, they had limitations such as a lack of interaction among learners and being unable to organize learning (Supornpraditchai & Tansuwan, 2025a).

Figure 1

Thailand Retail Index 2018–2020



Source: Adapted from Bangkokbiznews (2021)

Panyapiwat Institute of Technology College, Panyapiwat Institute of Management, Panyapiwat Institute of Management (EEC), and 11 Panyapiwat Institute of Management Learning Centers across the country all utilize the same teaching approach, Work-based Learning (WBL), in their Modern Trade Business Management programs. Each year, over 40,000 students complete internships at convenience stores across the country.

Effectively training employees and students store management and QSS principles is a major challenge, despite its significance. Traditional teaching approaches including lectures,

manuals, and on-the-job training, sometimes fail to fully engage students. These approaches could be passive and lack the participatory element needed to get students ready for real-world situations. Additionally, many employees and students find traditional QSS guides to be confusing and time-consuming, resulting in a lack of motivation, enthusiasm and inconsistent execution of the standards (Supornpraditchai & Tansuwan, 2025b). One of the primary reasons students fail is a lack of interest, and GBL is the most effective technique to improve student interest (Al-Khayat et al., 2023; Rajan, 2022).

In response to these problems, this study expands on prior research into the creation of the "MyShop" board game, an instructional tool intended to improve understanding of current retail store management and QSS principles. The game was systematically developed using a mixed-methods research approach in the post-COVID-19 pandemic period, integrating Design Thinking, the Mechanics-Dynamics-Aesthetics (MDA) Framework, and Game-Based Learning (GBL). The design focused on imitation of real-life retail scenarios, such as store location selection, product management, and staff management, all of which are critical aspects of retail store operations. Experts have previously validated the effectiveness of this board game, ranking it as "very appropriate" for educational purposes. Studies have also found that students who played the game had a significant increase in QSS understanding (Supornpraditchai & Tansuwan, 2025a, 2025b). These previous works lay a good platform for future research into the game's educational value.

This study examined the effectiveness of the board game "MyShop" as a primary instructional tool vs traditional lecture-based instruction. Using QSS and retail management as a framework, this study investigated third-year university students enrolled in a professional store management subject. The study aimed to compare two groups: Group A, who utilized the MyShop board game, and Group B, which received a traditional lecture-based learning approach. The study's goal was to compare the learning outcomes and satisfaction of students in the group that used the board game as their primary teaching tool to gather empirical evidence on the effectiveness of GBL.

Literature Review

This study examines relevant literature in four key areas: 1) the Quality Store System (QSS) and its importance in retail store management, 2) Game-Based Learning (GBL) in the context of retail store management, 3) Panyapiwat Institute of Management and its Work-Based Learning (WBL) model, and 4) the Professional Management of Stores subject within the Modern Trade Business Management curriculum.

The Quality Store System (QSS) and Its Importance in Retail Management

Thailand's modern retail sector is a major economic driver, with thousands of stores and millions of customers visiting daily. To ensure long-term growth and consistent operations, major chain stores, such as 7-Eleven convenience stores, have used frameworks known as QSS. The QSS aims to deliver consistent and uniform operations throughout all locations in the country in order to increase consumer satisfaction and maintain high service standards. The QSS construction management consists of seven main components, including SAVEQC and QMS (CP All Public Company Limited, 2021).

Regardless of its importance, efficient QSS implementation requires extensive expertise from store managers to front-line workers. However, traditional training methods, such as manual-

based instruction and on-the-job training, usually result in low interest and information retention. Employees frequently perceive QSS training materials to be excessively complex and time-consuming, resulting in low motivation and perhaps inconsistent application of standards. This gap highlights the need of interactive learning strategies that can simplify QSS concepts while enhancing engagement and comprehension (Supornpraditchai & Tansuwan, 2025b).

The Panyapiwat Institute of Management and Its Work-Based Learning (WBL) Model

Panyapiwat Institute of Management (PIM) is a private higher education institution in Thailand that was established in 2007 with the support of CP All Co. Ltd. Its distinctive feature is work-based education, or learning through real-world experiences, which systematically integrates classroom instruction with practical workplace training. PIM's educational philosophy is focused toward producing graduates who are prepared for work, particularly in retail and related fields. PIM's work-based education model relies on David A. Kolb's (1984) experiential learning theory, which emphasizes a four-step learning cycle: 1) Concrete Experience: hands-on labor in the workplace; 2) Reflective Observation: analysis and evaluation of the experience; 3) Abstract Conceptualization: connecting experience to academic theory; and 4) Active Experimentation: applying newly acquired information to practical work. A combination of theory and practice provides PIM graduates with both in-depth academic knowledge and practical skills that are in high demand in the job market (Suthammanont et al., 2020).

PIM has created a broad curriculum that includes a variety of disciplines at the bachelor's, master's, and doctorate levels. Business Administration, Engineering and Technology, Communication Arts, Food Business Management, and Liberal Arts are among the key faculties. Another strength is its engagement with over 1,000 CP Group enterprises and external partners, which allows students to gain practical experience. This allows them to learn from industry leaders and network professionally while still in university. PIM also gives scholarships to the majority of students, decreasing financial burdens and making education more accessible to individuals from varied backgrounds (Suthammanont et al., 2020).

The Office of the Higher Education Commission (OHEC) accredits PIM, while the Office for National Education Standards and Quality Assessment (ONESQA) conducts periodical quality assessments. This demonstrates the institution's dedication to developing high-quality education that meets standards (Panyapiwat Institute of Management, 2017).

The Professional Management of Stores Within the Modern Trade Business Management Curriculum

Professional Management of Stores is an elective subject in the Modern Trade Business Management curriculum at Panyapiwat Institute of Management. The subject covers a wide range of topics, including: 1) Store management, such as product and service management, store layout, store design and area utilization, and in-store communication; 2) Sales strategy, covering both offline and online sales strategies, including product delivery; 3) Problem management, such as performance monitoring, preventing and solving store problems; and 4) QSS, which includes controlling and maintaining store conditions to ensure they meet standards (Panyapiwat Institute of Management, Faculty of Business Administration, 2022).

Given that graduates of this program will work in the retail industry, the “Professional Store Management” subject is necessary. It focuses on acquiring the knowledge, understanding, and

skills necessary to manage stores that meet standards and quality. This topic teaches students the fundamental ideas and concepts of quality retail management, including standardized work processes. This reinforces the idea that maintaining standards across all branches is vital to brand confidence. Consider a convenience store: if customers visit other branches and realize that the quality is lower than expected, the store's reputation suffers. As a result, the more retail stores a corporation owns, the more difficult it is to maintain consistent standards across all locations. As a result, ensuring that customers are satisfied and receive consistent service regardless of where they shop is important to brand reputation and business sustainability.

This subject also teaches students how to understand the standard workflow of a quality store, how to follow the process and work sequence, how to control work processes in order to meet quality store standards, how to develop sales management and shift staffing strategies, and how to analyze staff effectiveness. Consistent standards across all branches provide a competitive advantage and encourage long-term viability for retail businesses. As a result, this subject teaches not just retail shop management, but also how to maintain business reputation and sustainability.

Myshop: A Board Game for GBL in Retail Store Management

The Myshop board game was researched and developed using a mixed method that included both qualitative and quantitative data, as well as Design Thinking, MDA framework, and GBL. Experts evaluated the game's quality and applicability across six categories: content, game mechanics, game format, materials, graphic design, and overall quality. The evaluation was assessed on a 5-point rating scale. The results showed that the game was appropriate in all respects, with ratings ranging from good to excellent (Mean = 4.00 to 4.67). The study's participants were first-year undergraduate students enrolled in the Modern Trade Business Management program at the Faculty of Business Administration, Panyapiwat Institute of Management. Before and after playing the board game, students were given a Retail Management Knowledge Assessment Test and a QSS Test. To compare the test outcomes, the researchers conducted a paired t-test. The post-game scores were much higher than the pre-game scores (Supornpraditchai & Tansuwan, 2025a, 2025b).

The Myshop board game was developed to imitate the issues that players experience when managing a convenience store, such as raising sales, selecting products fit for the locations and client needs, and managing staff shifts to accommodate ever-changing situations. This helps game players improve their problem-solving and decision-making skills in convenience store management, simulating real-world settings. It was also very adaptive to learners of various levels. The rules, gameplay, and simulations can be tailored to the knowledge and experience levels of players, including students, the general public, assistant store managers, store managers, and area managers. Higher levels can increase the complexity of situations and the significance of actions by strengthening strategic thinking, analysis, and sophisticated convenience store management (National Research Institute of Thailand, 2025).

A search for board game patent information, both domestically and overseas, turned up no board games related to retail business management. Meanwhile, the Myshop board game has already been copyrighted (No. 448266). It also received the Outstanding Teaching Award for 2025 from the Permanent Secretary's Office, Ministry of Higher Education, Science, Research, and Innovation, in collaboration with Thailand's Association of Professional Development Networks for Teachers and Higher Education Organizations.

The purpose of this study is to examine at the extent to which the MyShop board game is effective in improving retail management skills in students who have prior field experience. The board game was designed to imitate real-world circumstances and encourage active learning, which differs from traditional techniques that focus on lectures and document reading. While prior study with first-year students showed that the board game considerably improved knowledge acquisition, the suitability to learners with practical experience remained a major barrier. Since third-year students have received at least three years of on-site training at convenience stores, this study looks into how the board game can help them develop strategic thinking, decision-making, and complex problem-solving skills in a variety of situations that relate to their real-world experiences.

Research Objective

1. To assess student learning outcomes and contrast the use of board games as a primary learning tool with standard lecture-based teaching in retail store management and QSS.
2. To investigate student satisfaction regarding the use of board games as a learning tool.

Methodology

Research Design

This study adopted a quasi-experimental, quantitative research design with a comparative focus. The design includes two groups: control and experimental. The goal is to compare the impact of two distinct learning methods—the MyShop board game and traditional lectures—on learning achievement and satisfaction.

Population and Sample

The study's population comprised of 285 third-year university students participating in the “Professional Management of Store” subject at Panyapiwat Institute of Management for the academic year 2024. The population included two distinct groups from the same curriculum.

The Krejcie and Morgan (1970) table was used to determine sample size for a given population. The required minimum sample size for a population of 285 students with a 95% confidence level and a 5% margin of error is 162. However, to increase the statistical power and trustworthiness of the findings, this study collected data from a bigger sample.

Group A (experimental group) primarily learned through the “MyShop” board game (n = 198), accounting for 69.5% of the overall population in this group.

Group B (control group) received a lecture-based learning approach on the same subject (n = 87), with 30.5% of the population in this group.

The actual sample obtained (n = 252) exceeded the minimum required sample size, with a response rate of 88.4% from the total population. This high response rate strengthens the generalizability of the findings and reduces sampling error.

Research Instruments

Data obtained using two main instruments.

Learning Achievement Test: This test aimed to assess students' knowledge and understanding of retail shop management and the QSS. The 50-item multiple-choice test, which consists of questions with four options each, was created using a systematic approach based on the "Professional Management of Store" subject. It evaluates both academic knowledge and practical application, focusing on major topics such as store location selection, merchandise management, store personnel management, and SAVEQC and QMS. To verify content validity, three experts reviewed the test using the Index of Item-Objective Congruence (IOC), which varied between 0.67 and 1.00, confirm the test's high degree of validity. The test was designed to be completed within 60 minutes and was administered as a pre- and post-test to measure learning achievement.

Following revisions based on expert feedback, the test was piloted with 30 third-year students who were not part of the main study. The difficulty score ranged from 0.38 to 0.76, and the discrimination index ranged from 0.23 to 0.51, indicating acceptable reliability. The test's reliability was further confirmed using the KR-20 formula, which yielded a coefficient of 0.69. To avoid recall bias, the final test, which was administered as a pre- and post-test to the experimental group, was inverted. This rigorous approach to instrument creation and validation underlined the study's rigor in ensuring the reliability and validity of the data.

Student Satisfaction Questionnaire: At the end of the study, students in Group A were given a questionnaire to rate their satisfaction with the Myshop board game as the primary teaching material in the course. The questionnaire employed a 5-point Likert scale with ten items and one open-ended question to get feedback. To verify content validity, three experts reviewed the test using the Index of Item-Objective Congruence (IOC), which varied between 0.80 and 1.00, confirming the test's high degree of validity. Cronbach's alpha coefficient was used to measure the reliability of the two subscales: "Content and Learning" and "Gaming Experience and Engagement." The results show that both scales have a high degree of internal consistency. The Content and Learning subscale has a Cronbach's alpha of 0.9236, indicating high reliability. This shows that the items on this scale have strong relationships and effectively assess the same underlying construct. Similarly, the Gaming Experience and Engagement subscale demonstrated strong reliability, with a Cronbach's alpha of 0.8930. This number is significantly higher than the accepted threshold of 0.70, indicating that the items in this subscale have exceptional internal consistency.

Data Collection Procedure

Pre-test: Before the experiment begins, both Group A and Group B completed a pre-test to establish a baseline of their past knowledge.

Learning Period: Group A used the "MyShop" board game as their primary instrument to learn about store management and QSS on course-related topics such as store location analysis, merchandise selection and management, retail personnel shift management, and QSS. After the game, the instructor explained what they had learnt and led group discussions on each topic. The remaining course content was delivered through lectures. In contrast, Group B attended regular lectures on the same topics.

Post-test: Following the 10-week learning session, both groups completed a post-test to assess their learning achievement.

Satisfaction questionnaire: After the 10-week learning period, Group A students filled out a satisfaction questionnaire. Group A had already experienced both traditional lecture and board game learning in lesson-related to the topics, so they were able to compare the two techniques and provide a more informed assessment of the MyShop board game.

Data Analysis

Learning Achievements

Paired-sample t-tests were used to compare the pre-test and post-test scores within each group to see if there was a statistically significant gain in learning ability.

Independent-sample t-tests were used to compare post-test scores from Group A and Group B to determine if the MyShop board game yielded a statistically significant difference in learning outcomes compared to traditional lectures.

Student Satisfaction

Data from student satisfaction questionnaires were summarized using descriptive statistics (e.g., mean, median and standard deviation).

Results

Descriptive Data

Data was collected from two groups to ensure a comprehensive analysis. For Group A, the target population consisted of 198 students, with data successfully collected from 181 individuals, yielding a high response rate of 91.41%. This high rate suggests that the findings are likely to be a representative reflection of this group. The sample (n = 181) was predominantly female, making up 55.8% (n = 101) of the respondents, while male respondents accounted for 44.2% (n = 80). For Group B, data was gathered from 71 out of a target population of 87 students, resulting in a strong response rate of 81.61%. This also indicates a high probability that the results represent this group. Within this sample (n = 71), the majority of respondents were female at 70.4% (n = 50), with male respondents comprising 29.6% (n = 21).

Learning Achievements

The goal of this study was to compare the effectiveness of two instructional styles on student learning achievement. 1) A lecture-based method incorporated with the “MyShop” board game (Group A) and 2) A traditional lecture-based learning method (Group B).

1. Baseline Data Analysis

A comparison of pre-test scores revealed no statistically significant difference between the two groups before the experiment. The game-based group (Group A, n = 181) had a mean pre-test score of 28.38 (SD = 5.74), while the lecture-based group (Group B, n = 71) had a mean pre-

test score of 28.34 (SD = 5.59). This demonstrates that both groups had comparable amounts of baseline knowledge before the trial began.

2. Within-Group Learning Achievement Analysis

A Paired Samples t-test was used to compare pre-test and post-test scores in each group. Both groups demonstrated significant gains in learning outcomes ($p < .05$). Specifically, Group A's mean post-test score rose to 42.60 (SD = 2.81), while Group B's rose to 37.61 (SD = 4.95). This shows that both teaching methods were effective in improving student learning.

3. Between-Group Effectiveness Analysis

To compare the effectiveness of the two teaching methods, learning gains (measured as the difference between post-test and pre-test scores) were assessed using an Independent Samples t-test. The analysis found that the game-based learning group (Group A; Mean = 14.22, S.D. = 5.90) exceeded the lecture-based learning group (Group B; Mean = 9.27, S.D. = 7.25), with $t = 5.12$, $p < .05$.

Table 1

Comparison of Learning Outcomes for Game-Based and Lecture-Based Groups

	Number of Student	Mean (pre-test)	S.D.	Mean (post-test)	S.D.	Mean (Gain Score)	S.D. (Gain Score)
Group A	181	28.38	5.74	42.60	2.81	14.22	5.90
Group B	71	28.34	5.59	37.61	4.95	9.27	7.25

The findings indicate that, while both teaching methods were capable of improving student achievement, the method combining lectures with the “MyShop” board game was significantly more effective in promoting learning and increasing score improvement than the traditional lecture-only method.

Student Satisfaction

The study discovered that students (Group A) were pleased with the MyShop board game in all aspects. The average satisfaction score for each question was more than 4.4 out of 5, with a median of 5, indicating that the majority of students gave full marks to each. As shown in Table 2, Myshop was regarded as an enjoyable teaching tool that encourages involvement and comprehension of the subject matter.

In conclusion, both scales are highly reliable and suitable for use in measuring the specified constructs in this study. According to the data, “students gave the greatest marks for ‘Myshop’ board game encourages group learning” (Mean = 4.62) and “‘Myshop’ board game encourages analytical thinking and problem solving” (Mean = 4.62), showing that this board game's strengths include creating interaction and practicing problem-solving abilities.

Table 2
The Level of Student Satisfaction (n = 181)

Satisfaction topics	Mean	Median	S.D.	Interpret result
Content and Learning:				
The Myshop board game enhances your understanding of store management and QSS.	4.58	5	0.62	very satisfied
Myshop's board game material aligns with the lesson.	4.55	5	0.72	very satisfied
The simulation scenarios of Myshop board game are based on actual situations.	4.48	5	0.76	satisfied
Myshop board game encourages analytical thinking and problem solving.	4.62	5	0.64	very satisfied
Total	4.56	5	0.69	very satisfied
Gaming Experience and Engagement:				
Myshop board game promotes fun and learning.	4.57	5	0.69	very satisfied
Myshop board game is simple to learn.	4.46	5	0.72	satisfied
Myshop board game encourages group learning.	4.62	5	0.59	very satisfied
Myshop's board game equipment and design are of high quality and attractive.	4.53	5	0.62	very satisfied
Total	4.55	5	0.66	very satisfied
Overall satisfaction:				
I am satisfied with using Myshop board games for learning.	4.48	5	0.80	satisfied
I would like to use board games for learning other subjects as well.	4.57	5	0.68	very satisfied

The qualitative examination of student data summed up the following:

1) The most popular replies were about having fun and being engaged. Students enjoyed playing with their friends, which reduced classroom stress and made learning more engaging. This was reflected in student responses such as:

> This game allows me to play with friends and share my experiences working in the store, assessing consumers and selling products, … the most pleasurable or memorable part of learning through this board games is working as a team with friends, … this game allows me to have fun with friends while learning, thinking analytically, and seeking solutions to store problems, … this game helps me to interact with and get to know people around me better.

2) Learning by practice: Myshop use simulations similar to real-world experience to assist students grasp and learn complicated topics (e.g., QSS, retail management). For instance, participants noted:

> Learning through hands-on experience while playing games makes the topic easier and more enjoyable to understand, It also allows me to exercise critical thinking, decision-making, and teamwork, all of which are valuable abilities in the real world situation, … This game helps me understand store management concepts like QSSI and emergency situations, … this game helps me study and comprehend QSSI better, …this game has made me aware of the rules and regulations regarding QSS and QMS, … this game simulates many situations in store management, making me more alert and cautious when I go to work, keeping me from making mistakes like I did in the board game, … this game represents the operation of a 7-Eleven convenience shop, … the creative use of board games in studying allows me to quickly absorb the lessons while also having fun, … what fascinated me the most was that this game allows me to apply my knowledge in real-world scenarios, which improves my understanding and drives me to learn and grow, … this game taught me about checklist scores and the significance of scores in each SAVEQC and QMS category, … learning using board games was enjoyable because it mirrored a real-life retail scenario, … the game encouraged me to think about and examine actual-life situations, which helped me understand what to do and how to deal with them, … playing this game provided me with a realistic viewpoint, highlighting how much luck is involved in real life. Managing a simulated store was similar to interning at a real 7-Eleven, where consumers either bought or did not buy the products that we chose for sale, among other scenarios that the game accurately replicated.

3) Improving Thinking Skills: Students enjoyed practicing analytical thinking, planning, decision-making, and problem-solving. Student feedback highlighted this point, for example:

> I was quite impressed because the game was both entertaining and educational. It required a lot of thought, particularly when selecting products to offer in the store. I was really impressed by the usage of board games in this course, … I had to use my head to choose products from a deck of five cards. I needed to determine which one to keep, … I loved the game since it taught me how to select product to sell that fulfill the demands of customers in order to improve sales for the store, … this game taught me about the function of store manager, which includes ensuring that the store meets standards, managing best-selling products, and managing the store's staff structure. It is a complete guide to retail management, … this game allows students to learn from their mistakes and improve their store management skills, … playing this game makes players feel like a store manager in charge of the entire store, … I appreciate how this game encourages me to analyze and manage different scenarios to win the game, … what I appreciate the most about the MyShop board game was that I learned about store management and financial planning, as well as situational analysis and decision-making, in a fun and easy-to-understand manner, … this game taught me what products each store in any particular location should provide. It also helped me learn more about store management, … this game appeals to me since it teaches me how to manage store staff, allowing me to learn from my mistakes and how mismanagement of retail personnel can affect a store's performance, … this game necessitates collaboration to plan ahead and foresee future events.

4) Teamwork: Myshop encourages communication, discussion, and collaboration. For instance, participants noted:

> This game taught me how to make decisions and what it meant to work as a group, … playing Myshop board game helps me comprehend decision-making and teamwork better, … this game teaches me about strategy, cooperation, comprehension, and trust, … this game encourages the exchange of knowledge among team members, … while playing this game, my buddies and I had to think, plan, and divide our responsibilities, … this game allows me and teammates to collaborate, communicate, learn, and analyze problems together.

Conclusion and Discussion

The purpose of this study was to compare the effectiveness of a GBL method using the "MyShop" board game to traditional lecture-based learning in terms of improving retail management and QSS knowledge. A key initial finding was that both the experimental and control groups had identical levels of baseline knowledge, with no statistically significant difference in pre-test scores. This demonstrates that the significant difference in outcomes was related to the method of learning used rather than pre-existing knowledge differences. The data indicate a considerable difference in student development. While both groups showed statistically significant learning gains, the group that used game-based learning achieved significantly more progress. Their average learning gain score was significantly higher than that of the lecture-only group. This is consistent with a meta-analysis by Freeman et al. (2014), who discovered that students in traditional lecture courses were more likely to fail than those in active learning courses. This demonstrates that, while regular lectures are effective to some extent, incorporating the "MyShop" board game into lectures produces a clearly better result.
Several significant educational variables contribute to the GBL group's excellent success. The "MyShop" board game turns students from passive users of information to active participants by encouraging them to apply theoretical principles to simulated, real-world retail scenarios. This active participation is precisely aligned with Kolb's (1984) Experiential Learning concepts, which drive the WBL approach at Panyapiwat Institute of Management. By providing a secure setting in which to make mistakes and learn from them, the game bridges the gap between classroom theory and practical application.

This is also consistent with the findings of Al-Khayat et al. (2023), Klein et al. (2023), and Rajan (2022), who discovered that active engagement is a cornerstone of effective learning because it is based on constructivist concepts that emphasize hands-on experiences in which students build their own understanding. The game requires players to apply academic principles to simulated, real-world retail scenarios, which promotes important cognitive abilities include critical thinking and problem solving. This method is very useful for helping students understand complex subjects and bridging the gap between classroom theory and practical application.

Furthermore, the social aspect of the board game developed as a key reason in its success. The findings showed that students valued the possibility for group learning and teamwork, which improved both engagement and peer-to-peer knowledge exchange. This collaborative problem-solving setting is difficult to capture in a traditional lecture hall, but it is critical for developing the soft skills needed in managerial positions.

In conclusion, this study provides strong empirical support for using well-designed educational board games as the major instructional instrument in higher education. The "MyShop" board game proved to be more than simply a fun activity; it is also an effective teaching tool that improves conceptual knowledge, practical application, and student pleasure. The findings

imply that by incorporating such innovative, active-learning approaches, educators can better prepare students for the dynamic and complicated problems of today's retail industry.

Limitation

A fundamental limitation is the quasi-experimental approach, which relied on pre-existing class registrations rather than random assignment. This led to unequal sample sizes and, more importantly, increased the likelihood of selection bias. Although pre-tests revealed the same baseline knowledge, unmeasured pre-existing variables between the groups, such as motivation or learning preferences, could have influenced the outcomes.

Suggestion

Suggestions for Further Development

Although most students provided no comments and were pleased with the board game, there were several interesting recommendations for future enhancement. Here are a few: 1) Reducing the “luck” factor: Some students complained that the game depends too heavily on card randomness or “luck,” which may lead to results that do not sufficiently reflect their planning ability; 2) Improving the rules and timing: It was proposed that a “Game Master” or expert oversee and explain the rules for a smoother experience, rather than allowing players to play on their own.; 3) Some student believed that the game took too long to play. They recommended offering explicit instructions or making instructional videos available; and 4) Raising the difficulty level or adding new situations for greater complexity.

Suggestions for Future Research

Future research could build on this study's findings and look into a variety of critical topics. Longitudinal studies are needed to establish the long-term retention of knowledge achieved from playing the "MyShop" game and its use in professional settings. Furthermore, the generalizability of these findings should be studied by conducting the study again with more diverse groups, such as students from different universities, students with no prior retail experience, or employees in corporate training settings. Finally, future research could investigate the effect of instructor facilitation techniques on the success of GBL sessions.

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A Preliminary Evaluation of an Educational Game for Developing Spatial Ability Using Minecraft and Generative AI Scaffolding

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Abstract

Spatial ability is vital for addressing daily and scientific challenges. This study aims to design and conduct a preliminary evaluation of an educational game integrating the Minecraft virtual world with generative AI (GenAI)-guided scaffolding. Fifteen undergraduate and graduate students (8 female, 7 male) participated in the game, with comprehensive assessment conducted through flow, activity anxiety, cognitive load scales, spatial ability tests, and qualitative feedback. Results indicate participants experienced flow states during gameplay, with significantly higher scores than the median of 3 on dimensions including “clear goals,” “immediate feedback,” “concentration,” and “loss of time perception.” Cognitive load analysis revealed the activity had significant “germane cognitive load” (p = .004), while “activity anxiety” remained significantly below 3. Regarding spatial ability performance, the post-test average score (80.00) exceeded the pre-test score (73.33), though the difference did not reach statistical significance (p = .078). Qualitative analysis revealed that over 85% of participants found the GenAI robot helpful for problem-solving; 93.3% agreed the game process enhanced spatial sense application; and 80% believed skills learned were transferable to real life. Collectively, this study preliminarily confirms the game's potential in creating immersive learning experiences and promoting germane cognitive load, while receiving strong learner endorsement.

Keywords: Minecraft, spatial ability, GenAI, game-based learning, scaffolding

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Introduction

Spatial ability is a core cognitive skill involving the understanding and manipulation of object location, orientation, and structure. Consequently, effectively cultivating and assessing learners' spatial abilities in educational settings has long been a focal point in educational psychology and learning sciences.

With the rise of digital games and immersive learning environments, open-world virtual platforms like Minecraft have increasingly been applied in education (Bile, 2022; Lee & Hou, 2025; Nkadimeng & Ankiewicz, 2022). Their highly flexible three-dimensional construction features allow learners to naturally engage in spatial reasoning and problem-solving processes through exploration, building, and problem-solving within the game context.

In recent years, advances in generative artificial intelligence have opened new opportunities for educational scaffolding design. Multiple studies have demonstrated that generative AI can effectively support higher-order cognitive activities (Chien et al., 2025; Ngu et al., 2025). When combined with immersive environments like Minecraft, it has the potential to form an interactive and adaptive learning model, offering innovative teaching solutions for enhancing spatial ability development.

Research Questions

This study aims to develop a scenario-based puzzle game integrating GenAI NPCs and explore the application of Minecraft Education in spatial competence instruction. The primary objectives are as follows:

1. Evaluate participants' spatial competence performance in the "Minecraft and GenAI-guided educational game."
2. Evaluate participants' flow in the "Minecraft and GenAI-guided educational game."
3. Evaluate participants' learning anxiety "Minecraft and GenAI-guided educational game."
4. Evaluate participants' cognitive load in the "Minecraft and GenAI-guided educational game."
5. Evaluate participants' qualitative feedback "Minecraft and GenAI-guided educational game."

Game Design

This educational game, developed on the Minecraft platform, utilizes command blocks to create game modules capable of calculating time and displaying game information. It incorporates a generative AI (GenAI) character, the "Village Chief," as scaffolding. The aim is to guide learners in cultivating spatial representation ability through exploration and problem-solving within the virtual world. The game is set in the "Mysterious Mining Village," where learners assume the role of a challenger undergoing trials. They must complete multiple tasks and safely escape amidst a village fire crisis. The narrative design enhances situational immersion, while coordinate-based mission design directly addresses the research core—the development of spatial orientation and reasoning abilities.

Figure 1

Utilizing Command Blocks to Develop Game Modules, Calculate Time, and Display Game Information



The game begins at the Village Chief's House (S0), which also serves as a tutorial area. Learners can understand the basic XYZ coordinate system and directional rules through conversations with the GenAI Village Chief. The GenAI Village Chief provides hints at different levels based on the learner's questions or performance, such as explaining relative positions in text or offering more concrete operational suggestions to help players complete tasks.

The main quest consists of three stages. The first is the Iron Mine (S1), where learners must locate targets using relative positional information. For example, the GenAI Village Chief might offer a key clue:

> To withstand the blazing heat, you must first find the ‘Miner’s Fireproof Armor’ crafted by our ancestors. This armor is hidden in the iron mine west of the village. The mine's X-coordinate is smaller than that treehouse over there, while its Z-coordinate is exactly 60 meters higher than my home.

Next, learners must locate a hidden mechanism to enter the mine and retrieve the armor. The Village Chief then offers a decisive hint:

> Be aware that the mine entrance was recently blocked by falling rocks from an earthquake. You must locate the ‘Old Mine Lever’ beneath a dead tree near the treehouse beside the entrance to activate the mechanism and open the secret passage.

This design requires players to flexibly apply coordinate judgment and spatial reasoning while integrating problem-solving strategies.

Figure 2

Consulting the GenAI Village Chief NPC Provides Hints, Enhancing Players' Spatial Reasoning



Second, if players encounter a "poisoning" scenario during exploration, they must proceed to the Ranch (S2). By determining the ranch's relative position to the treehouse and iron mine, they locate the correct spot to obtain "magical milk." The Village Chief guides:

> The village air is filled with toxic mist from the fire. If you're unlucky enough to be poisoned, the only antidote is milk from the 'magical cow' at the pasture. The pasture lies on a vast green field north of the treehouse and west of the iron mine.

This task tests learners' ability to synthesize judgments based on multiple reference points.

Finally, when the player's health is critically low, they must seek the "Miraculous Herb" in the cave (S3). The cave is positioned northeast of the pasture, elevated approximately 15 meters above it. The village chief advises: "If you're injured during the trial and your health is nearly depleted, hurry to find the 'Fire-Resistant Herb' in the cave. It will swiftly heal your wounds." That cave is hidden high up, northeast of the pasture. Its X-coordinate is larger than the pasture's, and its height (Y-coordinate) is nearly 15 meters higher than the pasture. This task not only requires learners to correctly deduce the relationship between the X, Y, and Z axes but also adds challenge and immersion by simulating the loss of life and spatial disorientation experienced in adventure mode.

Figure 3

NPCs in Each Level Provide Critical In-Game Resources



Participants

The study invited 15 undergraduate and graduate students (8 female, 7 male) to participate in the game. All participants were recruited online for camp activities and had no prior experience with this educational game course integrating Minecraft and GenAI-guided scaffolding.

Measurement

To assess learners' spatial abilities, we employed pre- and post-test learning evaluations designed by an instructor with 20 years of teaching experience, ensuring expert validity. The questions were divided into three sections: the first section comprised 8 items on spatial verbal reasoning; the second section included 7 items on spatial pictorial reasoning; and the third section featured 5 items on spatial visualization.

In order to ascertain the degree of involvement of the learners in this game, the present study adopted the Chinese version of the flow scale by Kiili (2006). This 22-item version was translated into Chinese by Hou and Chou (2012) and included flow antecedents and flow experience. Flow antecedents consists of five sub-dimensions: challenge, goal, feedback, control, and playability. These sub-dimensions were used to measure learners' perceptions of the game. Learners' experience in the game was measured by four sub-dimensions of flow experience: concentration, time distance, autotelic experience, and loss of self-consciousness. All dimensions were measured using a five-point Likert scale, with 1 being strongly disagree and 5 being strongly agree. Higher scores on a dimension (sub-dimension) indicate a more positive evaluation or experience of that dimension, and the flow scale was highly reliable in this study (Cronbach's $\alpha = .95$).

The cognitive load scale used in this study was adapted from the measure developed by Leppink et al. (2013). This scale assesses three components: internal cognitive load, external cognitive load, and germane cognitive load. Items were rated on a five-point Likert scale (1 = strongly disagree to 5 = strongly agree). The overall reliability of the scale for the current sample was Cronbach's $\alpha = .63$.

Procedure

To evaluate the "Educational Game Guided by Minecraft and GenAI Scaffolding," we conducted a total of 100 minutes of learning activities.

Table 1
Research Procedure

Procedure	Session time	Description
Description of teaching activity	5 minutes	The researcher explained the content of the activity and the experimental procedure
Pre-test	15 minutes	Complete pre-testing questionnaires online to evaluate learners' spatial abilities in advance.

Basic operation experience	10 minutes	Each learner experiences the standard version of minecraft gameplay to familiarize themselves with basic controls such as WASD movement, jumping, and opening the inventory.
Teaching activity	50 minutes	Play the Survive@Mine game
Post-test	20 minutes	Fill out post-testing questionnaires to assess learners' spatial ability, flow, activity anxiety, and cognitive load.

Results and Discussion

Table 2–5 summarizes the findings of this study. Regarding spatial ability, Table 2 shows that participants' post-test mean score (M = 80.00, SD = 9.64) was higher than their pre-test mean score (M = 73.33, SD = 9.57). Although scores improved, this difference did not reach statistical significance ($Z = -1.76$, $p = .078$). Nevertheless, this result indicates a positive trend of progress.

Table 2

Pre- and Post-test of Spatial Ability (n = 15)

Dimension	*Mean* (*SD*)		*Z*	*p*
	Pre-test	Post-test		
Score	73.33 (9.57)	80.00 (9.64)	−1.76	.078

Regarding students' experiences with the Survive@Mine game, Table 3 summarizes the game flow scale. Using the Wilcoxon signed-rank test with a scale median of 3, data analysis indicates participants achieved a significant overall flow level (M = 3.8) during the activity. Dimensions with particularly prominent scores include: loss of time perception, immediate feedback, clear goals, and focus on the task at hand. Additionally, “self-forgetfulness” and “loss of self-awareness” also reached significant levels.

Table 3

Nonparametric Test Summary for Flow Scale (n = 15)

Dimension	*M*	*SD*	*Z*	*p*
Challenge-skills Balance	2.98	1.08	−0.15	.877
Clear Goals	4.13	.93	2.96*	.003
Unambiguous Feedback	4.20	.62	3.23*	.001
Sense of Control	3.50	1.21	1.37	.170
Action-awareness Merging	3.00	1.13	−0.04	.964
Concentration	4.11	1.16	2.83*	.004
Time Distortion	4.40	.71	3.36***	.000
Autotelic Experience	3.87	1.17	2.49*	.012
Loss of Self-consciousness	3.70	1.14	2.08*	.038
Total	3.80	.85	2.84*	.004

Note. $^{*}p < .05$, $^{**}p < .01$, $^{***}p < .001$

Table 4 summarizes participants' activity anxiety in this study, tested using the Wilcoxon signed-rank test against the scale median of 3. Data analysis indicates participants did not experience high anxiety during activities. The mean activity anxiety score was 2.45 (*SD* = .90), significantly lower than the scale median of 3 ($p = .024$), indicating that this game environment constitutes a low-anxiety learning context.

Table 4

Summary of Nonparametric Tests for Activity Anxiety (n = 15)

Dimension	*M*	*SD*	*Z*	*p*
Activity Anxiety	2.45	.90	−2.25*	.024

Note. $^{*}p < .05$, $^{**}p < .01$, $^{***}p < .001$

Table 5 summarizes the data for each dimension of cognitive load in the education game. This study employed the Wilcoxon signed-rank test with a median of 3 for the scale. Learners' mean score for cognitive load was 4.00 (*SD* = .91), significantly higher than the median of 3 ($p = .004$). In contrast, neither intrinsic cognitive load ($M = 2.98$) nor extrinsic cognitive load ($M = 2.73$) reached statistical significance, indicating that the task difficulty and interface design did not impose excessive cognitive burden on learners. The significant level of generative cognitive load ($M = 4$) suggests learners experienced high spatial cognitive processing during the task.

Table 5

Summary of Nonparametric Cognitive Load Tests (n = 15)

Dimension	*M*	*SD*	*Z*	*p*
Intrinsic Cognitive Load	2.98	.57	−0.44	.660
Extrinsic Cognitive Load	2.73	.49	−1.92	.060
Germane Cognitive Load	4.00	.91	2.92**	.004

Note. $^{*}p < .05$, $^{**}p < .01$, $^{***}p < .001$

In qualitative feedback, the vast majority (over 85%) of participants found GenAI helpful. The primary ways GenAI assisted were by providing directions and coordinates, as well as prompting task objectives and steps. Participants identified challenges primarily in two areas: "spatial orientation" and "game operation." Furthermore, nearly all participants agreed that this experience significantly enhanced the application of spatial awareness and orientation skills. They generally found this learning approach more "proactive," "hands-on," and "engaging." Regarding learning method transformation and skill transfer, most participants believed skills acquired through the game could be applied to real life, particularly "learning how to effectively utilize AI" and "the ability to decompose problems."

Conclusion

This preliminary study evaluated the effectiveness of using Minecraft and GenAI scaffolding to cultivate spatial abilities, yielding positive supporting evidence. Findings indicate that the game design successfully created an immersive, low-anxiety learning experience. The "clear objectives" and "immediate feedback" provided by GenAI scaffolding strongly guided learners into a flow state while significantly reducing learning anxiety.

Second, the learning activities effectively promoted germane cognitive load. GenAI handled external cognitive load tasks like "how to read coordinates" and "where to go next," freeing learners' cognitive resources to focus on core spatial schema construction—such as

"understanding XYZ axis concepts" and "locating within a 3D environment." Although the pre-post spatial ability test difference did not reach statistical significance ($p = .078$), a positive trend emerged within the small sample (n = 15). Qualitative data strongly corroborated GenAI's value as a "cognitive partner": 86.7% of participants affirmed GenAI's assistance, and 80% believed skills like problem decomposition and AI tool utilization would benefit real life, indicating potential for skill transfer.

Research limitations primarily stem from the small sample size (n = 15) and absence of a control group. Future studies should expand the sample size, establish a control group, and employ more rigorous experimental designs. Long-term tracking and analysis of in-game behavioral data are recommended to deepen understanding of this learning method's sustained effectiveness and underlying mechanisms.

Overall, this study preliminarily validates the potential of GenAI as an effective scaffolding tool and cognitive partner in gamified spatial learning. Furthermore, the study did not analyze behavioral patterns of student interactions to explore how scaffolding within games facilitates better learning (Bakeman & Gottman, 1997; Chan et al., 2023; Hou, 2015). Furthermore, given the limitations of technical equipment, students' gaming experiences may be constrained by hardware performance, which represents a future direction for game design adjustments and improvements.

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The Role of Facebook in Promoting Environmental Education and Awareness of Sustainable Goal 13 (Climate Action) Among Cambodian University Students

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Abstract

The purpose of this study is to explore how Facebook supports climate action awareness (SDG 13) among Cambodian university students and which content formats students perceive as most effective. A quantitative online survey was conducted with 81 undergraduates from Cambodian universities. The questionnaire measured Facebook engagement, exposure to climate-related content, and perceived effectiveness of different content formats. Using descriptive statistics and inferential tests, including regression and t-tests (SPSS). The findings indicate that Facebook engagement is significantly associated with environmental awareness ($R^2 = 0.752$, $p < .001$). Students reported moderate but consistent exposure to climate-related content on Facebook ($M = 3.25–3.52$), with motivation to learn emerging as the most common response. Visually rich content formats were perceived as the most effective for environmental learning, particularly videos ($M = 3.67$) and infographics ($M = 3.62$), while active engagement behaviors such as commenting and sharing remained relatively limited. These findings suggest that Facebook can function as an informal learning space for environmental learning when content is visual, accessible, and designed to encourage engagement. The study provides Cambodia-based evidence that can inform educators, NGOs, and policymakers in developing more effective social media for climate literacy in higher education.

Keywords: Facebook, environmental education, climate change awareness

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Introduction

Environmental change remains one of the most critical global challenges, requiring both effective policy action and sustained public awareness. In this context, Facebook as an influential social media platform has become a significant tool for communicating environmental issues, engaging people, and encouraging sustainable attitude among younger audiences. Previous research shows that NGOs use Facebook strategically to increase public interaction emotionally engaging and action-oriented, messages and posts that highlight environmental impacts, evoke positive emotions, and include clear calls to action are associated with higher levels of engagement such as likes and comments (Barkallah et al., 2020; Ghermandi et al., 2023).

In the Cambodian context, digital inclusion is shaping how people access and understand sustainability awareness in response to the emerging issues. The stronger understanding of the environmental issues and the awareness of the eco-friendly practices are associated with greater access to the digital tools and a higher level of digital literacy. This suggests that digital platforms such as Facebook may be a practical tool for environmental education, particularly for Cambodian youth (Ly et al., 2024).

A study examining environmental awareness among Cambodian university students found that although students were generally aware of climate-related issues, misconceptions and a noticeable gap between awareness and actual behavior still existed. Many students show a strong interest in the issues of climate-related topics and pursuing environmentally related careers. Meanwhile, opportunities for serious engagement with environmental learning remained limited. Therefore, access to digital platforms, such as Facebook, can enhance environmental knowledge and encourage more sustainable practices among students (Barkallah et al., 2020).

Although prior research suggests that social media can support environmental advocacy, empirical evidence remains limited on how Cambodian university students engage with climate-related content on Facebook and whether such engagement is associated with awareness of Sustainable Development Goal 13 (Climate Action).

Research Objective

The primary objectives of this study are:

1. To examine the relationship between Facebook engagement and Cambodian university students' understanding of environmental issues and awareness of SDG 13 (Climate Action).
2. To measure how frequently Cambodian university students are exposed to climate change and environmental education content on Facebook.
3. To identify which Facebook content formats students perceive as most effective for promoting environmental education and climate literacy.

Literature Review

Facebook as an Informal Learning Space for Environmental Education

Facebook is often viewed as a supplemental educational tool that supports informal learning. This platform provides continuous access to information and learning materials due to the content can be posted, stored and revisited over time, the platform can function as a convenient repository for educational resources and announcements. Facebook is embedded in students' daily routines and encourages ongoing participation beyond the classroom. The empirical studies commonly describe Facebook's educational use through three core functions such as communication, resource sharing and collaboration. It enables active interaction among students, educators, and university personnel for course coordination and updates. For resource sharing, it supports the exchange of ideas, projects, documents, and multimedia materials such as videos and audio. For collaboration, Facebook groups provide structured spaces where students discuss course content, divide responsibilities and complete shared academic tasks (Yousef & Yousef, 2022).

In addition, Facebook is recognized as a popular social media network designed to connect people across distances; however, it has evolved into a useful platform for academic learning and information exchange. Facebook supports educational use among students through three key determinants such as motivation, Perceived benefits, Perceived disadvantages. Motivation refers to student desire to stay connected with peers, keeping update and discussing course material. Perceived benefits include gaining knowledge, sharing ideas and discovering new learning resources. Perceived disadvantages such as distraction or misinformation, were acknowledge but did not significantly deter Facebook usage (Alwreikat et al., 2021).

In the Cambodia context, research on digital technology and environmental sustainability typically emphasizes broader dimensions or digital inclusion such as digital access, digital literacy, and the use of digital platforms rather than focusing on specific social media brands. Within this perspective, digital platforms function as important tools for sustainability education by disseminating environmental information and raising public awareness. Internet access expands opportunities for citizens to learn about local and global environmental issues and to apply sustainable practices in everyday life. In addition, the digital environment can facilitate community building by enabling individuals to share ideas and develop collective awareness and around environmental issues. However, the effectiveness of these platforms depends on the level of digital literacy especially the ability to locate and evaluate information as well as the reliability of digital infrastructure (Ly et al., 2024).

Environmental Education: Concepts and Key Objectives

According to the Tbilisi Declaration (1997) provides core framework for Environmental Education (EE) by giving the five core definition goals. First, EE aims to develop awareness, helping individuals and social groups become sensitive to the environment and its related problems. Second, it promotes knowledge by building understanding of environmental systems and issues to support informed decision-making. Third, EE cultivates attitudes, encouraging values and concern that motivate people to protect and improve the environment. Fourth, it develops skills by equipping learners with practical abilities to identify environmental problem, investigate cause, and evaluate alternative solutions. Finally, EE emphasizes participation, providing opportunities for individuals and groups to actively engage at multiple levels in addressing environmental challenges. These goals describe environmental education as a

process that moves from awareness and understanding toward skill development and meaningful action (Fang et al., 2023; Uddin, 2023).

Moreover, Hungerford et al. (1980), as cited in Fang et al. (2023), introduced a curriculum-oriented framework for environmental education that organizes learning goals into four progressive levels. The first level emphasizes building ecological knowledge as a foundation for understanding environmental problems and making informed decisions. The second level focuses on developing conceptual awareness of environmental issues and values, helping learners recognize how individual and collective actions affect both environmental quality and overall quality of life. The third level examines issue investigation and evaluation, where learners develop skills to analyze environmental problems and compare alternative solutions while clarifying their own values. The fourth level moves toward action competence and participation, aiming to equip learners with practical skills to take positive environmental action and contribute to a balance between human well-being and environmental health. This framework is useful for positioning environmental education not only as knowledge acquisition but also as a pathway from awareness to critical evaluation and responsible action as cite in (Fang et al., 2023).

Furthermore, The Three Threads framework, developed in the Schools Council's Project Environment (1974), provides a foundational structure for environmental education by explaining how learners interact with the environment through three interconnected approaches. The first thread, education about the environment, focuses on developing knowledge and understanding of environmental systems, human impacts, and environmental issues. The second thread, education through the environment, emphasizes learning through direct experience, using the environment as a resource for inquiry, observation, and interdisciplinary learning. The third thread, education for the environment, aims to cultivate environmental values and responsibility, encouraging learners to take informed actions to protect and sustain the environment. Together, these three dimensions highlight that environmental education should integrate knowledge, experiential learning, and responsible action (Neal, 1994).

Following the Tbilisi Declaration, UNESCO further emphasized that environmental education should not be taught as a passive or purely theoretical subject. Instead, it should adopt a critical and participatory approach that encourages learners to understand the multiple social, economic, and ecological factors involved in environmental issues. This perspective promotes active student involvement in planning and shaping their own learning experiences, rather than relying solely on teacher-centered instruction. Environmental education is also encouraged to take place in diverse learning environments beyond the traditional classroom, allowing learners to explore real-world contexts and develop practical understanding. In addition, the approach highlights the importance of collaborative and participatory decision-making, where students are encouraged to engage in discussion, evaluation, and collective problem-solving related to environmental challenges (Gough & Gough, 2010).

Sustainable Development Goals

Sustainability is widely recognized as a key factor in maintaining and improving human quality of life. Environmental degradation can lead to serious consequences such as natural disasters, health risks, and declining living conditions, making sustainability education increasingly important in higher education. Universities play a critical role in promoting sustainability awareness by integrating environmental topics into teaching, campus practices, and student

engagement activities. Awareness is often strengthened not only through formal education but also through visible sustainability practices such as recycling programs, energy conservation, and waste reduction initiatives. In addition, social media platforms have become important tools for sharing sustainability information and promoting environmentally responsible behaviors. By disseminating environmental knowledge and highlighting green practices, digital platforms can encourage students to engage with sustainability issues and adopt more environmentally conscious lifestyles (Hamid et al., 2017).

Ban Ki-Moon (2019), former Secretary-General of the United Nations, asserted that former eighth secretary-general of the United Nations emphasized that young people have an important role as global citizens and should take the lead in calling for climate justice. He also pointed out the value of informal education tools like social media in raising awareness (Ki-moon, 2019). From a policy point of view, Long et al. (2023) explain that the SDGs are carried out using goals, targets and indicators to help countries take action. These ideas support the use of environmental education and digital platforms such as Facebook to support people to understand about climate literacy (Long et al., 2023).

Cambodia Case Study

A study of the exploring the nexus of digital inclusion and environmental sustainability: insights from Cambodia examined how digital transformation can support environmental awareness and sustainable practices. Using survey data from 380 participants in Siem Reap province, the study found that digital access and digital literacy play a key role in improving environmental knowledge and encouraging sustainable behavior. Access to online resources enables individuals to learn about climate change, conservation, and environmental protection through digital materials such as articles, documentaries, and interactive tools. The findings explain that digital literacyparticularly the ability to search for and evaluate informationcan positively influence behavioral changes, including waste reduction and energy conservation. These results indicate that digital platforms can support environmental education by expanding access to sustainability knowledge and promoting environmentally responsible practices within the Cambodian context (Ly et al., 2024).

A case study conducted under the GREENCAP Project (2020) assessed environmental awareness among students from several universities. The findings indicated that students generally demonstrated high awareness and concern about climate change. Most participants understood that climate change is occurring, expressed concern about its impact on nature and human health, and recognized that personal lifestyles and corporate behavior contribute to environmental problems. Despite this strong awareness, the study also highlighted a gap between knowledge and action, suggesting that universities should focus less on basic awareness and more on practical engagement and informal learning opportunities such as projects, field activities, and community initiatives. These findings highlight the importance of exploring additional channels, including digital platforms, that can strengthen environmental learning and encourage more active engagement among students (Barkallah et al., 2020).

Therefore, exploring how digital platforms such as Facebook support environmental education among Cambodian students becomes important.

Methodology

This study employed a quantitative research design using an online survey to investigate the relationship between Facebook engagement and environmental awareness among Cambodian university students. The questionnaire was developed based on relevant literature and distributed through Google Forms. To ensure content validity, the instrument was reviewed by experts and evaluated using the Index of Item–Objective Congruence (IOC). A total of 117 responses were collected, and after data screening, 81 valid responses were retained for analysis. The data were analyzed using SPSS, applying descriptive statistics and inferential tests, including regression analysis and independent samples t-tests, to examine the relationship between Facebook engagement and awareness of Sustainable Development Goal 13 (Climate Action).

Finding

Descriptive statistics were used to summarize the demographic characteristic of the respondents. These characteristics provide context for understanding students' engagement with Facebook and environmental learning.

Table 1

Demographic Characteristic of Respondents

Characteristic	Category	n	%
Gender	Male	47	58
	Female	34	42
Age (years)	18–20	47	58
	21–22	22	27.2
	23–24	8	9.9
	25–30	4	4.9
Daily Facebook use	1–2 hours	28	34.6
	2–3 hours	14	17.3
	Less than 1 hour	18	22.2
	More than 3 hours	21	25.9
Total		81	100

Note. N = 81

Table 1 shows that 58% of the participants were male and 42% were female. Most respondents were between 18–20 years old, followed by 21–22 years, while smaller proportions were 23–24 years and 25–30 years. Regarding Facebook usage, the largest group of students reported spending 1–2 hours per day on Facebook, followed by more than 3 hours, less than 1 hour, and 2–3 hours.

Table 2

Regression Analysis: Facebook Engagement Predicting Environmental Awareness

Variable	B	SE	β	t	p
Constant	0.24	0.217		1.104	0.273
Facebook Engagement	0.945	0.061	0.867	15.491	< .001
R^2	.752				
Adjust R^2	.749				
F (1,79)	239.965				
p	< .001				

Note. N = 81. Dependent variable = Environmental Awareness. β = standardized coefficient.

Table 2 indicates that Facebook engagement significantly predicts environmental awareness among Cambodian university students (β = 0.867, p < .001). The model explains a substantial proportion of variance in environmental awareness, with R^2 = .752, indicating that approximately 75.2% of the variation in environmental awareness can be explained by Facebook engagement. The regression model was statistically significant (F(1,79) = 239.965, p < .001), suggesting a strong relationship between students' engagement with Facebook content and their awareness of environmental issues related to Sustainable Development Goal 13 (Climate Action).

Table 3

Perceived Effectiveness of Facebook Content Types for Environmental Education

Content Type	Mean Rank	M	SD
Videos	5.49	3.67	1.111
Articles	5.28	3.66	1.085
Infographics	5.26	3.62	1.067
Visual content (images)	5.22	3.64	1.088
Infographic posts	5.16	3.62	1.079
Article posts	4.71	3.52	0.976
Influencer content	4.83	3.47	1.119
Activist content	4.5	3.43	1.106
Interest-based video content	4.54	3.44	1.194
$X^2(8)$	20.028		
p	.01		

Note. N = 78. Rankings based on Friedman test. Higher mean rank = greater perceived effectiveness.

Table 3 shows that the Friedman test results indicate a statistically significant difference in the perceived effectiveness of content formats ($\chi^2(8) = 20.028$, p = .01). Among the content types, videos were ranked as the most effective format for environmental learning (Mean Rank = 5.49, M = 3.67), followed by articles (Mean Rank = 5.28) and infographics (Mean Rank = 5.26). Visual-based content such as images and infographic posts also received relatively high rankings. In contrast, activist content and video content focused on interest were perceived as less effective compared to other formats. These results suggest that multimedia and visually engaging content formats are more effective in supporting environmental education on Facebook.

Discussion

The first objective explore how Facebook engagement influences students' comprenhesion of environmental issues and awareness of Sustainable Development Goal 13 (Climate Action). The findings demonstrated a strong and statistically significant relationship between Facebook engagement and environmental awareness, indicating that higher levels of interaction with environmental content are associated with deeper understanding of climate issues (Fang et al., 2023; Yousef & Yousef, 2022). Students reported that Facebook contents helped them recognize the urgency of climate action, suggesting that the platform can effectively support cognitive awareness of sustainability topics. However, active behaviors such as sharing environmental content were less common, indicating that while Facebook contributes to awareness building, it may be less effective in encouraging participatory engagement or advocacy.

The second objective specifically examines on how students encounter climate-related content on Facebook. The results indicate moderate exposure to environmental information on the platform. Students reported feeling motivated to learn about environmental issues through Facebook, yet interactive behaviors such as commenting remained relatively limited. This pattern suggests that students are likely to consume environmental information passively rather than actively engaging in discussions. Such behavior aligns with existing research on social media usage, which shows that users often act as content consumers rather than active contributors in online discussions (Caers et al., 2013; Hamid et al., 2017; van Dijck, 2011).

The third objective aimed at recognizing the most effective Facebook content formats for environmental education. The results showed that videos, articles, and infographics were perceived as the most effective formats for learning about environmental issues. These findings highlight the importance of visually engaging and multimedia content in supporting environmental literacy among students. The result is consistent with the cognitive theory of multimedia learning, which suggests that combining visual and textual information enhances comprehension and knowledge retention more effectively than text-based content alone. Overall, this study provides evidence that Facebook, when used intentionally, can support environmental education efforts and promote climate literacy (Barkallah et al., 2020; Hamid et al., 2017; Ly et al., 2024; Neal, 1994).

Conclusion

This study examined the role of Facebook in promoting environmental education and awareness of Sustainable Development Goal 13 (Climate Action) among Cambodian university students. The findings indicate that Facebook engagement significantly contributes to students' environmental awareness, suggesting that social media can serve as an effective platform for climate education. Students perceived videos, infographics, and articles as the most useful content formats for learning about environmental issues, highlighting the importance of visually engaging materials. However, while students frequently consume environmental content, active participation such as sharing and commenting remains relatively limited. These results suggest that Facebook can support environmental learning, but greater emphasis on interactive engagement may further strengthen its educational impact.

Implication and Limitation

Based on the findings, it is recommended that educators, NGOs, and environmental communicators utilize Facebook more strategically by developing engaging multimedia content that promotes both awareness and interaction. Videos, infographics, and visually engaging materials appear particularly effective for environmental education. Universities may also consider integrating social media platforms into environmental literacy campaigns or sustainability education initiatives to enhance students' engagement with climate-related topics.

However, this study has several limitations. First, the research focused only on students who actively use Facebook, which may not represent students who use the platform less frequently or prefer other social media platforms. Second, the participants were limited to undergraduate students from a small number of universities, which may affect the generalizability of the findings. Third, the study relied heavily on self-reported survey responses, which may not fully reflect students' actual behaviors. Future research should cover a broader range of participants, incorporate qualitative methods such as interviews or focus groups, and examine other social media platforms to better understand how digital environments influence environmental learning and awareness.

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Declaration of Generative AI and AI-Assisted Technologies in the Writing Process

This manuscript was refined with the assistance of AI-based language generation and editing tools, specifically ChatGPT, Gemini, and Notebooklm. The AI was used to enhance clarity, coherence and structure in support of the discussion.

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Chapter by Chapter, Prayer by Prayer: An Indonesian Muslim Woman's Autoethnography of Faith, Labour, and Learning in Australian Higher Education

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Abstract

This article presents a scholarly autoethnography that intertwines multiple aspects, covering the personal, spiritual, and intellectual journey of an Indonesian Muslim woman pursuing a PhD in Australia. It reflects on the lived experience of navigating the doctoral process, chapter by chapter, in which academic labour is sustained by daily prayers performed five times a day. Prayer, as both a spiritual discipline and an embodied practice, provides continuity, grounding, and resilience, positioning scholarly writing as inseparable from acts of faith and emotional endurance. The narrative demonstrates how each stage of the doctoral journey corresponds to confirmation, data collection, analysis, and submission. Drawing on Islamic feminism and care-focused feminism, this work highlights how women's voices and lived realities must be placed at the centre of both religious and academic discourse, challenging reductive interpretations that marginalise women's contributions to international education. Meanwhile, Institutional Ethnography (IE) provides an analytic lens for connecting personal experiences to broader institutional structures, covering key requirements and university regulations. Through situating the self within these intersecting frameworks, this autoethnography illustrates how prayer, care, and writing form a triadic structure of survival, resilience, and agency for Muslim women scholars in the Western academic field. Ultimately, the article contributes to discussions of international doctoral education by foregrounding how faith and care practices are not peripheral but central to the intellectual and institutional negotiations of Muslim women's academic lives.

Keywords: Indonesian Muslim woman, international education, academic, spirituality, feminism

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Introduction

I began writing this article in the quiet corner of the PhD hub. Then, the call to *Dzuhur* echoed softly through my headphones. I closed my laptop, performed ablution, and stood in prayer. Between the rhythmic cycles of bowing and prostration, I felt the tension of argument loosen and the clarity of intention sharpen. I returned to my writing and typed the opening line: *In the name of God, I begin my article*.

This article emerges from such moments in which spiritual devotion and academic labour do not compete but coexist, intersect, and sustain one another. Prayer, in this sense, is not an interruption of productivity but constitutive of it. As an Indonesian Muslim woman doctoral student studying within Australian higher education, I experience prayer not as a suspension of intellectual work but as a reorganisation of it.

In dominant imaginaries of Western higher education, religion is often framed either as a private belief system or as a potential impediment to rational inquiry (Casanova, 1994; Habermas, 2008). Secular academic norms tend to position knowledge production as detached, neutral, and disembodied (Asad, 2003; Taylor, 2007). This framing reflects what scholars have described as the implicit secularism of modern universities, where faith is tolerated as identity but marginalised as epistemology (Ahmed, 2012; Braidotti, 2013).

The marginalisation of spiritual epistemologies within Western academia has produced what some scholars describe as an artificial disembodiment of knowledge production (Asad, 2003; Connolly, 1999). Modern universities, shaped by Enlightenment rationalism, tend to define legitimate knowledge as secular, objective, and detached from devotional commitments (Taylor, 2007). Within this framework, religious practice is frequently treated as either irrelevant or suspect within scholarly environments. Yet scholars of Islam and embodiment challenge this secular binary and need the reconceptualisation. It is crucial for understanding Muslim women scholars' engagement with academia. Prayer structures time; fasting reconfigures bodily rhythms; intention (*niyyah*) reorients purpose. These practices are not external to intellectual labour but shape how it is understood and enacted.

Muslim woman scholar Amina Wadud (2006) argues that worship is not merely ritual observance but an ethical and intellectual discipline that shapes moral reasoning and interpretive authority. Similarly, Saba Mahmood (2005), in Politics of Piety, reconceptualises agency through embodied religious practice. Studying women's mosque movements in Egypt, Mahmood (2005) demonstrates that ritual acts such as prayer, veiling, and bodily discipline are not signs of passivity but modes of ethical self-formation. Agency, in this framing, is cultivated through disciplined repetition rather than oppositional resistance.

Within such contexts, religious practice is rendered largely invisible in formal academic discourse, even as institutions rhetorically celebrate diversity (Ahmed, 2012; Stevenson, 2014). However, for visibly Muslim women, particularly those who wear the hijab, religion is neither invisible nor easily privatised. Instead, it becomes embodied, spatial, and often hyper-visible within university environments. Research on Muslim students in Western universities demonstrates that religious practices such as prayer, fasting, and veiling frequently shape experiences of belonging, visibility, and negotiation within secular campuses (Mir, 2014). These experiences highlight the ways institutional norms of secularism intersect with gender, race, and religion in shaping Muslim women's academic lives.

Drawing on scholarly feminist autoethnography, this article narrates my doctoral journey chapter by chapter, prayer by prayer. In doing so, it contributes to three intersecting conversations: first, scholarship on religion within secular higher education; second, feminist autoethnography as an embodied epistemological practice; and third, critical analyses of Muslim women's intellectual labour. By foregrounding prayer as both a spiritual discipline and an epistemic practice, I challenge the presumption that faith must remain peripheral to academic life for scholarship to be considered legitimate. Instead, I argue that recognising faith as an epistemic practice exposes the narrowness of secular productivity norms and invites more pluralistic understandings of knowledge-making.

Theoretical Underpinnings

This article is grounded in the intersecting theoretical perspectives of Islamic feminism and care-focused feminist theory. Together, these frameworks challenge dominant secular assumptions about knowledge production and illuminate how spiritual practice, care, and intellectual labour can coexist within academic life.

Islamic Feminism

Islamic feminism provides a critical lens for understanding the relationship between spiritual devotion and intellectual inquiry. Within this framework, acts of *ibadah* (worship) and the pursuit of *'ilm* (knowledge) are not opposed but mutually reinforcing practices (Barlas, 2002; Wadud, 2006). Islamic intellectual traditions have historically positioned knowledge-seeking as a form of devotion, in which learning itself becomes an act of worship (Halstead, 2004; Nasr, 2001). Contemporary Islamic feminist scholars emphasise that ritual practices such as prayer, fasting, and charity cultivate ethical discipline, moral accountability, and spiritual reflection that inform both personal and intellectual life (Mahmood, 2005; Wadud, 2006).

As Etin Anwar (2018) argues, Islamic feminism reclaims interpretive authority by foregrounding women's lived religious experiences and their engagement with Islamic ethical traditions. Through this lens, religious practices are not merely personal rituals but sites of meaning-making and agency. Prayer, fasting, and other devotional acts become forms of embodied resistance against secular narratives that portray faith as incompatible with intellectual autonomy (Mahmood, 2005). In this sense, Islamic feminism reframes spiritual practice as a source of intellectual resilience, ethical orientation, and epistemic grounding within academic environments that often marginalise religious ways of knowing.

Despite these contributions, Islamic feminism also has certain limitations when applied to the analysis of academic labour within secular institutions. Much of the scholarship within this field focuses on scriptural interpretation, gender justice in Muslim societies, or legal reforms within Islamic traditions. While these discussions are crucial, they sometimes pay less attention to how Muslim women navigate institutional structures such as universities, bureaucratic policies, and academic productivity regimes. As a result, Islamic feminism alone may not fully account for how institutional power relations shape the everyday experiences of Muslim women scholars within Western higher education.

Care-Focused Feminism

Care-focused feminist theory further deepens this analysis by foregrounding relationality, interdependence, and emotional labour within knowledge production. Scholars such as Joan

Tronto (1993) challenge dominant academic norms that prioritise detachment, productivity, and individualism. Instead, they conceptualise care as a central ethical and political practice that sustains both communities and intellectual work.

Within this perspective, care extends beyond interpersonal relationships to include practices that nurture the self, the body, and the spirit. Rest, reflection, and spiritual devotion are therefore not interruptions to academic productivity but essential conditions that enable sustained intellectual engagement. Building on these insights, Rosemarie Tong (2009) highlights how diverse feminist traditions recognise care as both a moral orientation and a methodological approach that shapes the production and sharing of knowledge. By framing care as a method, care-focused feminism invites a reconsideration of academic labour as relational and embodied. Writing, prayer, rest, and reflection become interconnected practices situated within a broader ecology of care. In this article, these practices are understood not as separate domains of life but as mutually sustaining forms of labour that support intellectual creativity, emotional resilience, and spiritual grounding.

However, care-focused feminist theory also has limitations in this context. Much of the literature on care ethics emerges from Western philosophical traditions and often focuses on interpersonal relationships, caregiving roles, and social welfare structures (Gilligan, 1982; Tronto, 1993). While these frameworks illuminate the importance of relational labour, they do not always address how spiritual practices and religious commitments shape care experiences (Held, 2006). Consequently, care-focused feminism may not fully capture how faith-based practices such as prayer function as forms of self-care, discipline, and ethical orientation for religious scholars.

Methodology

Feminist Autoethnography and Institutional Ethnography (IE)

This article employs a feminist autoethnographic methodology informed by Institutional Ethnography (IE). The study is grounded in the lived, embodied, and spiritual experiences of a Muslim woman doctoral student navigating an Australian university. Feminist autoethnography recognises the researcher's lived experience as a legitimate site of knowledge production and challenges the assumption that scholarly inquiry must remain detached from personal or embodied perspectives (Adams et all., 2014). Rather than positioning the researcher as a distant observer, this approach acknowledges that knowledge is produced through situated experiences shaped by identity, power, and institutional structures (Smith, 2005).

In this study, my positionality as an Indonesian Muslim woman and a visibly hijabi doctoral student forms the starting point of inquiry. Experiences of prayer, writing, fatigue, and moments of reflection are not treated merely as personal anecdotes but as analytically significant sites through which broader institutional processes become visible. Feminist autoethnography enables the examination of how everyday academic practices, such as writing deadlines, supervisory meetings, and navigating campus spaces, intersect with spiritual practices, including prayer, fasting, and intentional reflection (Ellis et al., 2011; Hopkins, 2016). Through this approach, embodied experiences of faith within academic spaces are analysed as forms of knowledge that reveal how secular institutional norms shape the possibilities and constraints of academic life (Smith, 2005).

This autoethnographic approach is further informed by the IE developed by Dorothy E. Smith (2005). IE begins with people's everyday experiences and investigates how these experiences are coordinated by broader institutional relations. Rather than studying individuals in isolation, IE traces how daily activities are organised through what Smith (2005) describes as "ruling relations": the complex networks of texts, policies, administrative procedures, and institutional expectations that structure social life.

By integrating feminist autoethnography with IE, this study connects personal narrative with institutional analysis. Experiences of prayer during writing sessions, negotiating Ramadan within academic schedules, or encountering the visibility of the hijab within predominantly secular spaces are analysed not simply as individual experiences but as entry points for examining how universities organise academic labour. In this way, the autoethnographic account becomes a methodological tool for tracing how institutional norms surrounding productivity, secularism, and professional conduct shape the everyday lives of Muslim women scholars.

Data Sources

The analysis draws on multiple forms of qualitative material generated throughout the PhD journey. These include reflexive journals documenting everyday academic practices, emotional responses, and spiritual reflections encountered in spaces such as prayer rooms, libraries, and workshops. These journals capture the rhythms of daily academic life and record moments where spiritual practice intersected with intellectual labour (Ellis et al., 2011; Habermas, 2008). Reflexive journaling is widely used in qualitative research to document the researcher's evolving interpretations, emotions, and positionality throughout the research process.

The study also incorporates memory work reflecting on significant moments of visibility, vulnerability, and decision-making within academic spaces. These moments include navigating prayer within institutional schedules, negotiating expectations during Ramadan, and encountering the visibility of the hijab in academic environments. Memory work allows for the reconstruction of events that reveal how personal experiences are shaped by broader institutional contexts (Smith, 2005).

Fieldnotes were also developed through ongoing engagement with institutional settings. These notes document interactions in academic environments regarding the organisation of space, time, and academic expectations at the university. In addition, the analysis engages with institutional texts encountered in everyday academic life. These texts include academic schedules, doctoral workshops, university policies, and access to prayer spaces. Within IE, such texts are not merely background documents but active coordinators of institutional life, shaping how doctoral work is organised and evaluated (Campbell & Gregor, 2004; Smith, 2005).

Reflexivity and Ethical Considerations

Reflexivity forms a central component of this research. As both the subject and author of the study, I continuously interrogated my positionality as an Indonesian, Muslim woman and international doctoral student within Australian higher education. Reflexive writing served as a methodological tool for examining how my embodied experiences of faith, identity, and academic labour were shaped by institutional contexts. These reflections were further enriched through conversations with peers and mentors, which helped situate personal experiences within broader social and institutional dynamics (Berger, 2015; Pillow, 2003).

Ethical considerations were carefully addressed throughout the research process. References to specific individuals or institutional locations have been anonymised to protect confidentiality. At the same time, the research acknowledges an ethical responsibility to represent experiences honestly and respectfully, recognising accountability not only to academic audiences but also to the broader spiritual and scholarly communities with which the researcher identifies (Ellis et al., 2011; Tolich, 2010).

Analytic Process

The analytic process followed an iterative and reflexive approach consistent with both feminist autoethnography and IE. Journal entries, fieldnotes, memory narratives, and institutional texts were read and re-read to identify recurring patterns and moments of tension within everyday academic life. Themes were derived inductively through this process, with particular attention to moments of disjuncture, instances where institutional expectations clashed with lived realities (Braun & Clarke, 2006; Smith, 2005).

Within IE, such disjunctures are analytically significant because they reveal how institutional norms operate in practice. In this study, moments when prayer schedules conflicted with academic timelines or when embodied religious practices intersected with expectations of academic productivity became key points of analysis. These moments were then traced to broader relations of ruling embedded within institutional texts, policies, and cultural norms governing academic life.

Through this analytic process, the study moves beyond personal reflection to examine how faith-based academic labour is often rendered invisible within secular institutional frameworks. By tracing connections between individual experiences and institutional structures, the analysis highlights how Muslim women scholars negotiate the intersections of spirituality, care, and intellectual work within contemporary universities (Campbell & Gregor, 2004; Smith, 2005).

Results and Discussion

Faith, Prayer, and Academic Life

In Islam, faith is understood as *iman*, encompassing belief in the heart, profession by the tongue, and action through embodied practice. Central to this faith is the declaration known as the *Shahadah*, the foundational testimony that affirms belief in the oneness of God and the prophethood of Muhammad "أَشْهَدُ أَنْ لَا إِلَهَ إِلَّا اللهُ وَأَشْهَدُ أَنَّ مُحَمَّدًا رَسُولُ اللهِ" (*I bear witness that there is no god but Allah, and I bear witness that Muhammad is the Messenger of Allah*).

Within Islamic life, faith is not merely a belief but a lived discipline structured through acts of worship. Among these practices, *ṣalāh* (daily prayer) holds a central place. Performed five times a day, Subuh, Dzuhur, Ashar, Maghrib, and Isya prayer structures time, shapes bodily rhythms, and sustains a continuous awareness of God. As the second pillar of Islam, prayer is both a spiritual obligation and a source of ethical orientation, discipline, and reflection (Hopkins, 2016; Nasr, 2001; Qur'an 29:45). The Prophet Muhammad also described prayer as the "pillar of religion," emphasising its central role in Muslim life (Al-Tirmidhi, Hadith 2616).

During my doctoral journey, these five daily prayers gradually became more than moments of worship; they formed a temporal framework through which my academic labour unfolded. Rather than interrupting scholarly work, prayer organised it. The rhythm of prayer created a

structure that sustained writing, reflection, and intellectual struggle. Through the lens of feminist autoethnography and Institutional Ethnography (IE), this alignment between prayer and academic labour reveals how spiritual practices can serve as epistemic and emotional support within institutional environments that often privilege secular norms of productivity (Anwar, 2018; Nasr, 2001).

Chapter by Chapter, Prayer by Prayer

Subuh (Before Sunrise) – Beginnings and Epistemological Reflection

The first chapter of my article emerged during the early hours surrounding *Subuh* prayer. Before sunrise, when the world had not yet fully awakened, I reflected on the epistemological tensions between institutional expectations and my lived experiences as a Muslim woman scholar in Western academia. In these moments of stillness, the research aim began to take shape. These insights did not emerge solely through intellectual reasoning but also through prayer, reflection, and *dua* (supplication), practices that in Islamic tradition cultivate mindfulness and spiritual intention (Nasr, 2001).

From the perspective of IE, these moments reveal that academic inquiry begins in lived experience rather than in abstract theoretical spaces. Starting from the standpoint of a hijabi doctoral student makes visible the disjunctures between the secular assumptions embedded in university structures and the spiritual practices that shape everyday academic life (Smith, 2005). Beginning from one's standpoint is central to IE because it allows researchers to trace how institutional relations organise everyday experiences (Campbell & Gregor, 2004).

Dzuhur (Midday) – Literature Review and Intellectual Reorientation

As the day progressed toward the *Dzuhur* prayer, the work of synthesising literature often demanded sustained cognitive focus. Reading and engaging with Western feminist theories sometimes produced intellectual dissonance, particularly when religion was framed primarily as a constraint on women's agency. Pausing for prayer during *Dzuhur* created a moment of recalibration.

These pauses challenged dominant academic norms that view interruptions as inefficiencies. Instead, prayer functioned as a form of intellectual care. Through the lens of care-focused feminist theory, particularly Rosemarie Tong's (2009) work, such practices can be understood as part of an ethics of care within academic labour. Feminist scholars have long argued that intellectual work is sustained not only by productivity but also by practices of care, reflection, and relational well-being (Tronto, 1993). In this context, prayer becomes a moment of restoration that enables sustained intellectual engagement rather than disrupting it.

Ashar (Afternoon) – Methodological Struggles and Embodied Discipline

The writing of the methodology section coincided with the afternoon period associated with the *Ashar* prayer. During this time, I navigated complex research processes, including designing and developing the approach for my article. Much of this work occurred during Ramadan, when fasting intensified both physical fatigue and spiritual awareness.

From an Islamic feminist perspective, prayer and fasting are not simply acts of ritual obedience but practices that cultivate ethical discipline, intentionality, and spiritual consciousness. Islamic

feminist scholarship highlights how women's lived religious practices function as sites of knowledge production and agency (Anwar, 2018; Tong, 2009). Within this framework, fasting did not diminish my academic capacity but deepened my commitment to the research process. The discipline of fasting reinforced a sense of purpose that grounded the methodological decisions shaping this study. The Qur'an also emphasises fasting as a practice that cultivates self-discipline and moral consciousness (*taqwa*) (Qur'an 2:183).

Maghrib (After Sunset) – Discussion and Self-Reflection

As evening approached and the *Maghrib* prayer marked the transition from day to night, I often engaged in analysis and self-reflection by journaling about my daily experiences and those of other women navigating academic life. These reflections revealed shared tensions between faith, identity, and institutional expectations.

Through the lens of IE, such narratives illustrate how individual experiences are coordinated through broader institutional structures. University policies, doctoral timelines, and productivity norms shape how scholars organise their daily lives (Smith, 2005). Yet religious practices such as prayer, fasting, and spiritual reflection provide resources for resilience, ethical orientation, and identity formation within these structures. These practices can be understood as forms of spiritual scaffolding that sustain academic life within institutional environments that often privilege secular norms.

Isya' (Night) – Writing in the Silence of Night

The final stages of writing frequently occurred after the *Isya* prayer, when the quiet of the night created space for concentrated work. In these moments, writing and prayer existed side by side. Drafting chapters, revising arguments, and engaging in spiritual reflection became intertwined practices.

Writing in the silence of the night gradually transformed academic labour into a form of devotional practice. Within Islamic intellectual traditions, the pursuit of knowledge (*'ilm*) is itself understood as a form of worship when undertaken with sincere intention (*niyyah*) (Nasr, 2001). The process of producing knowledge, therefore, became inseparable from spiritual intention. In this sense, the thesis itself evolved into a space where intellectual inquiry and spiritual devotion converged, illustrating how faith can sustain scholarly life within secular institutional environments.

Institutional Ruling Relations and Spiritual Scaffolding

While prayer provided rhythm and grounding, the doctoral journey remained deeply shaped by institutional ruling relations. Institutional Ethnography (IE) highlights how everyday activities are coordinated through texts, policies, and bureaucratic processes that organise institutional life (Campbell & Gregor, 2004; Smith, 2005). Milestone deadlines, ethics applications, supervision meetings, and university regulations structured the temporal rhythms of doctoral study.

These institutional structures often operate on the basis of secular assumptions about productivity and time. Prayer schedules, Ramadan fasting, and other religious practices are rarely considered within official timelines or institutional policies. As a result, Muslim PhD students frequently navigate a hidden negotiation between institutional expectations and

spiritual commitments (Ahmed, 2012; Braidotti, 2013). Research on Muslim students in Western universities has also shown how visible religious practices, such as wearing the hijab or observing prayer, can create tensions within academic environments that assume religion to be private or invisible (Pouraskari et al., 2023).

Within this context, faith functioned as a form of spiritual scaffolding. Prayer was a structured time when institutional pressures created chaos. Fasting cultivated discipline when exhaustion threatened motivation. Spiritual reflection provided meaning during moments of uncertainty and grief. Islamic traditions have long emphasised that acts of worship cultivate patience (*sabr*), mindfulness, and perseverance (Nasr, 2001; Qur'an 2:153). The alignment between religious routines and academic tasks was therefore not accidental but intentional and deeply resilient.

Beyond academic achievement, the doctoral journey became a spiritual process of self-discipline, resistance, and transformation. Recognising this dimension challenges dominant assumptions that treat faith as irrelevant to scholarly work. Instead, the experiences documented in this study highlight the importance of legitimising spiritual labour and acknowledging the epistemic value of faith-based practices within academic environments (Anwar, 2018; Braidotti, 2013).

Rethinking International Doctoral Education

The experiences presented in this study also raise broader questions about how international higher education understands student well-being and support. Universities often emphasise academic skills, productivity, and professional development while overlooking the diverse realities that shape the lives of international doctoral students (Mir, 2014).

For many global scholars, doctoral education involves navigating multiple temporal, emotional, and spiritual dimensions simultaneously. Temporal realities include managing academic schedules alongside religious calendars and prayer times. Emotional realities involve balancing academic demands with personal responsibilities, family expectations, and experiences of cultural displacement. Spiritual realities include maintaining religious practices that provide meaning, resilience, and identity. Studies on international students have shown that religious and cultural practices often serve as important sources of belonging and psychological support during study-abroad experiences (Yakushko, 2010).

Recognising these dimensions requires universities to expand their understanding of student support. Rather than viewing religious practices as private matters outside academic life, institutions could acknowledge how spiritual practices contribute to students' well-being and intellectual engagement. Providing prayer spaces, flexible scheduling during religious observances, and culturally responsive support systems are important steps toward creating more inclusive academic environments (Ahmed, 2012; Hopkins, 2016).

From the perspectives of Islamic feminism and care-focused feminism, such changes also represent broader commitments to justice and relational care within higher education. Islamic feminism highlights how Muslim women's religious practices can function as sources of agency and intellectual authority (Anwar, 2018; Tong, 2009), while care-focused feminism emphasises the importance of recognising emotional, relational, and ethical labour within academic life (Tong, 2009; Tronto, 1993).

Together, these perspectives invite a reimagining of doctoral education that acknowledges the full humanity of scholars. For international Muslim women PhD students in particular, faith is not separate from intellectual life but deeply intertwined with the pursuit of knowledge, resilience, and becoming.

Conclusion

For many Muslim women like myself, the PhD is more than an academic pursuit; it is a spiritual journey of self-discipline, resistance, care, and becoming. Conventional framings of scholarly work as purely cognitive or disembodied overlook the full labour of international scholars who navigate complex temporal, emotional, and spiritual realities, including time-zone differences, gendered responsibilities, and religious rituals. This feminist autoethnography calls on international higher education institutions to expand their definitions of support, inclusion, and well-being to better recognise the lived realities of global scholars. Universities should consider practical measures such as inclusive scheduling, accessible prayer spaces, and culturally responsive support systems that acknowledge spiritual practices as part of academic life. Faith-based practices are not interruptions to scholarly productivity; they function as infrastructures of resilience. The prayer mat and the manuscript are not opposites but allies. In affirming the epistemic legitimacy of spiritual labour, this study offers not a narrative of deficit but one of depth, highlighting how faith can sustain intellectual life and enrich the possibilities of knowledge-making.

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Declaration of Generative AI and AI-Assisted Technologies in the Writing Process

I acknowledge the use of Microsoft Copilot (https://copilot.microsoft.com/) to refine the academic language and accuracy of my own work. I significantly adapt and critically modify the content generated by this tool to accurately reflect my unique style and voice. Consequently, I take full responsibility for the final content of this document, noting that it represents my original ideas and adheres to academic integrity and quality requirements.

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Design and Evaluation of a Digital Agricultural Insurance Platform to Improve Claims Processing Efficiency in Indonesia: Applications in Agricultural Education

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Abstract

Digital technology innovation plays a pivotal role in enhancing the efficiency of the agricultural sector, including in the management of agricultural insurance. This study aims to design and evaluate a digital agricultural insurance platform that improves the efficiency of claims processing in Indonesia, with a particular focus on its applications within agricultural education. The proposed platform is designed to simplify the process for farmers in submitting insurance claims through an application-based system integrated with digital agricultural data, accelerating claim verification and reducing the potential for human error. The research adopts a user-centered design (UCD) approach combined with user testing involving farmers and agricultural education institutions to ensure usability and contextual relevance. The findings demonstrate that the developed platform significantly improves claims processing efficiency, reduces processing time, and enhances overall user satisfaction. Furthermore, the integration of this digital solution into agricultural education offers a pedagogical innovation by linking practical technology adoption with theoretical learning, equipping students with the digital competencies necessary for future agri-tech ecosystems. The results contribute to the broader discourse on digital transformation in agriculture by providing an implementable framework for efficient, accessible, and educationally relevant agricultural insurance systems in developing countries.

Keywords: digital agriculture, agricultural insurance, claims processing, user-centered design, agricultural education

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Introduction

Agricultural production systems worldwide are increasingly exposed to climate-related risks that threaten food security and farmer livelihoods. Climate change has intensified the frequency and severity of extreme weather events such as droughts, floods, and pest outbreaks, which can significantly disrupt agricultural production systems. According to the Intergovernmental Panel on Climate Change (IPCC, 2022), these environmental changes are expected to further increase agricultural vulnerability, particularly in regions where farming systems depend heavily on natural climatic conditions. Similarly, the Food and Agriculture Organization (FAO, 2022) highlights that strengthening agricultural resilience has become a global priority to ensure sustainable food systems and safeguard rural livelihoods.

Climate-related risks pose particularly serious challenges for agricultural systems in developing countries. As noted by Morton (2007), smallholder farmers are among the most vulnerable groups to climate variability because their livelihoods often depend directly on rainfall-based agricultural production. Wheeler and von Braun (2013) further emphasize that climate change is likely to intensify production risks in agriculture, potentially affecting global food security and increasing economic instability in rural communities. In addition, Challinor et al. (2014) argue that the growing uncertainty of climate patterns may significantly alter crop productivity and farming practices across many regions of the world.

In Indonesia, agriculture remains a fundamental sector supporting both the national economy and rural employment. The World Bank (2021) reports that millions of Indonesian households rely on agricultural activities as their primary source of livelihood, while rice continues to play a central role in maintaining national food security. However, the agricultural sector in Indonesia is highly vulnerable to environmental hazards such as floods, droughts, and pest infestations. These environmental disturbances frequently lead to crop failures that disrupt agricultural production cycles and create severe financial shocks for farmers. Previous research has shown that rice farmers often experience production losses caused by pest attacks and climate-related disturbances, resulting in unstable farm income and increased production risks (Naylor et al., 2007; Saragih et al., 2018).

Given the high level of uncertainty in agricultural production, effective risk management mechanisms are essential to protect farmers from severe economic losses. One of the most widely adopted approaches for managing agricultural risks is agricultural insurance. According to Mahul and Stutley (2010), agricultural insurance programs are designed to provide financial compensation to farmers when crop losses occur due to uncontrollable environmental factors. By stabilizing farm income and facilitating post-disaster recovery, agricultural insurance can play a significant role in improving the resilience of farming systems. Empirical studies also show that agricultural insurance can help reduce economic vulnerability among rural households and encourage farmers to maintain agricultural production following adverse events (Carter et al., 2020; Jensen & Barrett, 2022a).

Despite these potential benefits, the effectiveness of agricultural insurance programs often depends on the efficiency of their operational processes, particularly in claims management. In many agricultural insurance schemes, the claims process involves multiple administrative stages, including damage reporting, field inspections, document verification, and institutional approval procedures. Mahul and Stutley (2010) note that these administrative processes often require coordination among multiple stakeholders such as farmers, insurance providers, and

government agencies. As a result, the verification and approval of insurance claims may take considerable time before compensation payments are delivered to farmers.

For farmers who rely on timely financial recovery to restart agricultural production, delays in claims processing can significantly affect their ability to resume farming activities. Cole et al. (2013) argue that inefficient insurance procedures may reduce farmers' trust in insurance programs and discourage participation in risk-management initiatives. Similarly, Greatrex et al. (2015) observe that administrative complexity and slow claim settlement remain major challenges in the implementation of agricultural insurance programs in many developing countries. Improving the efficiency and accessibility of claims management systems has therefore become an important priority for strengthening the practical effectiveness of agricultural insurance.

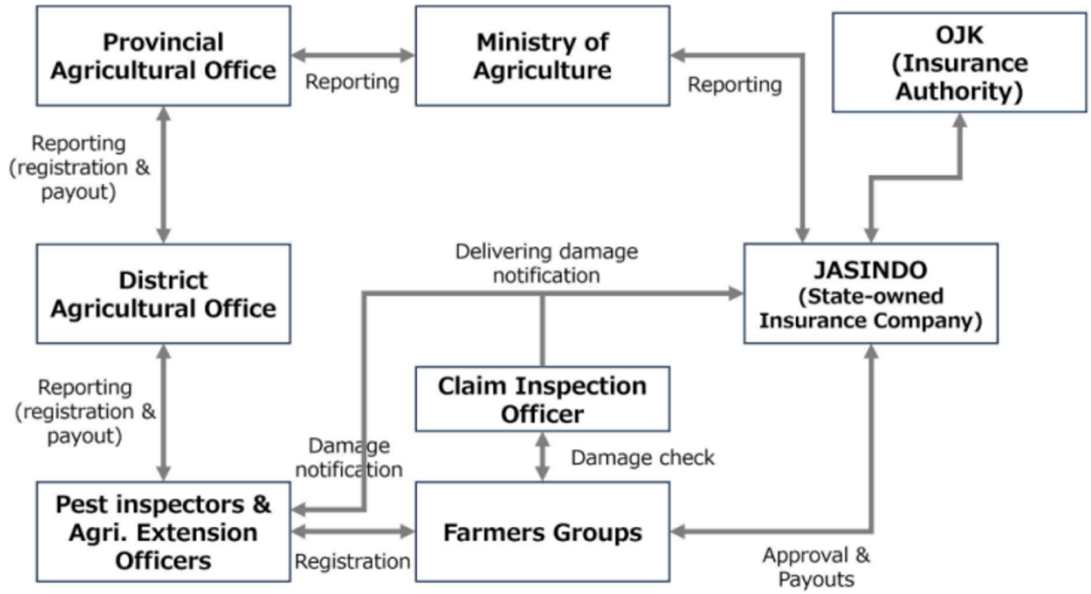
Recent advancements in digital technologies offer promising opportunities to address these operational challenges. Digital platforms can facilitate faster damage reporting, improve coordination among stakeholders, and provide transparent tracking of claim processing. Research on digital agriculture suggests that digital technologies have the potential to transform agricultural services by improving information flows, reducing transaction costs, and increasing operational efficiency (Wolfert et al., 2017). In addition, Klerkx and Rose (2020) emphasize that digital platforms can enhance the delivery of agricultural services and support more efficient agricultural management systems.

However, existing research on digital agriculture has primarily focused on production-related technologies such as precision farming, remote sensing, and farm management systems. Klerkx and Rose (2020) note that most digital agriculture innovations are designed to improve agricultural productivity and resource efficiency. Comparatively limited attention has been given to administrative support systems such as agricultural insurance claims management. Furthermore, many digital initiatives overlook the importance of ensuring that technological solutions remain accessible and usable for farmers with varying levels of digital literacy.

To address these challenges, there is a growing need for approaches that integrate technological innovation with human-centered system design. User-centered design (UCD) emphasizes the active involvement of end users throughout the design process to ensure that technological systems align with users' needs, capabilities, and real-world contexts (ISO, 2019). By incorporating user feedback during system development, UCD can improve system usability and increase the likelihood of successful technology adoption.

Therefore, this study aims to design and evaluate a digital agricultural insurance platform that improves the efficiency of claims processing in Indonesia. The research adopts a user-centered design approach to develop a farmer-friendly digital claims prototype and explores the integration of the platform within agricultural education contexts to support technology adoption among farmers.

Figure 1
Conventional Agricultural Insurance Claims Workflow



Source: Directorate Agricultural Financing, MoA, Indonesia

Literature Review

This section reviews relevant studies related to digital transformation in agriculture, agricultural insurance systems, and user-centered design approaches. The review aims to identify key findings from previous research and highlight the research gap addressed in this study.

Digital Transformation in Agriculture

Digital transformation has become a key driver of innovation in modern agricultural systems. Digital technologies such as mobile applications, data analytics, and digital platforms have the potential to improve agricultural productivity and enhance service delivery within agricultural value chains. Digital platforms can facilitate communication between farmers and institutions, enabling more efficient exchange of information and improving access to agricultural services (Klerkx & Rose, 2020).

However, most digital agriculture initiatives focus primarily on improving farm-level productivity rather than administrative support systems. As a result, important components of agricultural services, such as insurance management, often remain characterized by inefficient administrative procedures.

Agricultural Insurance and Risk Management

Agricultural insurance plays an important role in protecting farmers from financial losses caused by environmental risks. By providing financial compensation following crop failure, insurance systems can reduce income volatility and enable farmers to continue investing in agricultural production (Jensen & Barrett, 2022b).

Nevertheless, the effectiveness of agricultural insurance programs often depends on how efficiently claims are processed. Slow verification processes and administrative complexity can

discourage farmers from participating in insurance schemes and reduce the overall impact of these programs (Miranda & Farrin, 2021).

User-Centered Design in Digital Systems

User-centered design (UCD) provides a methodological framework that emphasizes designing systems based on the needs and capabilities of end users. By involving users throughout the development process, UCD helps ensure that digital systems are usable, accessible, and aligned with real-world contexts (ISO, 2019).

In agricultural contexts where digital literacy levels vary widely among farmers, incorporating user-centered design principles is particularly important for ensuring successful technology adoption.

Methodology

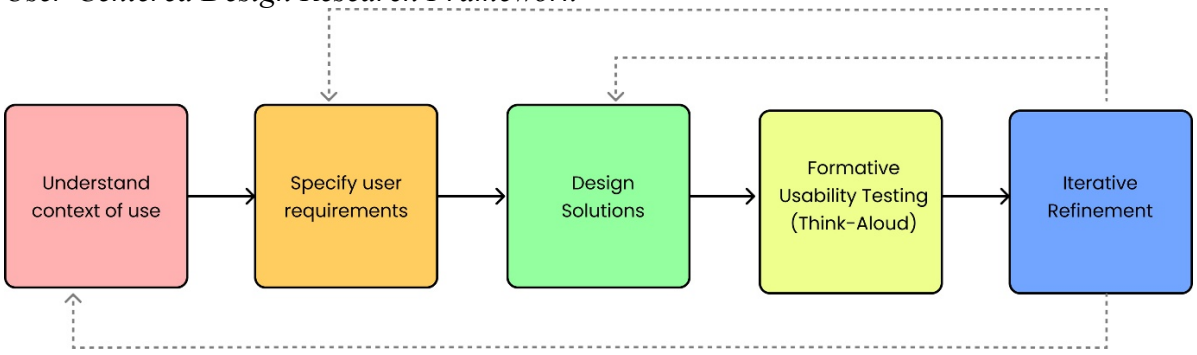
This study adopts a user-centered design (UCD) approach based on the ISO 9241-210 framework for human-centered system development. The UCD approach emphasizes iterative design and active user involvement throughout the system development process.

The research process consisted of five main stages:

1. Understanding the context of use
2. Specifying user requirements
3. Designing the solution prototype
4. Conducting usability testing
5. Iterative refinement of the system

Figure 2

User-Centered Design Research Framework



Source: ISO 9241-210 (2019)

Participants

A total of 44 participants were involved in this study, consisting of:

- 24 farmers
- 20 agricultural education students

Participants were selected through purposive sampling to represent different agricultural contexts and levels of digital literacy.

Data Collection

Data were collected through several methods:

- Semi-structured interviews
- Field observation
- Usability testing using think-aloud protocol

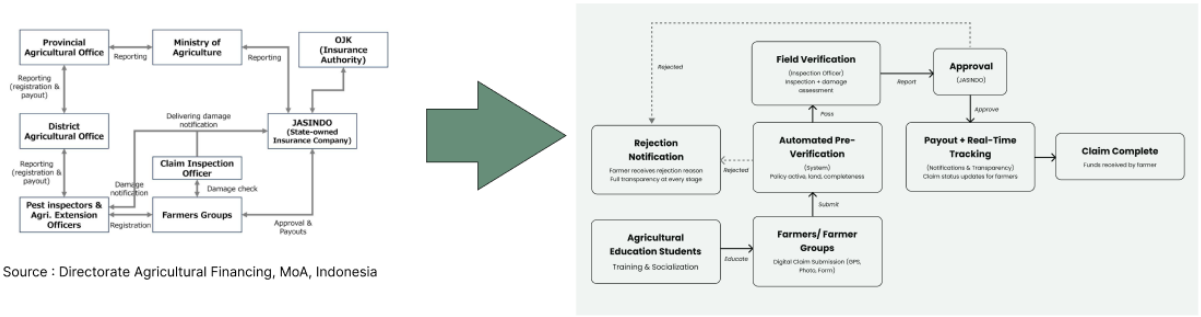
The think-aloud method allowed researchers to observe user interactions with the prototype while participants verbalized their thoughts during task completion.

Results and Discussion

Current Insurance Claims Process

Field observations revealed that the existing agricultural insurance claims process involves multiple administrative stages and relies heavily on manual documentation. Farmers are typically required to report crop damage to local agricultural officers, after which field inspections and document verification procedures are conducted before claims can be approved.

Figure 3
Current vs Proposed Insurance Claims Workflow



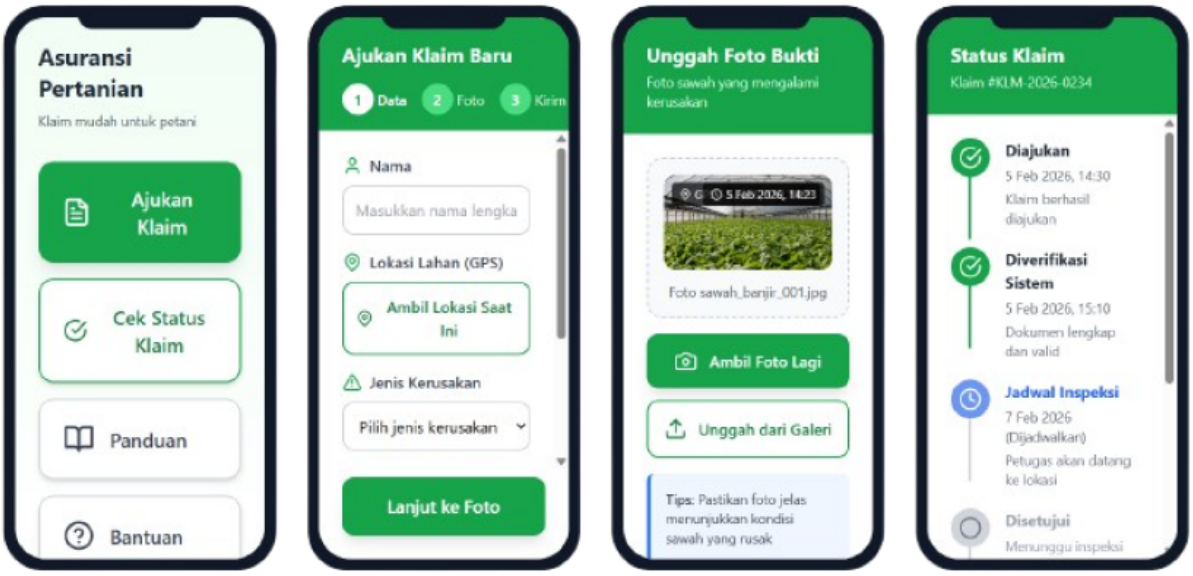
Source : Directorate Agricultural Financing, MoA, Indonesia

Digital Claims Prototype

Based on the user-centered design process, a digital claims platform prototype was developed. The prototype includes several key features:

- Digital claim submission
- Photo-based evidence upload
- GPS and timestamp verification
- Real-time claim status tracking
- Dashboard interface for insurance administrators

Figure 4
Digital Claims Platform Prototype Interface



Usability Testing

To evaluate the usability of the proposed digital agricultural insurance platform, usability testing was conducted with representative users, including farmers who are potential end users of the system. The testing focused on assessing how easily participants could complete key tasks such as submitting claims, uploading evidence of crop damage, and monitoring claim status. User feedback was also collected to identify usability issues related to navigation, interface clarity, and overall system interaction.

Table 1
Usability Testing Results of the Digital Agricultural Insurance Prototype

Feature / Task	Description	User Feedback	Improvement Outcome
Claim Submission Process	Step-by-step process for submitting agricultural insurance claims through the platform	Users reported that the digital workflow simplified the claim submission process compared to conventional manual procedures	Reduced administrative complexity and improved task completion
Photo Evidence Upload	Feature allowing farmers to upload photographic evidence of crop damage directly through the system	Farmers appreciated the ability to document crop damage quickly without relying on manual reporting	Improved documentation efficiency and reduced reporting time

Claim Status Tracking	Real-time monitoring of claim processing status within the platform	Users valued the transparency provided by real-time updates on claim progress	Increased user confidence and reduced uncertainty
System Navigation	Navigation structure guiding users through the main functions of the platform	Initial testing showed minor confusion in menu structure	Interface layout refined to improve navigation clarity
Interface Clarity	Visual presentation of system menus, icons, and instructions	Early prototypes required clearer instructions for some tasks	Improved labeling and simplified interface design
Task Completion	Ability of farmers to complete key tasks such as submitting claims and tracking claim status	After several iterations, users were able to complete tasks with fewer errors	Improved usability for users with limited digital experience

The results presented in Table 1 indicate that the digital prototype improved the usability of the agricultural insurance claim process. Participants highlighted that the system reduced the complexity of administrative procedures and provided greater transparency during the claim process. Iterative design improvements also enhanced navigation and interface clarity, enabling farmers to complete key tasks more efficiently, even among users with limited digital experience.

Conclusion

Agricultural insurance is an important risk management tool for protecting farmers from crop losses caused by environmental hazards. However, the effectiveness of agricultural insurance programs often depends on the efficiency of their operational systems, particularly the claims management process.

This study demonstrates that a user-centered digital platform can significantly improve the efficiency and accessibility of agricultural insurance claims processing. By simplifying administrative procedures, enabling digital evidence submission, and providing real-time claim tracking, the proposed system reduces complexity for farmers and improves transparency within the insurance process.

Furthermore, integrating the digital platform into agricultural education offers an innovative pathway for technology adoption. By positioning agricultural students as facilitators who support farmers in using digital systems, educational institutions can contribute to strengthening digital literacy and promoting wider adoption of agricultural technologies.

Overall, this research contributes an implementable framework that connects digital system design with education-based facilitation to improve agricultural insurance services in developing country contexts. Future research should explore the implementation of the platform in larger-scale pilot programs and evaluate its long-term impact on claims processing efficiency, farmer satisfaction, and insurance adoption rates.

Future Research

Future research may further explore the large-scale implementation of digital agricultural insurance platforms in different agricultural regions to evaluate their effectiveness in diverse farming contexts. Additional studies could also examine the long-term impact of digital claims systems on farmers' participation in agricultural insurance programs, particularly in terms of trust, accessibility, and adoption rates. Furthermore, future research may investigate the integration of emerging technologies such as satellite imagery, remote sensing, and artificial intelligence to enhance the accuracy and efficiency of damage verification in agricultural insurance systems. Expanding the role of agricultural education institutions in supporting digital technology adoption among farmers also presents an important area for further investigation.

Declaration of Generative AI and AI-Assisted Technologies in the Writing Process

The authors declare that AI-assisted technologies were used during the preparation of this manuscript solely for language refinement, including proofreading, grammar correction, and improving clarity of expression. The use of these tools was limited to editing support and did not contribute to the generation of the research content. All research ideas, study design, data collection, analysis, findings, and discussions presented in this paper are the original work of the authors and are derived from the careful and systematic conduct of the research.

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Academic Performance and Self-Concept Across Generations: Effects of Parents' Education, Gender, Year Level, and ChatGPT Use

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Abstract

This study examined the relationships among parents' educational attainment, gender, ChatGPT use, year level, academic performance (AP), and academic self-concept (ASC) among 563 undergraduates from Chinese Traditional University (10.8%), Wenzhou-Kean University (63.9%), and Kean University (25.2%). A comparative quantitative design was employed, and data were analyzed using descriptive statistics, two-way multivariate analysis of variance (MANOVA), and follow-up univariate ANOVAs. Results indicated that parents' educational attainment significantly predicted ASC but not AP. Continuing-generation students (i.e., those with at least one parent holding a college degree) reported higher academic self-concept than first-generation students (i.e., those whose parents did not complete a college degree), suggesting that parental education is associated with differences in academic self-beliefs. Gender and the Gender × Parents' Education interaction were not significant predictors of either academic outcome. ChatGPT usage frequency significantly predicted AP, with more frequent users demonstrating higher performance, but did not significantly predict ASC. Although year level showed no significant main effects on AP, a significant interaction emerged between ChatGPT usage × year level for AP: the positive association between ChatGPT use and performance was stronger among upper-year level students than freshmen. Year level was significantly associated with ASC, with seniors reporting higher self-concept than juniors. Overall, familial background was more closely linked to academic self-concept, whereas technology engagement—particularly in interaction with year classification—was associated with performance outcomes. These results underscore the multifaceted nature of student success and highlight the importance of considering both sociocultural and technological factors in higher education.

Keywords: academic performance, academic self-concept, first-generation and continuing-generation students, parents' education level, ChatGPT usage

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Introduction

The rapid uptake of generative AI, particularly ChatGPT, has quickly altered how undergraduates approach learning tasks. ChatGPT has been discussed as offering a range of functionalities that may support learners' study efforts (Lera et al., 2023). Prior research suggests that specific AI affordances are associated with improvements in learning efficiency and, in some contexts, with stronger academic performance (Echiverri et al., 2025). Specifically, Echiverri et al. found that ChatGPT's real-time feedback significantly enhanced student engagement and critical thinking, while adaptive tutoring features were linked to reduced anxiety and higher academic self-efficacy. Their results also revealed a strong positive correlation between learning efficiency and academic performance, and a moderate positive relationship between academic performance and academic self-concept, suggesting that students who experience efficiency gains with ChatGPT tend to report stronger academic self-beliefs. However, existing evidence remains limited and fragmented regarding whether these benefits translate into more sustained academic outcomes or into systematic differences across student backgrounds. In particular, there is still insufficient understanding of how background characteristics such as gender, parents' education level, and year level, together with differences in ChatGPT usage frequency, relate to students' academic development in higher education (Al-kfairy, 2024; J. Wang & Fan, 2025). To address this gap, the present study focuses on two central outcomes, Academic Performance and Academic Self-Concept, and examines how they vary across student backgrounds and patterns of ChatGPT use.

Academic Performance

Academic performance, often measured by grades and GPA, reflects students' academic capabilities (Agrawal & Nehajul, 2017; Alyahyan & Düştegör, 2020). It may improve via chatbot use, especially for first-generation students (Georgia State University, 2022). While ChatGPT offers personalized learning (Firat, 2023), it also risks spreading misinformation and increasing plagiarism (Lo, 2023; Qasem, 2023).

Critical Thinking

AI supports critical thinking by enhancing literature screening, theoretical analysis, and hypothesis testing, thus improving research quality (Darwin et al., 2024). It also fosters deep reflection through personalized systems and intelligent mentors (Spector & Ma, 2019).

Engagement/Motivation

AI boosts engagement and motivation by personalizing content delivery, increasing interest and participation (Huang et al., 2023). In language learning, it enhances enjoyment and goal-setting through interactive, tailored feedback (Yuan & Liu, 2025).

Self-Efficacy

Chatbots enhance self-efficacy by offering real-time, personalized support, building confidence and autonomy (Parsakia, 2023). In programming education, ChatGPT helps learners tackle challenges more effectively, improving outcomes (R. Yilmaz & Yilmaz, 2023).

Plagiarism Awareness

While AI improves writing efficiency, it raises concerns about originality and academic integrity (Hutson, 2024). Research shows it may lead to fabrication and ethical violations, posing risks to education and science (Elali & Rachid, 2023; Khalaf, 2025).

Academic Self-Concept

Academic self-concept reflects how students perceive their abilities and potential within educational settings (Bong & Skaalvik, 2003; Kavanagh, 2020; Marsh & Martin, 2010). Evaluation and comparison are the two core aspects of academic self-concept (Meyer et al., 2023).

Parents' Level of Education

Higher parental education correlates with a more positive academic self-concept (Zhao et al., 2023). College-educated parents often instill greater confidence in their children's learning abilities through academic support and involvement (Chevalère et al., 2023; Yeung et al., 2010).

Self-Evaluation

Self-evaluation reflects perceived academic competence, shaped by past achievements (Wu et al., 2021). Success or failure experiences influence this self-belief (Preckel et al., 2013).

Peer Comparison

Adolescents form academic self-concept by comparing themselves to peers (Wouters et al., 2013). Social comparison theory suggests students assess their abilities relative to noticeable or similar peers (Jansen et al., 2022; Meyer et al., 2023).

School-Focused Environment

Effort-focused environments foster student success by valuing learning processes over innate ability (Bauer et al., 2023). Talent-focused settings may harm minority or first-generation students' self-concept, making them feel less capable (Bauer et al., 2023; Leslie et al., 2015).

Gender Differences: AP & ASC

Academic Performance

Empirical evidence regarding gender differences in academic performance is mixed. Some studies indicate that female students tend to outperform male students in overall coursework or language-related subjects, whereas male students may demonstrate advantages in mathematics or selected STEM disciplines (Jahanifar, 2022). These performance differences are often influenced by prior academic preparation, assessment formats, learning strategies, and motivational factors, rather than gender alone (L. Wang & Yu, 2023; Yu & Deng, 2022). As a result, gender is increasingly understood as one component within a broader set of interacting variables that shape academic outcomes in higher education.

Academic Self-Concept

Gender differences in academic self-concept frequently emerge at the domain-specific level. Research suggests that female students tend to report higher academic self-concept in language-related areas, while male students often report stronger self-concept in mathematics and technology-oriented fields (Cooper et al., 2018; L. Wang & Yu, 2023). Social comparison processes, classroom practices, and culturally embedded expectations may shape how students evaluate their academic abilities, contributing to observed gender patterns in self-concept (Jahanifar, 2022). These findings imply that gender-related differences in academic self-concept are context-dependent rather than uniform across educational settings.

First Generation vs Continuing Generation College Students Differences: AP&ASC

Definition of Generational Status

In this study, generational status was derived from parents' educational level (National Center for Education Statistics [NCES], 2024). First-generation college students were defined as students whose parents (or primary caregivers) had not completed a bachelor's degree (i.e., neither parent holds a four-year college degree) (NCES, 2024). Continuing-generation students were defined as those with at least one parent who had completed a bachelor's degree or higher (NCES, 2024). This binary classification was based on parental educational attainment, which is commonly used in recent empirical literature as a proxy for differential access to academic, social, and cultural resources prior to college (Blanden et al., 2022; Nunes & de Andrade, 2024).

Academic Performance

Research on academic performance consistently shows that first-generation college students, on average, face greater academic challenges than their continuing-generation peers. These challenges are reflected in lower grades, reduced academic persistence, and lower likelihood of entering highly selective academic programs (W. Wang et al., 2020). Such differences are often attributed to disparities in pre-college academic preparation, financial constraints, and limited access to educational guidance within the family (Hood et al., 2020). Importantly, evidence suggests that targeted academic support and increased access to institutional resources can mitigate, though not entirely eliminate, these performance gaps (Ko et al., 2025).

Academic Self-Concept

In terms of academic self-concept, first-generation college students frequently report lower academic confidence and greater concerns about belonging in higher education environments (Hood et al., 2020; Means & Pyne, 2021). These psychological differences may stem from socialization processes within the family as well as perceived mismatches between students' backgrounds and institutional expectations (Muñoz & Del Picò, 2020). However, not all studies identify significant differences in academic self-concept based on parents' education level, suggesting that contextual factors such as institutional support and peer environment may moderate these relationships (W. Wang et al., 2020).

ChatGPT Use Differences: AP & ASC

Academic Performance

During academic life, ChatGPT could bring students a lot of knowledge and help them accomplish their assignments, which could improve the efficiency on their study process. Studies discovered that Students who use ChatGPT have a great improvement on their academic performance (Amjad et al., 2024; Cheong & Chong, 2025; Gonzalez-Garcia et al., 2025; Yusfi & Asmara, 2023). Gonzalez-Garcia et al. (2025)'s study further pointed that students with higher GPA inclined to highly accept the usage of ChatGPT and benefited more from it. Additionally, ChatGPT users have higher motivation in learning process than students who do not use (Yusfi & Asmara, 2023). Shahzad et al. (2025)'s study investigated the ChatGPT Usage in English learning at higher education level, which also indicated students who use ChatGPT had higher GPA and motivation than those who do not use.

Academic Self-Concept

ChatGPT Usage influenced students' self-concept under the learning context. Periyasamy et al. (2025) conducted a qualitative study and investigated that ChatGPT Usage had dual-impact on college students' academic self-concept, which reflected negatively on their self-doubt about knowledge and positively on their feeling of achievement.

Almineeai et al. (2025)'s study found that ChatGPT enhanced students' confidence and motivation during the learning process. Moreover, overreliance on large language models like ChatGPT was correlated with decreased self-efficacy during learning process for students (Padiyath et al., 2024).

Year Level Differences: AP & ASC

Academic Performance

ChatGPT has been pervasively used in higher education among college students. However, there is a dearth of studies investigated the use of ChatGPT based on the academic year-level. H. Yilmaz et al. (2023) explored students' perception of ChatGPT at higher education level. Results showed that there was no significant difference between 4 year-level's students' perception and attitude of the usefulness and ease of use of ChatGPT. However, some studies discovered there were differences in use of ChatGPT among year levels. As pointed by Köhler and Hartig (2024), students toward the end of bachelor's degree tended to be more familiar with and more frequent to use ChatGPT. Moreover, Andalibi et al. (2024) study indicated junior students had a significantly higher usage of ChatGPT than freshman students. Additionally, seldom research analyzed the difference of student's academic performance under the interaction of year level and ChatGPT usage.

Academic Self-Concept

Academic self-concept is crucial for college students' academic achievement. According to Fryer (2015)'s study, academic self-concept was important for first year students in college to keep intrinsic motivation. Haktanir et al. (2021) found that first-year students who perceived college requirements as similar to those of high school maintained higher academic self-concept, suggesting that perceived academic continuity may buffer potential declines in self-

concept during this adjustment phase. Beyond the transitional effect, differences across year levels have also been observed. Isiksal (2010)'s study indicated that senior students had the highest positive academic self-concept and followed with freshman, junior and sophomore. Based on this study, it was suggested that different social environment and university required courses influence second-year students negatively which reduced their academic self-concept.

Methodology

A quantitative comparative, cross-sectional design was employed to extend prior correlational findings by examining the effects of gender, parents' education level, year level, and ChatGPT usage frequency on students' academic performance and academic self-concept. Data were drawn from the same dataset reported in Echiverri et al. (2025), consisting of 563 undergraduate students. Convenience and snowball sampling techniques were used to recruit participants from Chinese traditional universities (10.8%), Wenzhou–Kean University (63.9%), and Kean University in the United States (25.2%). Data were collected through an online self-constructed questionnaire administered via Sojump (Wenjuanwang) and Qualtrics platforms. Compared with the previous descriptive-correlational study, which focused on associations between ChatGPT usage, academic performance, and academic self-concept, the present study represents an extended analysis by introducing additional predictors and examining both main and interaction effects using comparative statistical methods.

The survey employed a five-point Likert scale, and reliability analyses indicated acceptable internal consistency for the key outcome variables, with Cronbach's alpha values of .710 for Academic Performance and .828 for Academic Self-Concept. All procedures complied with ethical standards, including Institutional Review Board approval, informed consent, and assurances of anonymity and confidentiality.

Statistical analyses were conducted using SPSS version 29.0. Descriptive statistics were first computed, followed by two-way multivariate analysis of variance (MANOVA) to simultaneously examine the effects of gender, parents' education level, year level, and ChatGPT usage frequency on academic performance and academic self-concept. When significant multivariate effects were detected, follow-up univariate analyses of variance (ANOVA) were conducted to identify the contributing dependent variables. Given the multiple groups of ChatGPT usage and year level, Bonferroni-adjusted post hoc comparisons were conducted to identify specific group differences while controlling for Type I error.

Results and Discussion

Gender and Parents' Education Level Effects on Academic Performance and Academic Self-Concept

A two-way multivariate analysis of variance (MANOVA) was conducted to examine the effects of gender and parents' education level (PEL) on academic performance (AP) and academic self-concept (ASC). Preliminary analyses supported the suitability of MANOVA. Box's M was nonsignificant, $p = .060$, indicating homogeneity of covariance matrices. Levene's tests were nonsignificant for AP, $F(3, 521) = 0.36$, $p = .780$, and ASC, $F(3, 521) = 0.63$, $p = .596$, supporting homogeneity of variances.

Multivariate Effects

There was no significant multivariate main effect of gender, Wilks' Λ = .99, $F(2, 520) = 1.41$, $p = .244$, partial $\eta^2 = .005$, nor a significant Gender × PEL interaction, Wilks' Λ = .99, $F(2, 520) = 0.47$, $p = .629$, partial $\eta^2 = .002$. A marginal multivariate effect was observed for PEL, Wilks' Λ = .98, $F(2, 520) = 2.92$, $p = .055$, partial $\eta^2 = .011$ (See Table 1).

Table 1
Multivariate Tests of Significance for Gender, Parents' Education Level, and Interaction Effects

IVs	Wilks's Lambda (λ)	F	Hypothesis df	Error df	p	η^2
Gender	.99	1.41	2	520	.244	.005
PEL	.98	2.92	2	520	.055	.011
Gender * PEL	.99	0.47	2	520	.629	.002

Note. PEL= Parents' Education Level.

Univariate Effects

Parental education level (PEL), which differentiates first-generation students (no parent with a college degree) from continuing-generation students (at least one parent with a college degree), demonstrated a significant effect on academic self-concept (ASC). Follow-up ANOVAs (see Table 2) indicated that continuing-generation students (M = 3.56, SD = .62) reported significantly higher ASC than first-generation students (M = 3.43, SD = .62), $F(1, 521) = 5.65$, $p = .018$, partial $\eta^2 = .011$. In contrast, PEL did not significantly affect academic performance (AP), $F(1, 521) = 0.40$, $p = .527$, partial $\eta^2 = .001$. Gender showed no significant main effects on AP or ASC (all ps > .05), and the interaction between PEL and gender was nonsignificant across outcomes (see Table 2).

Table 2
Univariate Tests of Between-Subject Effects for Gender and Parents' Education Level on Academic Performance and Academic Self-Concept

DVs	Sources	Df	F	*p*	η^2
AP	Gender	1	0.28	.590	.001
	PEL	1	0.40	.527	.001
	Gender* PEL	1	0.89	.345	.002
ASC	Gender	1	1.45	.228	.003
	PEL	1	5.64	.018	.011
	Gender* PEL	1	0.34	.558	.001

Note. AP=Academic Performance; ASC=Academic Self-Concept; PEL= Parents' Education Level.

Interpretation and Implications

Although academic performance did not significantly differ across parental education groups in the present study, first-generation students reported lower academic self-concept compared to their continuing-generation peers. This finding aligns with prior research indicating that first-generation college students frequently report lower academic confidence and heightened concerns about belonging in higher education environments (Hood et al., 2020; Means & Pyne, 2021).

Such differences have been attributed to socialization processes within the family and perceived mismatches between students' backgrounds and institutional expectations (Muñoz & Del Picò, 2020). From a social capital perspective, continuing-generation students may benefit from access to implicit academic norms, expectations, and confidence-reinforcing messages embedded within family contexts, which contribute to the development of stronger academic identity. First-generation students, in contrast, may achieve comparable performance outcomes yet internalize lower perceptions of competence due to reduced exposure to these forms of academic capital.

At the same time, the absence of significant performance differences in this study contrasts with research documenting achievement gaps (W. Wang et al., 2020), and partially aligns with evidence suggesting that contextual factors—such as institutional support and peer environment—may moderate disparities in academic self-concept (W. Wang et al., 2020).

The present findings therefore suggest that while institutional mechanisms may mitigate performance gaps, disparities in academic identity may persist. Closing achievement gaps does not automatically eliminate differences in students' academic self-beliefs or sense of belonging (Bong & Skaalvik, 2003; Kavanagh, 2020; Marsh & Martin, 2010).

This study contributes to the literature by demonstrating that parity in academic performance does not necessarily eliminate disparities in academic self-concept among first-generation students. By distinguishing between achievement outcomes and academic identity, the findings extend existing research on educational equity and underscore the importance of integrating psychosocial dimensions into evaluations of student success.

ChatGPT Usage and Year Level Effects on Academic Performance and Academic Self-Concept

A two-way MANOVA was conducted to examine the effects of ChatGPT usage frequency and year level on academic performance (AP) and academic self-concept (ASC). Box's M Test showed a significant result (M = 157.923, F (57, 5594.367) = 2.554, $p < .001$), indicating that the variance-covariance matrices of the academic performance and academic self-concept across groups of ChatGPT usage and year level were heterogeneous. Levene's test of equality of error variances was significant for AP ($p < .001$) but not significant for ASC ($p = .299$). Therefore, Pillai's Trace was applied to test statistical significance, which is more robust when assumptions were violated.

Multivariate Effects

There was a significant multivariate main effect of ChatGPT usage, Pillai's Trace = .27, $F(8, 1010) = 19.66$, $p < .001$, partial $\eta^2 = .135$. In contrast, year level did not demonstrate a significant multivariate main effect, Pillai's Trace = .02, $F(8, 1010) = 1.78$, $p = .100$, partial $\eta^2 = .010$. However, the interaction between ChatGPT usage and year level was statistically significant, Pillai's Trace = .07, $F(24, 1010) = 1.72$, $p = .016$, partial $\eta^2 = .039$, indicating that the relationship between ChatGPT usage and the dependent variables varied across year level (see Table 3).

Table 3
Multivariate Tests of Significance for ChatGPT Usage, Year Level, and Interaction Effects

IVs	Pillai's Trace	F	Hypothesis df	Error df	p	η^2
CGPTU	.27	19.66	8	1010	<.001	.135
YL	.02	1.78	6	1010	.100	.010
CGPTU *YL	.07	1.72	24	1010	.016	.039

Note. CGPTU= ChatGPT Usage; YL= Year Level.

Univariate Effects

Follow-up ANOVAs revealed that ChatGPT usage had a significant effect on academic performance, $F(4, 505) = 44.57$, $p < .001$, partial $\eta^2 = .261$, indicating a large effect size (see Table 4). ChatGPT usage also had a statistically significant, though smaller, effect on academic self-concept, $F(4, 505) = 3.14$, $p = .014$, partial $\eta^2 = .024$ (see Table 4).

Table 4
Univariate Tests of Between-Subject Effects for Year Level and ChatGPT Usage on Academic Performance and Academic Self-Concept

Dependent Variable	Source	Df	F	p	η^2
AP	YL	3	0.76	.515	.005
	CGPTU	4	44.57	<.001	.261
	YL* CGPTU	12	2.41	.005	.054
ASC	YL	3	2.67	.046	.016
	CGPTU	4	3.14	.014	.024
	YL* CGPTU	12	1.36	.181	.031

Note. AP=Academic Performance; ASC=Academic Self-Concept; YL=Year Level; CGPTU=ChatGPT Usage.

Post hoc comparisons using Bonferroni adjustment indicated that students who used ChatGPT often or always demonstrated significantly higher academic performance compared to those who used it sometimes or rarely or never (see Table 5). Although ChatGPT Use significantly affected academic self-concept (see Table 4) but pairwise comparisons for academic self-concept were not statistically significant (see Table 5).

Table 5

Multiple Comparison of Differences in Academic Performance and Academic Self-Concept Based on ChatGPT Usage

Dependent Variable	(I) ChatGPT Usage	(J) ChatGPT Usage	Mean Difference (I-J)	SE	p	95% CI	
						Lower Bound	Upper Bound
AP	Never (0 days/week)	Rarely	-.65*	.10	<.001	-.94	-.37
		Sometimes	-1.04*	.09	<.001	-1.31	-.76
		Often	-1.25*	.10	<.001	-1.54	-.97
		Always	-1.39*	.10	<.001	-1.69	-1.10
	Rarely (1-2 days/week)	Never	.65*	.10	<.001	.37	.94
		Sometimes	-.38*	.07	<.001	-.58	-.18
		Often	-.60*	.07	<.001	-.81	-.38
		Always	-.74*	.07	<.001	-.96	-.51
	Sometimes (3-4days/week)	Never	1.04*	.09	<.001	.76	1.31
		Rarely	.38*	.07	<.001	.18	.58
		Often	-.21	.07	.028	-.41	-.01
		Always	-.35*	.07	<.001	-.56	-.14
	Often (5-6 days/week)	Never	1.25*	.10	<.001	.97	1.54
		Rarely	.60*	.07	<.001	.38	.81
		Sometimes	.21	.07	.028	.01	.41
		Always	-.13	.08	.888	-.36	.09
	Always (7 days/week)	Never	1.39*	.10	<.001	1.10	1.69
		Rarely	.74*	.07	<.001	.51	.96
		Sometimes	.35*	.07	<.001	.14	.56
		Often	.13	.08	.888	-.09	.36

Note. Bonferroni adjustment at p<.005 (0.05/10). CI=Confidence Interval; AP= Academic Performance; *Mean difference is significant.

Year level did not significantly influence academic performance but a modest effect was observed for academic self-concept (See Table 4). Multiple comparison tests showed that senior students (M = 3.73, SD = .72) had significantly higher score than junior student (M = 3 .38, SD =. 61) on academic self-concept (see Table 6).

Table 6
Multiple Comparison of Differences in Academic Self-Concept Based on Year Level

Dependent Variable	(I) Year Level	(J) Year Level	Mean Difference (I-J)	SE	p	95% CI	
						Lower Bound	Upper Bound
ASC	Freshman	Sophomore	.04	.07	1.000	-.14	.23
		Junior	.15	.07	.274	-.05	.36
		Senior	-.19	.09	.274	-.44	.06
	Sophomore	Freshman	-.04	.07	1.000	-.23	.14
		Junior	.11	.06	.568	-.06	.29
		Senior	-.23	.08	.038	-.46	-.00
	Junior	Freshman	-.15	.07	.274	-.36	.05
		Sophomore	-.11	.06	.568	-.29	.06
		Senior	-.35*	.09	.001	-.59	-.10
	Senior	Freshman	.19	.09	.274	-.06	.44
		Sophomore	.23	.08	.038	.00	.46
		Junior	.35*	.09	.001	.10	.59

Note. Bonferroni adjustment at p<.008 (0.05/6). CI=Confidence Interval; ASC= Academic Self-concept; *Mean difference is significant.

Interaction Effects: ChatGPT Use × Year Level

A significant interaction emerged between ChatGPT usage and year level for academic performance, $F(12, 505) = 2.41$, $p = .005$, partial $\eta^2 = .054$ (see Table 4), whereas no interaction was found for academic self-concept. Bonferroni-adjusted comparisons (see Appendix) indicated that the association between ChatGPT use and performance strengthened across academic cohorts.

Among freshmen, differences across usage levels were modest, with limited pairwise significance. In contrast, among sophomores, juniors, and especially seniors, students who reported never using ChatGPT performed significantly lower than peers who used it at least occasionally (all ps ≤ .002 in upper cohorts). The magnitude of mean differences increased progressively from freshman to senior year, suggesting that the performance advantage associated with ChatGPT use becomes more pronounced in later academic stages.

These results indicate that ChatGPT use is not uniformly associated with performance but interacts with year classification, with stronger differentiation observed in upper-year students.

Interpretation and Implications

The present findings reveal distinct pathways through which ChatGPT usage and year level relate to academic performance (AP) and academic self-concept (ASC). ChatGPT use significantly predicted AP but not ASC, whereas year level predicted ASC but not AP. These patterns highlight the differentiated academic and psychosocial mechanisms underlying student development in technology-mediated higher education contexts.

Consistent with prior studies (Amjad et al., 2024; Cheong & Chong, 2025; Gonzalez-Garcia et al., 2025; Shahzad et al., 2025; Yusfi & Asmara, 2023), students who reported more frequent

ChatGPT use achieved significantly higher academic performance (see Table 4). This supports the view that generative AI functions as a learning scaffold that enhances efficiency, clarification, and task completion. The findings align with evidence suggesting that students who adopt ChatGPT strategically derive measurable academic benefits, particularly in performance-based outcomes.

However, ChatGPT usage did not significantly influence academic self-concept (ASC) (see Table 5). Although prior research reports both positive (Almineeai et al., 2025) and negative (Padiyath et al., 2024; Periyasamy et al., 2025) effects on students' academic self-perceptions, the present findings suggest that performance gains associated with AI use do not necessarily translate into stronger academic self-beliefs. This suggests that technological assistance may improve outputs without fundamentally reshaping students' academic identity or perceived competence.

Year level did not significantly predict AP (see Table 6), indicating relative stability in achievement across cohorts. While some research reports variation in ChatGPT familiarity across academic years (Andalibi et al., 2024; Köhler & Hartig, 2024), increased exposure does not appear to produce performance differentials in this sample.

Importantly, however, a significant interaction emerged between ChatGPT usage and year level for AP. The performance advantage associated with more frequent ChatGPT use was more pronounced among sophomores, juniors, and seniors than among freshmen. This suggests that the academic benefits of AI engagement may become increasingly salient as coursework grows more advanced and specialized.

In contrast, year level significantly predicted ASC. Seniors reported higher academic self-concept than juniors (see Table 6), partially aligning with Isiksal (2010), who observed stronger ASC among upper-level students. This pattern suggests that academic self-perceptions may strengthen with sustained institutional engagement. The comparatively lower ASC among juniors may reflect transitional academic pressures or increased disciplinary demands, consistent with evidence that contextual and cohort-related factors shape self-concept trajectories (Haktanir et al., 2021).

Overall, the findings indicate that ChatGPT use is associated with performance-based outcomes—particularly in interaction with year classification—whereas variation in academic self-concept is more closely linked to students' year level and background characteristics. Together, these results underscore the importance of addressing both technological engagement and psychosocial dimensions of student experience in higher education.

Limitations of the Study

Several limitations warrant consideration. First, the cross-sectional design precludes causal inference. Although significant associations were observed among ChatGPT use, parental education, year level, and academic outcomes, temporal ordering cannot be established, and alternative explanations remain possible. For instance, higher-performing students may be more inclined to use ChatGPT rather than ChatGPT use leading to improved performance.

Second, measures of ChatGPT usage and academic indicators were self-reported and may be subject to response or social desirability bias. ChatGPT use was assessed primarily in terms of frequency, without capturing qualitative differences in purpose, depth, or cognitive reliance.

Finally, although some effects were statistically significant, effect sizes were small, and the sample—drawn from three institutions with distinct international contexts—may limit generalizability. Longitudinal and multi-method research is needed to clarify developmental trajectories and underlying mechanisms.

Conclusion

The findings indicate that academic performance did not significantly differ by parental education level (PEL), yet disparities in academic self-concept (ASC) persisted between first-generation students (no parent with a college degree) and continuing-generation students (at least one parent with a college degree). These results suggest that parity in measurable achievement does not necessarily translate into equity in students' academic self-perceptions or sense of competence.

The study further demonstrates that ChatGPT usage and year level are differentially associated with student outcomes. Frequent ChatGPT use was linked to higher academic performance but was not significantly related to academic self-concept. In contrast, year level was associated with differences in academic self-concept—particularly between juniors and seniors—while academic performance remained stable across cohorts. The interaction between ChatGPT use and year level further suggests that technological engagement may differentially enhance achievement across academic cohorts.

Collectively, these findings indicate that technological engagement is associated with performance-based outcomes, whereas variation in academic self-concept is more closely linked to students' year classification and parental education background. The results underscore the importance of addressing both academic achievement and psychosocial dimensions of student experience in higher education.

Recommendations

Institutions should complement performance-focused academic support with initiatives that strengthen academic self-concept and belonging, particularly among first-generation students. Mentoring, identity-affirming practices, and enhanced access to social capital may help reduce disparities in self-perception.

Given the positive association between ChatGPT use and academic performance, institutions should promote structured and pedagogically guided integration of generative AI, coupled with reflective practices that foster competence and ownership of learning. Targeted psychosocial support during transitional stages, especially the junior year, may further sustain academic identity.

Future research should employ longitudinal designs to examine whether sustained achievement and scaffolded AI engagement contribute to long-term development of academic self-concept.

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Declaration of Generative AI and AI-Assisted Technologies in the Writing Process

During the preparation of this manuscript, the authors used OpenAI's ChatGPT (GPT-4) to assist with language editing, clarity, and organization of the text. The tool was used solely to improve readability and did not generate original research content, conduct data analysis, or contribute to the interpretation of findings.

All content generated with AI assistance was critically reviewed, revised, and verified by the authors. The authors take full responsibility for the accuracy, integrity, and originality of the manuscript.

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Appendix

Multiple Comparisons of Academic Performance by ChatGPT Usage and Year Level

DV	Year Level	(I) CGPTU	(J) CGPTU	Mean Difference (I-J)	SE	p	95% CI	
							Lower Bound	Upper Bound
AP	Freshman	Never	Rarely	-.204	.150	1.000	-.627	.220
			Sometimes	-.635*	.163	.001	-1.095	-.175
			Often	-.566	.213	.081	-1.168	.035
			Always	-1.028	.314	.011	-1.913	-.143
		Rarely	Never	.204	.150	1.000	-.220	.627
			Sometimes	-.431	.137	.018	-.819	-.044
			Often	-.363	.194	.623	-.910	.185
			Always	-.824	.301	.064	-1.674	.025
		Sometimes	Never	.635*	.163	.001	.175	1.095
			Rarely	.431	.137	.018	.044	.819
			Often	.069	.204	1.000	-.508	.645
			Always	-.393	.308	1.000	-1.261	.476
		Often	Never	.566	.213	.081	-.035	1.168
			Rarely	.363	.194	.623	-.185	.910
			Sometimes	-.069	.204	1.000	-.645	.508
			Always	-.461	.337	1.000	-1.412	.489
		Always	Never	1.028	.314	.011	.143	1.913
			Rarely	.824	.301	.064	-.025	1.674
			Sometimes	.393	.308	1.000	-.476	1.261
			Often	.461	.337	1.000	-.489	1.412
	Sophomore	Never	Rarely	-1.217*	.193	<.001	-1.761	-.672
			Sometimes	-1.539*	.180	<.001	-2.046	-1.031
			Often	-1.752*	.185	<.001	-2.274	-1.230
			Always	-1.831*	.185	<.001	-2.352	-1.309
		Rarely	Never	1.217*	.193	<.001	.672	1.761
			Sometimes	-.322	.119	.069	-.657	.013
			Often	-.535*	.127	<.001	-.893	-.178
			Always	-.614*	.126	<.001	-.970	-.258
		Sometimes	Never	1.539*	.180	<.001	1.031	2.046
			Rarely	.322	.119	.069	-.013	.657
			Often	-.213	.105	.434	-.510	.084
			Always	-.292	.105	.055	-.587	.003
		Often	Never	1.752*	.185	<.001	1.230	2.274
			Rarely	.535*	.127	<.001	.178	.893
			Sometimes	.213	.105	.434	-.084	.510
			Always	-.079	.114	1.000	-.399	.242
		Always	Never	1.831*	.185	<.001	1.309	2.352
			Rarely	.614*	.126	<.001	.258	.970
			Sometimes	.292	.105	.055	-.003	.587
			Often	.079	.114	1.000	-.242	.399
	Junior	Never	Rarely	-.672	.238	.050	-1.344	.000
			Sometimes	-1.043*	.223	<.001	-1.671	-.415
			Often	-1.384*	.228	<.001	-2.026	-.743
			Always	-1.416*	.238	<.001	-2.088	-.744
		Rarely	Never	.672	.238	.050	.000	1.344
			Sometimes	-.371	.152	.150	-.799	.058
			Often	-.712*	.159	<.001	-1.160	-.264
			Always	-.744*	.174	<.001	-1.235	-.253
		Sometimes	Never	1.043*	.223	<.001	.415	1.671
			Rarely	.371	.152	.150	-.058	.799
			Often	-.341	.134	.114	-.720	.038
			Always	-.373	.152	.144	-.801	.055
		Often	Never	1.384*	.228	<.001	.743	2.026

		Rarely	.712*	.159	<.001	.264	1.160
		Sometimes	.341	.134	.114	-.038	.720
		Always	-.032	.159	1.000	-.480	.416
	Always	Never	1.416*	.238	<.001	.744	2.088
		Rarely	.744*	.174	<.001	.253	1.235
		Sometimes	.373	.152	.144	-.055	.801
		Often	.032	.159	1.000	-.416	.480
Senior	Never	Rarely	-1.390*	.365	.002	-2.420	-.360
		Sometimes	-1.854*	.367	<.001	-2.890	-.818
		Often	-1.937*	.370	<.001	-2.980	-.894
		Always	-2.179*	.359	<.001	-3.190	-1.167
	Rarely	Never	1.390*	.365	.002	.360	2.420
		Sometimes	-.464	.215	.310	-1.069	.141
		Often	-.547	.219	.128	-1.164	.070
		Always	-.789*	.199	<.001	-1.351	-.226
	Sometimes	Never	1.854*	.367	<.001	.818	2.890
		Rarely	.464	.215	.310	-.141	1.069
		Often	-.083	.222	1.000	-.710	.544
		Always	-.324	.203	1.000	-.898	.249
	Often	Never	1.937*	.370	<.001	.894	2.980
		Rarely	.547	.219	.128	-.070	1.164
		Sometimes	.083	.222	1.000	-.544	.710
		Always	-.242	.208	1.000	-.828	.344
	Always	Never	2.179*	.359	<.001	1.167	3.190
		Rarely	.789*	.199	<.001	.226	1.351
		Sometimes	.324	.203	1.000	-.249	.898
		Often	.242	.208	1.000	-.344	.828

Note. Bonferroni adjustment at p<.005 (0.05/10). CI = Confidence Interval; AP = Academic Performance; CGPTU = ChatGPT Usage; *Mean difference is significant.

Assessing Mathematical Creativity Using Non-routine Problem-Solving Task for High School Students

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Abstract

The study aimed to develop and validate non-routine problem-solving tasks to assess the mathematical creativity of high school students. Grounded on the Analysis, Design, Development, Implementation, and Evaluation (ADDIE) model, the study followed a developmental research design. Creativity in mathematics was operationalized through four components: fluency, flexibility, originality, and elaboration. A total of nine tasks were initially developed, reviewed, and validated by seven mathematics experts from various universities, with six tasks retained for pilot testing and final implementation. Seven experts validated the non-routine problem-solving tasks in terms of their suitability, clarity, and appropriateness, with an overall interpretation of "strongly agree." Thirty senior high school students were chosen using purposive sampling technique, with findings revealed that most students demonstrated a moderate level of mathematical creativity. In terms of its components, result shows that students received high in fluency but low in originality in generating multiple solutions. Additionally, students evaluated the tasks based on their acceptability and practicality, indicating that the tasks were technically sound, clear, and engaging. The study concludes that the developed non-routine problem-solving tasks are reliable, valid, and feasible tools for assessing mathematical creativity among high school students. It recommends integrating these tasks into classroom instruction or curriculum development to enhance mathematical creativity and better prepare students for global assessments such as PISA. Future studies are encouraged to extend this research to other mathematics subjects and examine the effects of creative problem-solving on students' academic performance.

Keywords: non-routine, mathematical creativity, problem-solving tasks

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Introduction

Background of the Study

One of the most important skills in the face of global problems is creativity. Promoting creativity is essential for achieving success in the ever-evolving global economy. Equipping students with such necessary skills is vital to addressing complicated real-world problems and thriving in an evolving workforce that values innovation and creativity (Beghetto & Kaufman, 2007). According to the World Economic Forum (2023), creative thinking will become the most essential skill by 2027. Creativity is important in mathematics, as it is a fundamental aspect of the subject. Students must not only comprehend the theoretical principles but also demonstrate proficiency in their practical application and exhibit creative thinking skills. Thus, educators must prioritize implementing strategies that promote the development of students' mathematical creativity (Siregar, 2021).

Creativity is a complex concept that has attracted attention in mathematics education. A common accepted definition of creativity is the capacity to produce novel and useful solutions to a problem, encompassing different components such as flexibility, elaboration, originality, and fluency (Guildford, 1973; Hidayah, 2023; Imai, 2010; Kumar, 1994; Sriraman & Mahmood, 2012). These four dimensions serve as the foundational pillars in evaluation of individual's creative ability. Flexibility refers to the ability to shift perspectives and generate diverse solutions, while elaboration is about adding pertinent information to the given situation (Guilford, 1973; Kumar, 1994). Originality captures the uniqueness of the solutions produced, and fluency measures the ability to generate multiple responses and solution paths to a problem (Krutetskii, 1976; Kumar, 1994).

The integration of these dimensions within the instrument not only aligns with established theories of creativity but also strengthens its relevance in educational context. Sternberg and Lubart (1995) argued that a comprehensive assessment of creativity should include both divergent and convergent thinking. Divergent thinking emphasizes generating multiple solutions or ideas, while convergent thinking involves focusing on a single and correct solution (Guilford, 1967). Convergent thinking plays an important role in problem-solving by narrowing down options and selecting the best solution based on logical analysis (Cropley, 2006). However, Leikin and Lev (2007) argued that developing mathematical creativity through convergent thinking involves synthesizing knowledge and applying systematic reasoning to solve complex mathematical problems effectively.

The Philippine education system has been putting in efforts to improve the mathematical proficiency of students in the country. However, despite these efforts, Filipino students have not yet attained the desired level of competency in mathematics, as is evident from the results of the 2018 and 2022 PISA (Programme for International Student Assessment) exams. The country's score has only improved by two points from 353 to 355 between the two years. In comparison to other countries participating in the OECD (Organisation for Economic Co-operation and Development), the Philippines scored 14, which is below the average score of 33. Furthermore, among Southeast Asian countries, only Cambodia scored lower than the Philippines, with the country failing to surpass the OECD average. However, countries like Japan, Korea, Singapore, and China have consistently ranked highly on these exams, placing significant importance on problem-solving in their education systems.

After introducing a revised curriculum that extended basic education by two years, significant changes have taken place in the education system in the Philippines. This adjustment has placed high school students in a position to gain skills necessary for their future success across various fields. Many experts and teachers have acknowledged problem-solving as a competency. However, studies indicate that high school students in the country face challenges when it comes to honing their problem-solving skills.

One major issue student often encountered was the absence of exposure to real-life problems. According to Peralta (2018), students must face real-world challenges to develop their problem-solving abilities. The newly released PISA examination begs the question: "Why do Filipino students continue to lag behind other countries in global education assessment and why they are among the lowest creative thinkers in PISA?" Word problems and real-life applications dominated the PISA exams, revealing the Philippines' students' poor performance in handling these kinds of problems. The country's present curriculum is too focused on "memorization" or the low level of thinking skills, while international tests require analytical thinking. This data indicates that the country needs to incorporate more problem-solving activities to enhance students' critical thinking skills and mathematical creativity in the educational system.

Moreover, Fortes and Andrade (2019) agreed that one reason students struggle is their lack of experience in handling real-life problems. These problems call for thinking and innovative solutions, which are not commonly taught in methods. The limited exposure to such problems prevents students from honing their thinking skills. Seno and Manahan (2019) point out that students face difficulties due to the unavailability of technology and essential resources required for problem-solving. This limitation hinders their ability to enhance their skills effectively. Students must be proficient in utilizing tools given the continuous advancements in technology. Unfortunately, many Filipino students do not have access to these resources putting them at a disadvantage compared to peers from other countries.

To assess the creativity of students in the Philippines, it is essential to provide them with chances and freedom to experience multiple-solution tasks. This strategy revolves around designing tasks that assess and encourage creativity. Previous research had explored methods for measuring and fostering creativity, as evidenced by the studies conducted by Wiyanto et al. (2019), Sari and Abidin (2018), Safira and Susilo (2022), and Siregar (2021). Typically, these tools were for assessing creativity focused on three elements: originality, fluency, and flexibility. However, the lack of resources and the time-consuming nature of these instruments may have affected their usage. This research aims to develop creativity assessment methods specifically designed for Filipino students to pinpoint their strengths areas needing improvement and potential growth opportunities. Using these assessments' researchers hope to evaluate students' creative skills to offer tailored assistance.

Therefore, to boost students' creativity, it is important to provide them with the opportunity and freedom to solve reliable tools. To develop their problem-solving abilities and improve their performance it is vital to create tasks that engage and challenge their creativity. This will help to prepare themselves effectively for real-world problems and to par Filipino students for the global benchmarking tests like PISA.

Focus of Study

This specifically aimed at meeting the following objectives:

1. Identify the topics in problem-solving task.
2. Develop a problem-solving task that will assess mathematical creativity among high school students.
3. Validate the content of the developed problem-solving tasks.
4. Try out the developed problem-solving tasks.
5. Evaluate the technical quality of the tasks.

Methodology

Research Design

The descriptive developmental research design was used in this study. The ADDIE (Analysis, Design, Development, Implementation, and Evaluation) model was followed in the development of non-routine problem-solving tasks.

Participants

The researcher selected seven math experts using expert sampling to validate the tasks before they were put into use. Among the specialists, three have a Doctor of Philosophy degree, while four experts hold a Master of Education in Mathematics. All the experts involved in the study have a database online that has either h or i10-indices in published research. Additionally, the researcher utilized a purposive sampling technique in choosing thirty student respondents for the implementation and five for the pilot test of the developed tasks.

Instruments Used

During the analysis and design stages, the researcher carefully chose the Most Essential Learning Competencies (MELCs) established by the Department of Education (DepEd) for Senior High School, particularly focusing on the core subject of General Mathematics. Followed by identifying and creating the specific objectives that were suitable for eliciting mathematical creative tasks.

At the development stage, a panel of math experts reviewed assessment tools such as the problem-solving rubric, validation rating scale for math creativity, and tasks developed by the researcher. The adapted problem-solving rubric has a point system of proficient, apprentice, and novice with 5, 3, and 1 scores, respectively.

Finally, the same panel of experts was accountable for evaluating the problem-solving tasks developed that focus on content validity. The experts used feedback surveys and validation forms as tools. These instruments helped them provide feedback on each task and identify any errors or areas requiring improvement.

Data Collection

After obtaining approval from the Ethics Committee, implementation stage has occurred. The researcher asked the permission of the school's superintendent, university president, and

school heads to conduct the study. Also, the researcher instructed the participant to complete a consent form, stating that they were willing to participate in this study.

The researcher chose five senior high school students to participate in a pilot-testing. The researcher personally administered and distributed the developed problem-solving tasks to the student respondents. During the process, the sessions were divided into two parts. The first session concentrated on the first three problems for 70 minutes and a short orientation with the participants to explain the nature of the study for 10 minutes, while the second session focused on the remaining items. Following completion of the tasks, students' output went to evaluating and checking by three mathematics experts using the validated rubric. The process was conducted in a closed-door venue; this was to ensure that the evaluation given was agreed upon by all the panel members. Lastly, the same procedures were followed during the proper conduct of this research.

Data Analysis

In this research, the median was utilized as the measure of central tendency for analyzing the experts' validation rating scale and students' insights about the developed problem-solving tasks. Because the normality of the data distribution was not tested, the median was used instead of the mean, as it is less affected by outlier scores or skewed data. Additionally, mean was used to analyze the respondents' overall mathematical creativity. To determine the overall level of creativity of the students in the problem-solving tasks, the following mean intervals were applied.

Table 1
Mean Intervals (Overall Mathematical Creativity)

Levels of Mathematical Creativity	Mean Intervals
High	20.51–30
Moderate	10.51–20.50
Low	1.00–10.50

Fortes and Andrade (2019) initially introduced the scoring rubric and mean intervals. Nevertheless, their application was limited to the first three components of mathematical creativity.

Results and Discussion

The researcher thoroughly reviewed the journals, articles, books, and studies to design non-routine problem-solving tasks aimed at assessing learners' mathematical creativity. The following were the content standards being prepared: key concepts of functions, rational functions, exponential functions, and key concepts of simple and compound interest. The second purpose of the study was to design and develop a non-routine problem-solving task that will assess mathematical creativity among high school students. Table 3 were gathered for its purpose.

Table 2
Table of Specifications in General Mathematics

Content Standards	Item Number
Key Concepts of Functions.	Task 1, Task 2, and Task 3.
Key concepts of Rational Functions.	Task 4 and Task 5
Key concepts of inverse functions, exponential functions, and logarithmic functions.	Task 6 and Task 7
Key concepts of simple and compound interests.	Task 8 and Task 9

The table of specifications was prepared to allocate items in general mathematics. This involved selecting interesting and challenging tasks that require students to arrive at a specific solution but have different strategies. The problem-solving tasks were divided into a student's guide, teacher's guide, developed problem-solving tasks, and several strategies of solution paths.

Table 3 shows the comments and suggestions of experts on the validation of the problem-solving rubric. It was evaluated as "appropriate" by the experts Suggestions were noted and necessary corrections were incorporated in the final draft of the instrument.

Table 3
Experts' Content Validation of the Developed Problem-Solving Tasks

Indicators	Median	Interpretation
1. The items in the instrument can be solved in multiple strategies.	5.00	Strongly Agree
2. The items in the instrument are unstructured with complex questions that cannot be solved with a specific algorithm	5.00	Strongly Agree
3. The instrument requires some degree of creativity, flexibility, originality, and elaboration to solve.	4.00	Agree
4. The items in the instrument do not have an immediate solution.	5.00	Strongly Agree
5. The items on the instrument require analysis and insights into known principles of Mathematics.	5.00	Strongly Agree
6. The items on the instrument are culturally relevant to the respondents.	5.00	Strongly Agree
7. The level of complexity of the instrument is appropriate to the respondent's year level.	4.50	Strongly Agree
Total	5.00	Strongly Agree

Legend: 4.20–5.0 (Strongly Agree); 3.40–4.19 (Agree); 2.60–3.39 (Moderately Agree); 1.80–2.59 (Disagree); 1.00–1.79 (Strongly Disagree)

A total of seven experts validated all the nine developed problem-solving tasks. It could be depicted from the results that the panel of math experts strongly agreed that tasks developed were suitable and appropriate for assessing mathematical creativity at this level. Content validity tells if the assessment tasks relate to the appropriateness of the inferences, uses, and consequences attached to the assessment (OECD, 2021).

After thorough checking, the internal validator selected problems 2,3,4,5,7, and 8 with some comments and suggestions. After this, the instrument went to revisions, considering the expert's insights. The six problems were then used as the validated instrument in the final draft for try-out stage.

Table 4
Respondent's Overall Mathematical Creativity

Levels of Math Creativity	Fluency	Flexibility	Originality	Elaboration	Mean
Highly Creative	23.43	22.75	22.00	22.40	21.25
	(N = 14)	(N = 4)	(N = 1)	(N = 5)	(N = 4)
Moderately Creative	16.31	15.15	15.33	16.50	15.61
	(N = 16)	(N = 26)	(N = 15)	(N = 18)	(N = 23)
Lowly Creative	0	0	8.07	7.00	9.83
			(N = 14)	(N = 7)	(N = 3)
Mean	19.63	16.17	12.07	15.27	15.78
	(N = 30)	(N = 30)	(N = 30)	(N = 30)	(N = 30)

The table above shows the results of four components and the overall level of mathematical creativity of high school students. It can be depicted from the table that there were four students at a highly creative level. According to Siswono (2011), highly creative students can satisfy all criterion of creativity products, can synthesize ideas, generate new concepts and real-life experiences, and apply the concepts to construct some problems. In OECD (2021), these learners are suited for open-ended and complex problem-solving tasks that encourage brainstorming new products, artistic expression, or leading group discussions innovative concepts.

It was evident that majority of respondents belong to moderately creative with 23 students. Student's problem-solving task satisfied just one or two criteria of creativity product (Siswono, 2011). These students can excel in tasks such as writing essays, conducting simple research, or working with moderately complex problems where there is some flexibility on how to solve a task (OECD, 2021). For instance, tasks that involve innovation but within a set framework, such as designing experiments with clear objectives, and that will foster their ability to think beyond non-routine methods but still within a structured environment (Amabile, 1996).

Moreover, the result shows that there were three students under the lowly creative level. Students at this level cannot synthesize ideas from mathematical concepts or real-life experience, and cannot generate new ideas (Siswono, 2011). These learners generally perform best in structured, non-routine tasks that require following clear guidelines, and processes, such as data entry or solving straightforward mathematical problem-solving tasks (OECD, 2021). These tasks demand procedural knowledge and may prefer clear instructions and predictable outcomes (Cropley, 2006).

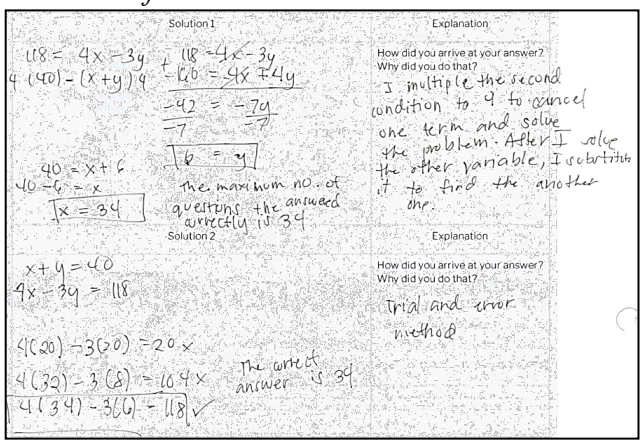
Among the four components of creativity, students performed well in fluency as they gained the highest frequency. Most of the students got the answers correctly but hardly generated multiple strategies or solutions, resulting in originality as the least dimension of mathematical creativity (Fortes & Andrade, 2019; Pasia & Andrade, 2020). This means that students can perform and solve problems while only using minimal strategies in dealing with non-routine problems. As implied in the study of Fortes and Andrade (2019), students were able to successfully answer a problem but failed to arrive at a unique solution as compared to other students.

Respondent's Mathematical Creativity in Terms of Fluency

Students who got a score from 21 to 30 are considered high in fluency, under this range were 14 students or 46.67% of the respondents. These students can give the correct answers and solutions while committing minimal errors or without errors at all. These students thoroughly analyzed the problems and were able to verify their answers by applying all related information to solving them.

Student 3 is most fluent compared to other students, which shows that they can perform mathematical ideas correctly. In answering the problems, student 3 showed fluency in solving the second problem by making a model or diagram (MD). Presented below are the problem, correct answer, and solutions of student 3 in Figure 1.

Figure 1
Solutions of Student 3 in Problem 2



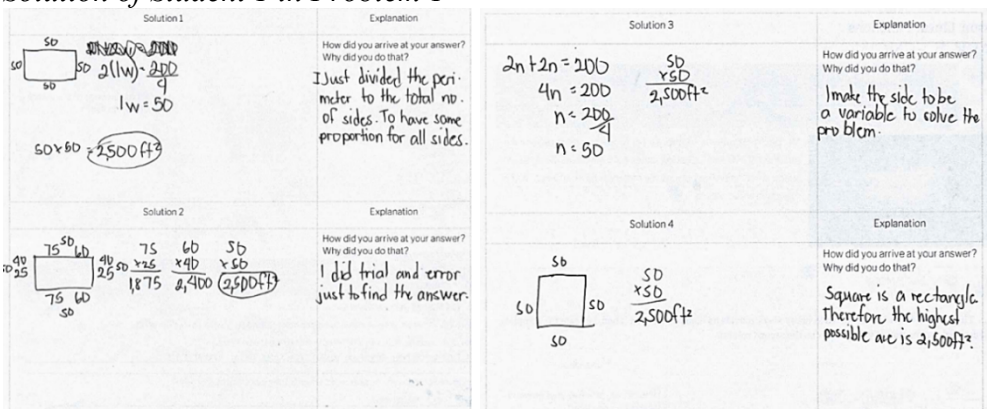
Problem 2: In a physics quiz, there are 40 multiple-choice questions. The quiz awards 4 marks for each correct answer and 3 marks for each incorrect answer. If a student scores 118 marks on the quiz, what is the maximum number of questions they could have answered correctly? Correct answer: the maximum number of questions that can be answered correctly is 34.

Referring to the figure above, student 3 used the concept of representing the problem into an equation or making a model as a strategy. She uses a linear equation in checking her answer as shown in the highlighted part "x = 34." As stated in her explanations *"I multiple [multiply] the second condition to 4 to cancel one term and solve the problem. After I solve[d] the other [first] variable, I substitute it to find the other one"* Her solution shows her knowledge and skill to utilize the technique without having any error to the solution presented, thus, considered as one of the high performing in fluency.

Respondent's Mathematical Creativity in Terms of Flexibility

There were only four students who were high in flexibility. These students were able to offer two or more strategies and have accurate answers. In answering the validated six problems, student 1 shows high flexibility in solving the first problem using computing or Simplifying (CS), formula (F), making a model or diagram (MD), and guessing, checking, and revising (GCR). Presented below are the problems, correct answers, and solutions of student 1 in Figure 3.

Figure 2
Solution of Student 1 in Problem 1



Problem 1: Mr. Dechavez intends to enclose his property with a rectangular fence using 200 feet of fencing material. To maximize the enclosed space, what dimensions should the rectangle have, and what is the maximum area possible? Correct answer: The dimensions should be 50 by 50 ft., and the maximum area should be 2500.

Considering the figure above, student 1 applies concepts on the correct information, series of operations, trial and error, equations, and drawing a diagram. It was evident in his solution when he noted that

> I just divided the perimeter to the total number of sides, to have some proportion for all sides; I did trial and error to find the answer; and I make the side to be a variable to solve the problem.

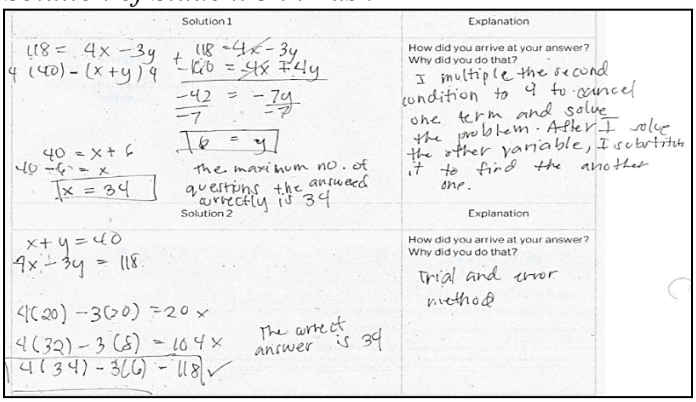
He also emphasized in his fourth solution that the *"square is considered a rectangle."* This notion failed to be achieved or explained by most of the respondents. The solution of student 1 explains his ability to utilize multiple strategies and not have errors in his solution paths, therefore, considered the most flexible among them.

Respondent's Mathematical Creativity in Terms of Originality

Originality has the lowest frequency compared to other components resulting in the difficulty of respondents to generate original solutions. There was only one student under high, 15 for moderate, and 14 for low. Student 3 has shown the most original solutions and created effective and unique strategies that help her successfully get the correct answer. Presented below are the problems, correct answers, and solutions of student 3 in Figure 5.

Figure 3

Solution of Student 3 in Task 2



Problem 2: In a physics quiz, there are 40 multiple-choice questions. The quiz awards 4 marks for each correct answer and 3 marks for each incorrect answer. If a student scores 118 marks on the quiz, what is the maximum number of questions they could have answered correctly? Correct answer: the maximum number of questions that can be answered correctly is 34.

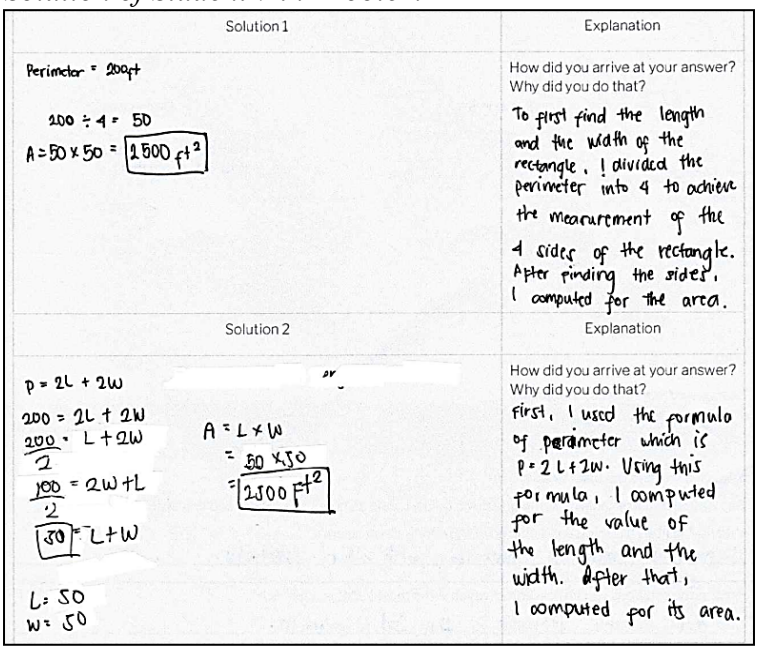
The most common strategy of the students in solving task 2 is guessing and checking with almost 55% of the respondents using it. Student 3 applied to make a model as the strategy for solving task 2. She understood the problem clearly as she even checked her answer to the created equation.

Respondent's Mathematical Creativity in Terms of Elaboration

There were five students under high in terms of elaboration. These students showed a detailed explanation of the solution path to each problem. In answering the first task, student 7 satisfied the highest level of elaboration. The following are solutions for student 7 in task 1.

Figure 4

Solution of Student 7 in Problem 1



Problem 1: Mr. Dechavez intends to enclose his property with a rectangular fence using 200 feet of fencing material. To maximize the enclosed space, what dimensions should the rectangle have, and what is the maximum area possible? Correct answer: The dimensions should be 50 by 50 ft., and the maximum area should be 2500.

As shown in her explanation, in the first solution she stated *"To first find the length and width of the rectangle, I divided the perimeter into 4 to achieve the measurement of 4 sides of the rectangle. After computing the sides, I computed the area."* While from her second solution, she explained that *"First, I used the formula of perimeter which is P = 2L+2W. Using this formula, I computed the value of length and width. After that, I computed its area."* Her explanations show a detailed step on how she arrived at the answers, which is why it belongs to the highest category in elaboration.

The last purpose was to evaluate the practicality of the developed tasks. This was done by the students with the use of a rating sheet. The table below presents the summary of students' responses.

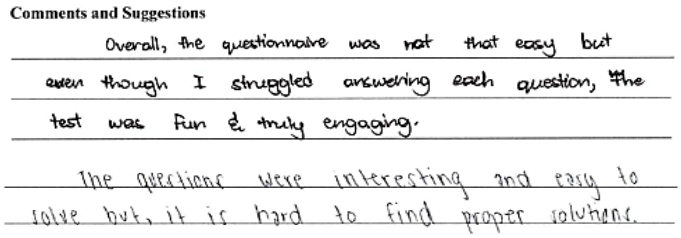
Table 5
Respondents' Perception Towards Technical Quality From

Indicators	Median	Interpretation
1. The items in the instrument are stated clearly.	5.00	Strongly Agree
2. The items on the instrument can elicit responses that are stable, definite, consistent, and not conflicting.	4.00	Agree
3. The layout or format of the instrument is technically sound.	5.00	Strongly Agree
4. The instrument is not too short or long enough that the participants will be able to answer it within a given time.	4.00	Agree
5. The instrument is interesting such that participants will be induced to respond to it and accomplish it fully.	5.00	Strongly Agree
Total	5.00	Strongly Agree

Legend: 4.20–5.0 (Strongly Agree); 3.40–4.19 (Agree); 2.60–3.39 (Moderately Agree); 1.80–2.59 (Disagree); 1.00–1.79 (Strongly Disagree)

The table above shows the level of perception of student respondents towards the developed problem-solving task for mathematical creativity. Indicators one, three, and five have received the highest mark of 5.00. It only indicates that the problems given to them caught their interest in finishing the tasks. As one of the recommendations of the experts, the problem must be localized and contextualized so that the students can relate. As mentioned by Pangan and Conde (2020), mathematical activities must be done in the practical application of mathematics in real life, and they were able to mathematize word problems and develop learners to be creative thinkers. The figure below shows one of the comments from the student respondents.

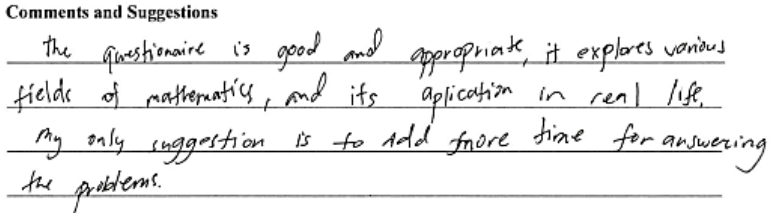
Figure 5
Comments and Suggestions of Students in Relation to Indicator 5



However, the fourth indicator "The instrument is not too short or long enough that the participants will be able to answer it within a given time" has the lowest mean score of 4.00. It emphasized that respondents were given a short period to answer the tasks. From the gathering of data, they were only given 2 hours and 10 minutes of short orientation for two sessions. As evidenced by one of their responses in the figure below.

Figure 6

Comments and Suggestions of Student in Relation to Indicator 4



Conclusion and Recommendation

Based on the findings, the development of non-routine problem-solving tasks for assessing mathematical creativity followed a systematic process, ensuring both practicality and validity. The ADDIE model was used to develop problem-solving tasks, which were grounded in well-defined objectives and content standards. Expert validation was done to ensure validity with strong agreement on the effectiveness to assess mathematical creativity. Lastly, student feedback indicated a high level of acceptance and perceived usefulness, confirming the problem's practicality and potential for classroom application.

The study recommends the application of the validated instrument inside the classroom or integrated into the curriculum. The results of this study may also serve as a basis for conducting students' and teachers' seminars in developing mathematical creativity. Students should be exposed to programs or training that promote creativity. Likewise, educators must be engaged in various workshops and seminars to be updated on the pedagogical approaches and to teach the students creative thinking effectively. Additionally, for future researchers-it is also recommended to broaden the context of the study. Similarly, it is recommended to have a comparative study of problem-solving heuristics of students from the school that surpassed OECD average and a regular class in the country. This is to examine any disparities and similarities of strategies employed from different settings. Finally, for future research directions – it is recommended to determine the effect of developed mathematical creativity tasks on the academic performance of the students; experimental research can be applied.

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Declaration of Generative AI and AI-Assisted Technologies in the Writing Process

The author declares that no AI or AI-assisted technologies have been used to generate, refine, or correct the content in the manuscript. The ideas, design, procedures, findings, analyses, and discussion are originally written and derived from careful and systematic conduct of the research.

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A Game-Based Home Visit Training for Long-Term Care Personnel Integrating SVVR Scenario Exploration and Generative AI Interaction

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Abstract

This study simulates the real process of conducting home visits and creates an educational game that combines SVVR (situational virtual reality exploration) with generative AI. The game integrates environmental observation with communication during interviews with elderly people. The goal of the game is for participants to role-play as newly hired LTC staff, assigned by a supervisor to carry out their first home visit. During the visit, participants must explore the environment, gather information from the elder, and then summarize and analyze what they find. In the end, they need to use observation, communication, and information integration skills to report back to the supervisor on whether the elder's condition matches their actual situation. The game involves participants moving through various SVVR rooms, clicking objects to access text/images, and utilizing visitation skill-improvement tips. A Generative AI simulates the elder, imposing a time limit for interaction, information collection, and confirmation. Google Docs functions as the simulated record forms typically completed by LTC staff during visits. The preliminary study involved 20 professional LTC workers in Taiwan (aged 28 to 39). Results showed that participants had significantly higher flow experience scores compared to the median (3 points). Their anxiety scores were also above the median. For cognitive load, extraneous load was significantly lower than the median, while germane load was significantly higher. Overall, the game design fostered a positive flow experience for participants without inducing excessive learning anxiety. Its ease of use and effectiveness in skill practice were highlighted.

Keywords: aging population, long-term care, virtual reality, generative AI, gamified interaction

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Introduction

The current global reality of aging is reflected in a population of approximately 857 million people aged 65 and above. This number is projected to nearly double to 1.58 billion by 2050, with the proportion of the global population increasing from the current 10% to 16%. These figures highlight that aging is an irreversible trend, particularly evident in Asia. Notably, Taiwan has been identified as the fastest-aging nation in the world (United Nations, 2023). The demand for long-term care (LTC) resources and professional personnel is rising rapidly. Consequently, cultivating an adequate supply of well-trained and high-quality LTC staff has become a major challenge for societal development.

Newbould et al. (2022) emphasized that effective educational and training programs can enhance the professional competence of long-term care (LTC) personnel and improve the overall quality of LTC services. In addition, such programs contribute to staff recruitment and retention while fostering a stronger sense of professional identity (Clarke & Ravenswood, 2019). Well-designed training initiatives can also increase LTC workers' confidence and help reduce the occurrence of adverse events and occupational burnout (Harrad & Sulla, 2018).

At the international level, there is broad consensus on the importance of strengthening training for LTC staff to address skill gaps and raise the quality of care (OECD, 2020). Nevertheless, implementation often encounters practical challenges, including insufficient staffing, time limitations, restricted resources, and a persistent gap between training content and real-world application.Chang and Hwang (2023) demonstrated that the use of virtual environments allows students to engage directly with simulated scenarios, practicing observation, exploration, and decision-making. Their findings revealed that participants in VR experiential courses performed significantly better in observation, exploratory skills, and problem-solving compared to those who received traditional training.

On the other hand, employing Generative Artificial Intelligence (Generative AI) to role-play the interviewee offers students a safe and repeatable practice environment. Research has shown that giving medical and nursing students the opportunity to engage in dialogue with simulated patients and receive immediate feedback significantly enhances their clinical communication skills, builds confidence, and strengthens their ability to manage challenging conversations (Thesen et al., 2025). Immersion in realistic and contextually relevant environments further supports learning by improving comprehension and retention. Evidence suggests that immersive learning enables students to develop practical skills that can be directly applied to their future professional practice and everyday life experiences (Goh et al., 2021).

Gamified interactive learning offers personalized and immersive educational experiences. Research by Shukla and Merikapudi (2024) demonstrated that combining Generative AI with gamified interaction can strengthen learners' observation, exploration, and problem-solving skills, while also increasing engagement. In addition, Chien et al. (2025) found that incorporating Non-Player Characters (NPCs) into role-playing activities can function as a scaffolding mechanism, guiding learners toward deeper reflection.

Despite its relevance, gamified learning within immersive interactive scenarios remains underexplored in the context of long-term care (LTC) education and training. To address this gap, the present study designs an educational game that integrates Scenario-based Virtual Reality (SVVR) exploration with Generative AI. The game enables students to simulate home visits conducted by LTC personnel with elderly individuals. Through this process, learners

practice essential exploration and interaction skills, collect and organize data, and ultimately verify the elder's condition with a supervisor to complete the task.

Methods

The objective of the game *"Chen A-Cheng's Visitation Time"* is to simulate a home visit to an elderly individual. Participants are required to synthesize, analyze, and organize information gathered through exploration, observation, and communication. At the conclusion of the visit, a supervisor evaluates whether the participant's understanding of the elder's multifaceted condition aligns with reality. The effectiveness of the game is assessed through participants' demonstration of observation, communication, and information integration skills.

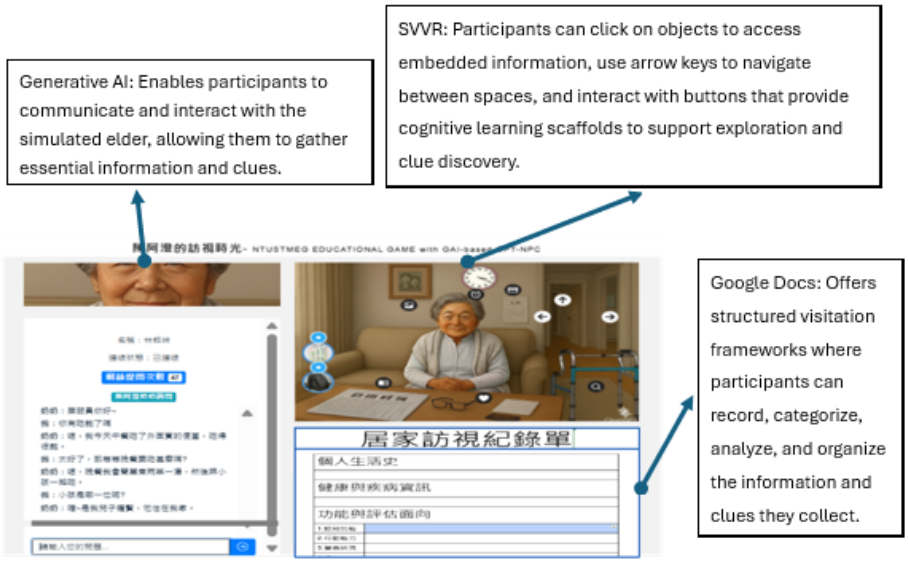
The game interface is hosted on Google Sites and integrates three platform tools—SVVR, Generative AI, and Google Docs (see Figure 1). Participants are free to explore and utilize these tools:

- SVVR: Enables participants to navigate the environment, read information embedded in objects, switch between scenes, and access the "backpack" for visitation skills and functional assessment guidelines. This process allows them to gradually collect clues about the elder's daily life.
- Generative AI: Provides interactive dialogue with the elder. Through communication, participants obtain information about the elder's personal history, health status, and functional domains.
- Google Docs: Offers structured form templates for categorizing, analyzing, and organizing the collected data.

Throughout the game, participants adopt different strategies and approaches, with the flexibility to prioritize scenario exploration, interactive communication, or documentation and organization.

Figure 1

The Game Interface Is Set Up Within a Google Sites Web Page, Detailing the Operational Methods for Each Component



The preliminary study recruited 20 LTC service personnel in Taiwan, aged between 28 and 39. Each participant was provided with a computer device equipped with internet access. The experiment lasted approximately 60 minutes and was divided into three phases:

- **10 minutes:** Explanation of the testing procedure and game instructions
- **30 minutes:** Game-based learning activity (simulation task)
- **20 minutes:** Completion of post-test questionnaires

The post-test included the Game Effectiveness Test, the Flow State Scale, the Activity Anxiety Scale, and the Cognitive Load Scale. In addition, five semi-structured questions on game practicality were administered to further explore participants' experiences with the game mechanism.

The Game Effectiveness Test was designed based on three sources: (1) content observed in the SVVR environment, (2) communication with the elder via Generative AI (GAI), and (3) a synthesis of both. The test comprised ten multiple-choice questions, each worth ten points, for a total possible score of 100. Each question included five options, and participants were required to select all correct answers to receive full credit.

To assess learners' flow performance during learning activities, Kiili's (2006) Flow Questionnaire was utilized. This instrument, which was translated into Chinese by Taiwanese scholars Hou & Li (2014), comprises 22 items across two major dimensions: Flow Antecedents and Flow Experience. A five-point Likert scale was employed for all responses.

Learners' anxiety levels during participation were investigated using Krashen's (1987) Affective Filter Hypothesis Scale, which was adapted by Hung Mei-Hsueh (2001) into the "Learning Experience Scale." This scale contains 8 items, all rated on a five-point Likert scale.

To examine learners' cognitive load, the Cognitive Load Scale developed by Klepsch et al. (2017) was applied. This 8-item scale distinguishes among three load types: intrinsic load, extraneous load, and germane load. Like the other instruments, it also utilizes a five-point Likert scale.

Results and Discussion

The data from Chen A-Cheng's Visiting Time were analyzed using Wilcoxon Signed-Rank tests. As shown in Table 1, participants' game performance ($M = 74.90$, $SD = 7.58$) was significantly higher than the passing score of 70 on the scale. Table 2 indicates that the overall flow experience ($M = 3.93$, $SD = 0.45$) was significantly higher than the scale's median value (i.e., 3). Table 3 shows that activity-related anxiety ($M = 2.1$, $SD = 0.8$) was significantly lower than the scale's median value (i.e., 3). Table 4 reveals that extraneous cognitive load ($M = 2.18$, $SD = 0.63$) was significantly lower than the scale's median value (i.e., 3), while germane cognitive load ($M = 3.62$, $SD = 0.66$) was significantly higher than the scale's median value (i.e., 3).

In the qualitative feedback, participants provided insightful comments such as: "*I can understand the life trajectory of the elderly, and the environmental setup allows me to infer their abilities*" (P8); "*It reminds me of the elders I once cared for or visited*" (P5); and "*Because it is AI simulation, the pressure is lighter, and I can focus on collecting questions*" (P10). Overall, the qualitative data demonstrate that the mechanism realistically presents the living situations of the elderly (100%), aids participants in understanding their conditions and difficulties (95%), fosters emotional connection with the elderly (70%), mitigates

communication pressure compared to interacting with real people (65%), and enables participants to concentrate more on assessment aspects (85%).

Collectively, these findings indicate that this game mechanism effectively facilitates participants' acquisition of information about the elderly. Throughout the process, participants report experiencing a sense of control, enjoyment, focus, and immersion (Flow), all without inducing excessive learning anxiety. Crucially, the learning operation does not impose unnecessary extraneous cognitive load while effectively facilitating germane cognitive load.

Table 1
The Mean and Standard Deviation of Learners' Game Performance

				(N = 20)
	M	*SD*	*Z*	*Sig.*
game performance	74.90	7.58	2.487*	0.013

Note. $^{*}p < 0.05$

Table 2
The Mean and Standard Deviation of Learners' Flow

				(N = 20)
	M	*SD*	*Z*	*Sig.*
Overall Flow	3.93	0.45	3.83***	< .001
Flow antecedents	3.97	0.57	3.81***	< .001
Challenge-skill balance	3.88	0.56	3.74***	< .001
Goals of an activity	3.95	0.94	3.14**	0.002
Unambiguous Feedback	3.55	0.84	2.47*	0.014
Control	4.10	0.90	3.40***	< .001
Playability	4.38	0.69	3.79***	< .001
Flow experience	3.79	0.47	3.83***	< .001
Concentration	4.18	0.67	3.60***	< .001
Time distortion	4.03	0.66	3.67***	< .001
Autotelic experience	3.95	0.70	3.58***	< .001
Loss of self-consciousness	3.00	0.69	−.135	0.893

Note. $^{*}p < 0.05$, $^{**}p < 0.01$, $^{***}p < 0.001$

Table 3
The Mean and Standard Deviation of Learners' Anxiety

				(N = 20)
	M	*SD*	*Z*	*Sig.*
Game Anxiety	2.10	0.80	−3.16**	0.002

Note. $^{**}p < 0.01$

Table 4
The Mean and Standard Deviation of Learners' Cognitive Load

(N = 20)

	M	*SD*	*Z*	*Sig.*
Intrinsic cognitive load	3.10	0.98	0.373	0.709
Extraneous cognitive load	2.18	0.63	−3.57***	< .001
Germane cognitive load	3.62	0.66	3.12**	0.002

Note. $^{**}p < 0.01$, $^{***}p < 0.001$

Conclusions and Limitations

Chen A-Cheng's Visiting Time is a simulation-based serious game developed for this study, targeting the home-visiting skills of long-term care personnel. The primary aim of the game is to enhance participants' proficiency in exploration, observation, and communication. It particularly underscores the importance of cross-checking, synthesizing, and analyzing information and cues derived from both the environment and the elderly resident.

Based on the data analysis, the game demonstrated significant positive effects on learning outcomes and flow experience, coupled with low levels of game-related anxiety, minimal extraneous cognitive load, and high germane cognitive load. Preliminary findings suggest that this experiential learning approach—integrating role-playing, environmental simulation, and GAI-based interactive simulation—effectively facilitates a high degree of learning flow, mitigates learning anxiety, minimizes unnecessary extraneous cognitive load, and successfully provides the essential germane cognitive load required for deep learning.

Initial results indicate that this mechanism of situational exploration and interaction successfully cultivates participants' observational skills, communication abilities, and information integration competence. Future research should prioritize expanding the sample size, conducting comparative studies against traditional long-term care training, and further investigating the influence of simulation fidelity and technology acceptance on learners' perceptions and outcomes.

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Higher Education Financing: Challenges for Small Independent States in the Caribbean

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Abstract

This paper examines the critical and persistent challenges confronting the financing of higher education (HE) systems within the Small Independent States (SIS) of the Caribbean. The Caribbean states face a unique nexus of structural, fiscal, and environmental vulnerabilities that compromise the long-term sustainability and equitable access of tertiary institutions, notably the University of Trinidad and Tobago (UTT), the University of the West Indies (UWI), and other national Caribbean colleges. The overarching challenges lie in the trilemma of small states: high operating costs due to limited economies of scale, inelastic public revenues, and disproportionate exposure to exogenous shocks, particularly escalating climate change-induced disasters. This financial volatility leads to HE systems being severely underfunded, characterized by reliance on diminishing government subventions, increasing tuition burdens on low-income populations, and underdeveloped private-sector investment. Furthermore, the limited administrative capacity of many SISs impedes their ability to navigate complex multilateral funding mechanisms and diversify revenue streams, thereby compounding their debt vulnerability. This paper argues that current financing models, often based solely on per capita Gross National Income (GNI), fail to account for the acute, multidimensional vulnerability of Caribbean SIS. Sustainable HE financing requires a change in basic assumptions, advocating for industry regional collaboration on shared resources and the adoption of vulnerability-adjusted metrics, such as the proposed Multidimensional Vulnerability Index (MVI), to unlock predictable, concessional development finance dedicated to building resilient educational infrastructure and fostering future human capital.

Keywords: higher education financing, higher education leadership, higher education policy, higher education in the Caribbean, financing higher education in the Caribbean, higher education and climate shocks

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Introduction

The Role of Higher Education in Small Island Developing States (SIDS)

The higher education (HE) sector in the Caribbean Small Independent States (SIS) is crucial, serving as the primary engine for social mobility, economic diversification, and the development of the high-level human capital required for global competitiveness. (Sain & Bozkurt, 2023). For small, resource-constrained nations such as Jamaica, Barbados, Trinidad and Tobago, St. Lucia, and indeed the entire Eastern Caribbean, universities face a complex dual mandate: advancing national development priorities while simultaneously cultivating world-class research and resilient thought leadership (Beckles & Richards-Kennedy, 2021). The regional University of the West Indies (UWI) system, comprising multiple campuses and nations, and major national institutions such as the University of Trinidad and Tobago (UTT), fundamentally underpins this structure. However, this critical function is increasingly threatened by deep-seated structural vulnerabilities inherent to the SIS model, placing severe strain on the financial sustainability and accessibility of higher education from Jamaica in the north to the eastern Caribbean archipelago.

The financial health of regional HEIs is critically dependent on inelastic government subventions, a model that has become untenable under recent global and regional economic shocks. (Finch, 2003). Fiscal pressures, heightened by the COVID-19 pandemic and declining revenues in commodity-dependent states, have led to significant government arrears in contributions to regional institutions (Hutton, 2022). This financial instability is compounded by the high operating costs associated with small scale and geographic dispersion, preventing HEIs from achieving typical economies of scale. Consequently, institutions face difficult choices: either raise tuition fees, which restrict access for low-income populations and undermine equity, or curtail essential investment in modernization, research infrastructure, and climate-resilient facilities needed to secure the region's future.

This paper addresses the central challenge of establishing sustainable financing models for higher education in the Caribbean SIS. The research design for this conceptual paper consisted of historical and comparative data that were utilized in the formulation of the policy initiatives that were obtained. The areas that were investigated were based on challenges of cost sharing, tuition fees, the country's economy, types of university, and access to higher education institutions in the Caribbean. The instruments that were used in this research were policy and document analysis, and as secondary data. The core problem lies in the collision between the Caribbean’s disproportionate economic and climate vulnerabilities and the restrictive mechanisms of global finance. Small island states are forced to divert scarce resources toward immediate existential threats, particularly climate adaptation following devastating events such as Hurricane Beryl (exceeding $3.4 billion USD) in 2024 and Hurricane Melisa (exceeding $10.5 billion USD) in 2025 (see Table A).

Notwithstanding the current international financial metrics, such as Gross National Income (GNI) per capita, Caribbean countries often fail to access the concessional funding necessary to buffer these shocks (Gamper et al., 2025). Addressing the resilience gap is not optional, as resilient education is the foundation of a competitive region (Cooke & Milano, 2025). The core challenge lies in the trilemma of small states: high operating costs due to limited economies of scale, inelastic public revenues, and disproportionate exposure to exogenous shocks, particularly escalating climate change-induced disasters. The subsequent analysis will examine

this structural trilemma and propose viable policy alternatives for diversifying revenue and reforming international support.

Defining the Caribbean Small Independent States (SIS)

Defining the Caribbean Small Independent States (SIC) is essential to framing discussions of public-sector financing, particularly in higher education. The key characteristics of SIS include the following: structural vulnerabilities, a small land area, limited human capital, undiversified economies with singular product or service dependence (such as trade and/or tourism), and susceptibility to external environmental and economic shocks (Nurse & Pace, 2021). Unlike larger nations, SICs have a limited capacity to absorb significant public debt or implement complex fiscal policies without an immediate and profound domestic impact (Gosine, 2019). This inherent structural fragility means that governmental resource allocation, including recurrent expenditure on higher education, is restricted by the need for resilience and stabilization. This restriction negatively impacts the budgetary allocation placed on public Higher Education Institutions (HEIs).

Statement of the Problem: Compromised Sustainability and Access in HE Financing

The challenge confronting public higher education (HE) financing in the Caribbean small island countries is a critical paradox: the absolute necessity of high-quality tertiary education for long-term economic diversification and human resource development directly clashes with fiscal unsustainability. The perpetual constraint of national budgeting (Pachamama, 2020) is triggered by a limited tax base compounded by a high public sector expenditure. In the circumstances, operating costs rise—often heightened by the diseconomies of small scale and the need to import specialized expertise. The net effect is that the government's fiscal capacity is constrained. A structural funding gap emerges, fundamentally compromising the financial sustainability of the entire system (Bourne, 2011).

The consequential issues arising from a compromised financial sustainability lead directly to a dual crisis affecting both access and quality. When public investment stagnates or declines, HEIs are forced to implement austerity measures, which commonly involve increasing tuition and mandatory student fees. This austerity measure increases the financial burden on students and creates a contradiction to the principle of equitable access. (Teelucksingh, 2022). Concomitantly, some HEIs that attempt to absorb cost increases without significant fee hikes are often compelled to reduce essential operational expenses. The implications result in larger class sizes, decreased investment in research and infrastructure, and reliance on underpaid or part-time faculty. This perpetual cycle of underfunding inevitably reduces academic quality (Kane & Orszag, 2003). Moreover, the relevance of the HE offerings ultimately undermines the region's long-term human capital goals. This research, therefore, addresses this critical information deficit by analyzing and comparing the known financial expenditure patterns to provide the evidence required for sustainable, access-preserving HE financing strategies.

Challenge 1: The Structural Predicament of Small State Financing

High Operating Costs and the Absence of Economies of Scale

Caribbean Small Island States (SIS) are noted for their small size and geographic isolation. This combination of size and isolation inevitably lead *diseconomies of scale* across all public sectors, including higher education (HE). This economic reality means that the unit cost of

providing goods and services, such as a university degree or specialized research, is disproportionately higher than in larger economies (Tauxe, 2024). This high operational expense range from basic logistics of higher import and export costs for specialized laboratory equipment and textbooks to basic campus consumables (United Nations, n.d.).

This structural disadvantage is larger within the higher education ecosystem, where certain fixed costs are unavoidable regardless of student enrollment numbers. A regional institution, such as a faculty of medical sciences or engineering, requires the same complement of high-cost infrastructure—specialized laboratories, comprehensive libraries, and administrative systems—whether it serves 500 or 5,000 students. This significantly increases the per-student cost, creating a persistent efficiency gap. Furthermore, institutions in SIDS face among the highest electricity costs globally due to the rising cost of imported fossil fuels, thereby increasing the operational budget for campus lighting, cooling, and technological resources (United Nations, n.d.).

Ultimately, the inability to realize classical economies of scale acts as a fundamental barrier to the sustainable development of the education sector (Tauxe, 2024). High transportation costs and the necessity of importing specialized human capital (e.g., specific faculty expertise) further embed a high-cost environment. This scenario forces universities to either charge prohibitively high tuition fees, rely on smaller, less diverse income streams, or perpetually struggle to cover fixed operating expenditures, placing immense pressure on already strained government subsidies.

Inelastic Public Revenues and Competing Fiscal Demands

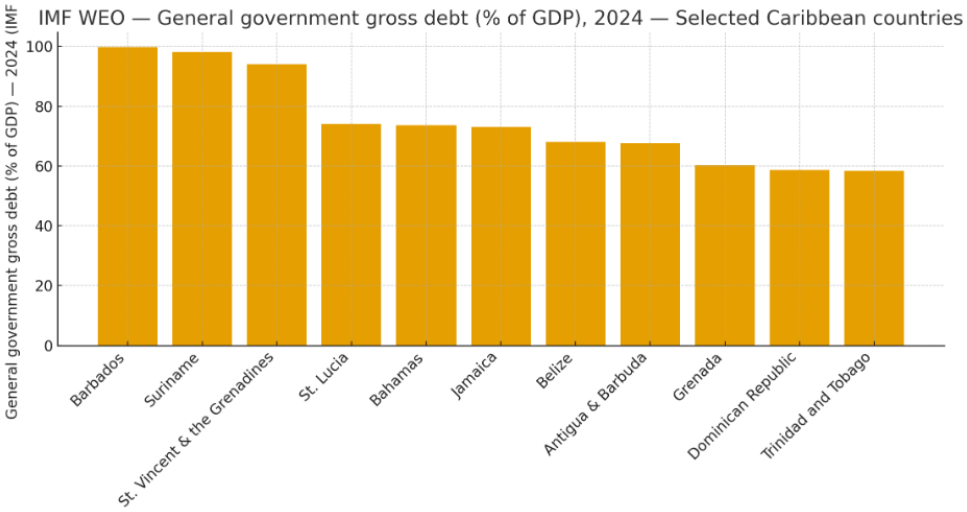
Caribbean SIS possess narrow and highly undiversified economic bases. This inelastic public revenue stream render these economies vulnerable to external fluctuations. For many states, the economic structure is fundamentally reliant on a single dominant sector, primarily tourism, which contributes an average of 30% to the Gross Domestic Product (GDP) of SIDS (United Nations, n.d.). This dependency means that state revenue—derived heavily from Value Added Tax (VAT), customs duties, and departure taxes—can fluctuate up or down during boom years or down years.

The volatility of this revenue structure was vividly exposed by the COVID-19 pandemic. In 2020, tourist arrivals across the Caribbean region declined by 67% compared with the previous year (United Nations, n.d.). This immediate reduction in economic activity caused a corresponding decline in government tax receipts. This effect eliminated the fiscal space for nonessential or long-term investments. Scheduled subventions to regional universities and national colleges are generally the first expenditures to be cut or delayed, demonstrating the direct and immediate link between external market shocks and the instability of higher education financing (Diris & Ooghe, 2018). When fiscal resources are severely constrained, governments must make stark trade-offs among critical, competing public demands. Post-pandemic, investment in health systems, social safety nets, and remarkably resilient infrastructure—essential for climate adaptation—takes precedence (CAF, 2025; UNOPS, n.d.). Higher education, which is important for long-term development but whose returns are realized slowly, is consistently displaced by immediate needs, creating a cycle of under-resourcing for the HE sector.

Sovereign Debt and Fiscal Constraints on Social Sector Spending

The historical high levels of sovereign debt constitute a fiscal crisis for many Caribbean SISs, directly limiting the state's capacity to invest in higher education. In 2024, approximately one-third of SICS had public debt-to-GDP ratios exceeding 60%, with some countries exceeding 80%, placing them at “high risk” of debt distress (DFI, 2024; PreventionWeb.net, 2024).

Figure 1
Debt to GDP for Caribbean Countries 2024



Source: IMF World Economic Outlook (WEO) / IMF Data Mapper – (% of GDP), 2024.

This substantial debt stock forms a significant portion of the annual government revenue structure. The implication of this debt has a significant curtailment of the fiscal space available for strategic development spending in HE. This figure is drastically higher than the 15–20% range that international financial institutions often deem a sustainable threshold. Such a high commitment to creditors crowds out funding for the Sustainable Development Goals (SDGs), including quality education, resulting in movements away from necessary resources for long-term national human capital development (CPDC, 2023; DFI, 2024).

Why can HEIs not rely on government subsidies? The stark reality of this fiscal constraint is evident in the comparison between debt service and social sector expenditure. For Latin American and Caribbean (LAC) SIDS, debt service payments (averaging 42% of budget revenue) are significantly greater than the combined expenditure on all social sectors (averaging 35%) (DFI, 2024). This structural imbalance guarantees a stark underfunding crisis for higher education. Without substantial debt relief or mechanisms to free up fiscal space, HE institutions cannot rely on consistent government subventions, leaving them financially vulnerable and unable to plan for the future.

Challenge 2: Disproportionate Vulnerability to Climate Change

The Caribbean SIS shows a disproportionate vulnerability to climate change and exogenous shocks. These shocks can have the effect of eliminating decades of economic progress and financial stability. Despite contributing less than one percent to global greenhouse gas emissions, the Caribbean small states are exposed to frequent and intense natural hazards (World Bank, 2021). The average annual cost of damage from these disasters, particularly

tropical cyclones, is significantly higher than the global average (United Nations, n.d.). The cost implications of these disasters add further fiscal complications to HE, competing with healthcare and social services following disasters.

The economic cost of climate events is catastrophic and often uninsurable. Between 1995 and 2022, tropical cyclones alone caused an estimated US$45 billion in damage across the Caribbean (PreventionWeb.net, 2024). Table A in the Appendix presents the approximate cost of damage resulting from climate-related activities in the Caribbean over the past decade.

On average, in years when a storm strikes a country, the economic losses can equal 17% of its GDP (UNDP, n.d.). These losses are not merely a drain on national wealth but a compulsory diversion of funds. Climate-related damage not only consumes immediate fiscal space but also compounds the long-term debt problem, perpetually limiting future investments in the HE sector.

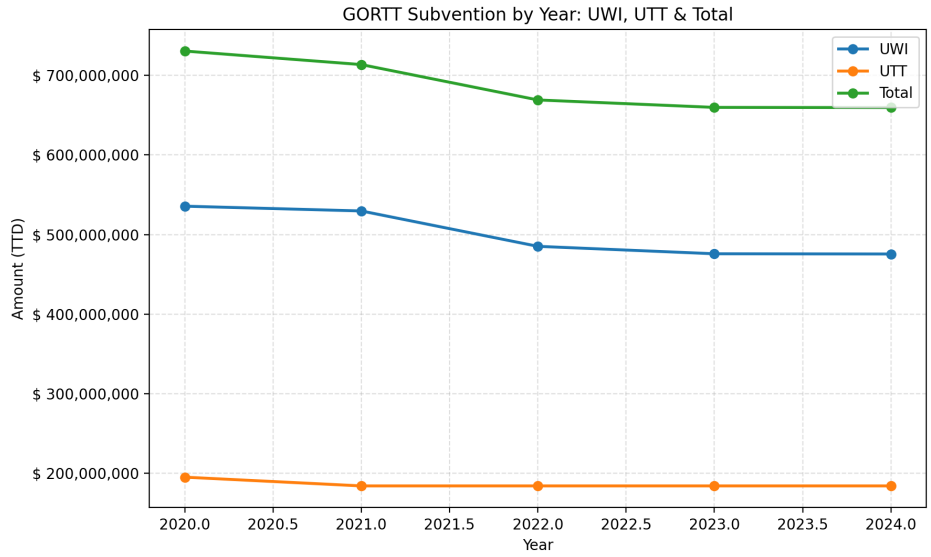
Challenge 3: Institutional Funding Sources

Faltering Government Subventions to Regional Institutions

Perhaps the most pressing financial challenge facing regional higher education (HE) institutions, such as UWI and UTT systems, is the systemic failure of contributing Caribbean governments to meet their mandated subventions. The typical Caribbean HE funding model is based primarily on the "economic cost" formula and requires UWI member states to provide the majority of the university's operational budget. However, perpetual economic vulnerabilities, mounting sovereign debt, and narrow tax bases frequently result in significant, delayed payments and sustained arrears (UWI, 2020). Some governments, such as Trinidad and Tobago, acknowledge these financial difficulties and pledge to settle outstanding arrears in subsequent fiscal years (Ministry of Finance, 2024). However, these pledges sometimes come in delayed disbursements, leading to severe cash-flow and strategic-planning instability for the entire regional university system. Figure 2 shows the government of Trinidad and Tobago's subventions to UWI and UTT for the period 2020 to 2024.

Figure 2

GORTT Declining Subventions to UWI and UTT 2019–2024



Source: UWI & UTT annual reports 2020–2024

This delay and underfunding have a significant impact on the quality and maintenance of educational infrastructure. The reliance on government grants—a primary funding source alongside tuition—means that when subventions are delayed or reduced, core operational expenditure suffers. Capital expenditure necessary for maintenance and modernization, such as updates to technology platforms, repairing physical infrastructure, or investing in climate-resilient facilities, is often the first casualty of fiscal constraint. Without timely investments, structural delays occur, compromising the long-term integrity and technological relevance of the regional HE provision. Consequently, the sector remains highly sensitive to the political and economic cycles of its contributing countries, limiting its potential to transition into a truly competitive, entrepreneurial, and globally ranked HE provider (UWI, 2020).

Increasing Tuition Burdens and Their Impact on Low-Income Students

Given the reality of the financial constraints brought on by reduced and delayed government funding, HEIs may consider a gradual shift toward greater cost-sharing, primarily through increased tuition fees (Blancaneaux, 2022). This trend directly contradicts the historical philosophy of subsidized higher education as a public good aimed at equitable national development. The growing reliance on tuition to close budget gaps poses a significant threat to educational equity and access, particularly for students from low-income families. While some mitigation to ease this student burden comes from nations that offer scholarship or financial aid programs, these are often insufficient to cover the full spectrum of educational costs, including tuition, accommodation, books, and living expenses. The implication of this measure results in delayed student enrollment, working full-time while studying, or withdrawing from higher education entirely, creating a barrier that affects vulnerable groups (ParlAmericas, n.d.).

Moreover, the perception of high tuition costs, coupled with increasing uncertainty about employment prospects, is prompting prospective students to question the Return on Investment (ROI) of a university education (UWI Quality Education Forum, 2021). This market-driven questioning, particularly evident in the post-pandemic environment of increased unemployment, suggests that rising tuition is not only an access issue but also a demand issue. Under the circumstances, a comprehensive needs-based financial aid scheme becomes a requirement to truly ease the burden on families. The Caribbean risks creating an HE system that only serves the socio-economic elite, undermining its fundamental purpose of broadening access to HE.

Challenges to Equitable Access in National Colleges

Beyond the regional university system, national colleges and technical institutions play a vital role in providing access to higher education, often serving local and vulnerable populations with more vocational and applied training. However, these institutions face unique equity challenges, primarily due to insufficient financial resources and the digital divide. While national colleges often have lower nominal tuition fees than regional universities, these colleges often lack robust student support services, modern learning technologies, and adequate physical infrastructure to ensure equitable student success (ParlAmericas, n.d.).

A significant barrier to equitable access is the technological and geographical isolation experienced by many students. COVID-19 initiated a rapid technological response to educational delivery. In Caribbean SISs, this sudden shift to eLearning exposed the region's disparities in internet access, reliable broadband, and the availability of personal computing devices. Students in remote or rural areas, or those from lower-income households, were

disproportionately affected by the "digital divide," creating unequal learning outcomes and heightening the risk of dropout.

Caribbean institutions struggle to attract and retain highly specialized faculty due to limited resources for competitive salaries and professional development. This issue impacts the quality of instruction and limits the expansion of leading-edge programs required by the evolving labor market. Equitable access in national colleges thus requires not only mitigating direct financial costs through subsidies but also strategic public investment in robust, decentralized digital infrastructure and capacity-building. This can provide the much-needed support to ensure that high-quality, relevant education is delivered consistently across all demographic groups and geographic areas.

Challenge 4: Administrative Barriers

Limited Technical and Administrative Capacity (Human Capital)

Expertise, human capital, and administrative capacity continue to be significant challenges in securing sustainable HE financing. This competency gap is more prevalent in the public service and presents a limitation in the technical and administrative capacity of government ministries and HEIs. This capacity constraint manifests as a difficulty in complex tasks such as long-term financial modeling, sophisticated scenario planning, and the rigorous monitoring and evaluation required by multilateral donors (Dougherty, 2016). The frequent high turnover and sometimes transfer of personnel within key government ministries, coupled with resource constraints, means that specialized knowledge often leaves with staff, hindering institutional memory and operational effectiveness (GCA, 2025).

This capacity gap is particularly acute in modern, innovative financing. The institutions often lack the specialized expertise needed to effectively develop "bankable" projects that meet the stringent requirements of international private investors or Multilateral Development Banks (MDBs). While capacity-building efforts are important for policy and infrastructure projects, similar targeted technical assistance is needed within HE institutions to enable them to diversify their funding portfolios and manage financial instruments independently.

Navigating Complex Multilateral and Climate Finance Mechanisms

Accessing non-traditional funding streams, particularly global climate finance, presents a formidable administrative barrier for Caribbean HEIs and, by extension, the governments that fund them. Although SIDS collectively require approximately US$12 billion annually for climate adaptation, the mechanisms for accessing this finance are not designed with the unique constraints of small island states in mind (Climate Policy Initiative [CPI], 2025). This complexity creates a significant challenge of "absorption capacity."

The application processes and the necessary project documents to access global funding can be both complex and bureaucratic. The Green Climate Fund (GCF) or MDB adaptation windows are notoriously long, bureaucratic, and highly technical. Ministries of Education and university administrators across the Caribbean often lack the human resources to commit to the rigorous process of developing project concept notes – a tasks that entail conducting detailed climate risk assessments, and compiling the extensive technical documentation required by these bodies. The implication of arising out of this capacity gap is that even when funding is

theoretically available, SIDS are effectively locked out due to the high transaction costs and complexity of the application process (CPI, 2025).

Furthermore, while MDB funding has increased, its structure is not always aligned with the developmental needs of the HE sector. Although the GCF has been the largest multilateral source of funding for SIDS, a significant portion of international public adaptation finance to SIDS is still provided as debt (44% in 2021–2022). This exacerbates the existing debt sustainability risks (CPI, 2025) and forces HEIs to critically evaluate whether pursuing climate finance for infrastructure resilience, though necessary, will ultimately lead to further macroeconomic instability for their host governments. The consequence of this is a deepening of the funding crisis for core academic functions.

Policy Alternatives and Avenues for Sustainable Financing

Reforming International Financial Metrics

The Gross National Income (GNI) per capita as a concessionary financing metric is a significant hurdle to sustainable financing in the Caribbean, inclusive of higher education (UN DESA, 2022). Low populations in member Caribbean states often inflate GNI, leading to reclassification of country status to "graduate," thus preventing concessionary financing. The implications of this reclassification mean that nations highly vulnerable to existential external shocks are forced to finance recovery and essential social services, such as higher education, through commercial or non-concessional loans, thereby dramatically escalating their debt burden (GOV.UK, 2019).

Another limitation in the GNI model is its failure to account for structural economic and environmental vulnerabilities. Because of diseconomies of scale, small domestic markets, and geographical remoteness, there is a higher probability of extremely high per-unit costs for imported goods, energy, and infrastructure maintenance (LSE, 2024). Furthermore, when climate shocks are factored into the financial model, the impact is disproportionately high; Hurricane Maria in 2017, for instance, caused damages estimated at 226% of Dominica's GDP. This illustrates how a single event can instantly eliminate decades of economic progress and significantly increase debt (AOSIS, 2022). These vulnerabilities necessitate constant, large-scale investment in resilient infrastructure—including educational facilities—which national budgets alone cannot meet. High vulnerability, masked by a high GNI per capita, can cause countries to be denied the affordable capital needed to ensure fiscal space for public services such as education.

Multidimensional Vulnerability Index (MVI) as a New Basis for Concessional Finance

The proposed solution championed by SIDS for decades is the adoption of the Multidimensional Vulnerability Index (MVI) to complement, not replace, GNI per capita in determining eligibility for concessional finance (UN OHRLLS, 2024). The MVI model supplements the existing GNI by including structural vulnerability (e.g., small size, remoteness, dependence on specific sectors) and matters of structural resilience (e.g., limited administrative capacity, high debt exposure) across economic, environmental, and social dimensions (UN DESA, 2024). MVI scores for Caribbean SIDS are typically 50–70 percent higher than the global average, clearly demonstrating their elevated vulnerability (CSIS, 2022).

Policy implementation of the MVI can be a significant intervention for higher education financing. A globally accepted MVI, developed and integrated by international financial institutions (IFIs), can provide the evidence base needed for SIDS to secure resources for climate-resilient education infrastructure systems. The implication of an MVI policy implementation to access concessionary financing and grant-based climate funds can free up inelastic public revenues currently dedicated to debt servicing and post-disaster recovery for core HE subventions (AOSIS, 2022). This policy shift can directly provide the financial stability of institutions such as the University of the West Indies (UWI) and other Caribbean colleges, and ensure that government budgets can reliably support access and equity objectives rather than constantly reacting to external crises.

Regional Collaboration and Shared Resource Models

Regional collaboration, coupled with enhanced efficiency are additional mechanism to mitigate the absence of economies of scale. Institutions like the UWI already serve 17 countries, but deeper integration is required across administrative and technological platforms. A key strategy is the implementation of shared service and delivery models for back-office functions, including procurement, IT infrastructure, course duplication, and library resources. For instance, the Caribbean Shared Educational Resource Service (CSERS) aims to pool access to digital content, making educational materials more affordable across the region (DataLore Inc., 2020). Although CSERS has had limited success, it presents tremendous potential for Caribbean higher education institutions. Through standardization of administrative processes and consolidating procurement activities, HEIs' operating costs can be optimized. Beyond administrative efficiency, regional strategies must focus on academic quality and knowledge transfer. Initiatives involving UWI, UTT, and partner institutions, such as the EU-funded project on Mainstreaming Energy Efficiency and Climate Change in Built Environment Training and Research, demonstrate successful capacity building through joint curriculum development and research mobility (EU-LAC Foundation, 2019). Furthermore, the implementation of a universal regional credit transfer system can facilitate student mobility. This measure can ensure specialized, high-cost programs (e.g., Engineering, Medicine) can be efficiently centralized at one campus, serving the needs of the entire region and avoiding costly duplication of resources in smaller national colleges (EU-LAC Foundation, 2019).

Developing Resilient Educational Infrastructure and Digital Delivery

Operational continuity and efficiency require that the educational planning include financing climate-resilient educational infrastructure is an integral part of capital investment The high incidence of hurricanes and floods in the region routinely results in damaged school buildings, prolonged learning disruptions, and damages costing millions, e.g., Hurricane Beryl caused over US$16.6 million in damages to Jamaica's education sector in 2024 (Global Partnership, 2025). The policy alternative is to proactively integrate disaster risk reduction into all HE infrastructure planning. Access to global funding agencies/instruments, such as the Green Climate Fund (GCF) and the World Bank's resilient transport/infrastructure programs (World Bank, 2024) become integral to HE infrastructure financing. Reports suggest that investing just $1 in climate-resilient infrastructure can yield savings of approximately $4 in post-disaster rebuilding costs (Commonwealth, 2024).

Accessibility and educational reach are integral to the philosophy of broadening higher education access. Further strategic investment in digital delivery and e-learning platforms offers both disaster resilience and economies of scale. Digitalization enables education systems

to continue operating during periods of physical disruption (e.g., pandemics, storms), thereby protecting learning continuity (Commonwealth, 2024). The policy shift must be supported by blended finance models that invest in high-speed, reliable, and regional internet connectivity, as well as centralized digital platforms. This intervention enables the delivery of specialized courses at lower marginal cost to a larger number of students across different SIS, effectively decoupling educational costs from physical location and mitigating the structural financial disadvantage posed by small populations.

Diversifying Domestic Revenue Streams

In the context of dwindling government transfers to HEIs, private capital becomes an attractive mechanism to augment any financing shortfalls. Strategic Public-Private Partnerships (PPPs) can mobilize private capital and expertise to bridge infrastructure and service gaps resulting from constrained public budgets. In the Caribbean, PPP has had limited success, primarily focusing on skills training. The alternative is to move toward structured, transparent PPPs for non-core academic functions (Ansari, 2023). Examples include private financing and management of student housing, campus facilities (e.g., laboratories, tech hubs), and administrative services (IDB, 2022). This allows universities to focus their limited public subventions on core academic delivery, research, and student financial aid.

However, the implementation of PPPs must be aligned with the necessary administrative and risk management capabilities to mitigate against cost overruns and loss of public control (Medium, 2023). PPP policies must ensure transparent procurement processes and clear performance-based contracts, prioritizing social equity over profit maximization to avoid excluding vulnerable students (Medium, 2023). The PPP models can involve aligning the private sector's need for skilled labor with the HE curriculum through Industry-Academic Partnerships, such as the UWI-Coventry Institute or the Indian Institutes of Technology (IIT) business incubation projects. These initiatives aim to promote innovation and entrepreneurial ecosystems, thereby turning private-sector investment into a revenue stream linked to student training and job outcomes (UWI, 2023).

Implementation of Needs-Based Financial Aid and Student Loan Schemes

While high tuition is a barrier to access, public funding should be redirected from broad, poorly targeted subsidies towards a needs-based financial aid system. High government subvention often masks inefficiencies and fails to achieve equitable access, as the principal beneficiaries are often students who could afford to contribute more (UWI, 2023). A comprehensive review of the existing student aid systems and the implementation of a more rigorous, means-tested financial aid system—including grants for the most vulnerable students—can ensure that limited public funds are efficiently targeted to those with the greatest need, thereby protecting the equity mandate of HE.

These financial aid schemes must be designed to be resilient to the economic cycles of small economies and cannot merely mimic commercial bank offerings. Furthermore, innovative repayment models, such as income-contingent loans (ICL), should be explored. Under an ICL model, repayment begins only after the graduate's income exceeds a certain threshold, mitigating the risk of graduate debt distress and stabilizing the loan fund's long-term revenue stream, thereby ensuring the scheme's sustainability as a revolving fund for future cohorts.

Conclusion

The research presented in this paper confirms that Higher Education (HE) financing in Caribbean Small Independent States (SIS) encompasses a cycle of compounding vulnerability driven by a fiscal trilemma. Severe diseconomies of scale have resulted in significantly higher per-student operating costs compared to larger nations. There is structural fragility heightened by inelastic public revenues and a disproportionate exposure to climate-induced disasters. These inelastic revenue sources force governments to divert essential HE subventions toward immediate disaster relief, leaving institutions like the UWI and the UTT in a precarious, reactive financial posture. The implication of a compromised sustainability has triggered a growing social equity crisis, as declining public support compels institutions to implement tuition and fee adjustments. This shifts the financial burden onto vulnerable students, thereby eroding equitable access. To mitigate these systemic issues, policy initiatives must transition from traditional grant-dependency toward innovative, climate-resilient financial instruments. Integrating HE infrastructure into national disaster risk financing frameworks must now be an integral part of HEIs' planning. Governments must incentivize HEIs to diversify revenue through strategies of the Blue and Green Economy by developing industry-aligned research hubs and utilizing Resilience Bonds or Debt-for-Education Swaps to secure long-term capital while reducing sovereign debt. Further, through alignment with these investments with the Multidimensional Vulnerability Index (MVI), SIS can advocate for favourable concessional financing that recognizes HE as a critical pillar of national climate resilience. Going forward, scholarly investigations must prioritize themes such as leveraging the MVI for specialized infrastructure loans, analyzing the diseconomies of scale within digital campus transformations, and developing spatial-financial risk models for coastal campus assets to predict long-term maintenance costs. Additionally, future research can explore the impact of sovereign debt restructuring on tuition policy, the feasibility of public-private resilience partnerships as dedicated revenue streams, and the behavioural economics of student debt in a region characterized by high climatic and economic volatility.

Declaration of Generative AI and AI-Assisted Technologies in the Writing Process

The author declares that Grammarly, an AI-assisted writing software, was used in proofreading and refining the language used in the manuscript. The usage was limited to correcting grammatical and spelling errors and rephrasing statements for accuracy and clarity. The ideas, design, procedures, findings, analyses, and discussion are originally written and derived from appropriate and systematic conduct of the research.

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Appendix

Table A
Caribbean Climate-Related Activities and Cost of Damages

Year	Name of Hurricane/Storm	Caribbean Countries Affected (Major Impact)	Approximate Cost of Damage (USD)
2025	Melissa (Cat 5)	Jamaica, Cuba, Bahamas	> $10.555 billion (Season Total, mostly from Melissa)
2024	Beryl (Cat 4)	Grenada, Jamaica, Cayman Islands	> $3.4 billion (Dorian, 2019) + Beryl, Oscar, etc.
	Oscar (Cat 3)	Bahamas, Turks & Caicos	Included in 2024 total
2022	Ian (Cat 5)	Cuba, Cayman Islands	> $1.1 billion (Cuba only)
2021	Elsa (Cat 1)	Barbados, Saint Vincent and the Grenadines, Saint Lucia, Jamaica	~$50 million (Barbados, St. Lucia)
2020	Eta (Cat 4)	Nicaragua, Honduras, Guatemala, Belize, Cayman Islands, Jamaica	> $1.4 billion (Central America/Caribbean total)
	Iota (Cat 5)	Nicaragua, Honduras, San Andrés (Colombia)	~$1.4 billion (Nicaragua/Colombia total)
2019	Dorian (Cat 5)	The Bahamas (most severe), Puerto Rico, US Virgin Islands	~$3.4 billion (The Bahamas only)
2018	Michael (Cat 5)	Cuba, Yucatán Peninsula (Mexico)	~$200 million (Cuba only)
2017	Irma (Cat 5)	Barbuda, Saint Barthélemy, Saint Martin, British Virgin Islands, Cuba, Turks and Caicos, Puerto Rico	~$64.8 billion (Total including US impact)
	Maria (Cat 5)	Dominica, Puerto Rico, US Virgin Islands, Guadeloupe, Dominican Republic	~$91.6 billion (Total including US impact)

Year	Name of Hurricane/Storm	Caribbean Countries Affected (Major Impact)	Approximate Cost of Damage (USD)
2016	Matthew (Cat 5)	Haiti, Cuba, Dominican Republic, The Bahamas	~$10.9 billion (Total including US impact)
2015	Joaquin (Cat 4)	The Bahamas, Haiti, Turks and Caicos	~$210 million
	Erika (Tropical Storm)	Dominica, Puerto Rico	~$483 million (Dominica only)

Source: National Hurricane Centre (NHC) Tropical Cyclone Reports (TCRs); Relief Web (UN Office for the Coordination of Humanitarian Affairs), Economic Commission for Latin America and the Caribbean (ECLAC), International Monetary Fund (IMF) reports

Effects of Mobile Devices Usage on Students' Learning Success at Vocational Colleges

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Abstract

The COVID-19 pandemic can be regarded as a significant catalyst for the digitalisation of school education. The widespread availability of mobile devices, combined with the emergency pandemic-conditions, fostered a greater acceptance of their use for educational purposes among both teachers and students. As there has been no apparent decline in the use of digital technologies since the end of the pandemic, a closer examination of mobile devices from an educational research perspective appears warranted. Notably, existing literature has paid limited attention to the temporal dimension of mobile device usage in educational contexts. Furthermore, a research gap has been identified with regard to vocational schools offering economics-related subjects. Against this background, the present study investigates whether the integration of mobile devices can enhance students' learning outcomes, and how the timing of their use specifically influences learning success. For data collection, both analogue and digital tests are administered within homogeneous educational programmes, allowing for meaningful comparison. The study involves a total of 243 students across 16 classes. These are evaluated at different points in time—at the beginning or the end of the lesson—to measure differences in performance. Overall, the findings indicate that the use of mobile devices, in and of itself, does not significantly enhance learning outcomes. Similarly, the timing of device use does not yield measurable differences in performance. Instead, the results underscore the importance of purposeful and pedagogically integrated use of mobile technologies within the learning process to achieve meaningful educational benefits.

Keywords: mobile devices, learning success, vocational education, didactic of economics

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Introduction

For about a decade, scientific research has increasingly focused on the influence of mobile devices such as smartphones and tablets on academic success (Heinen et al., 2013; Macgilchrist et al., 2023; Müller et al., 2018). Numerous studies highlight positive aspects, such as increased motivation through the use of mobile devices as a learning aid (Hillmayr et al., 2017, p. 19; Pichler, 2021; Scharpf & Gabes, 2022; Yamamoto, 2013), as well as the special support provided to lower-performing students through individualised teaching using smartphones and tablets in the classroom (Galley & Mayrberger, 2018, p. 50f). Other studies point to possible disadvantages of use, such as Lepp, Barkley & Karpinski (2014), who show in their study that multitasking and increased distraction can have potentially negative effects on academic success. Technical challenges, as highlighted by Gikas and Grant (2013), and data protection concerns (Galley & Mayrberger, 2018, p. 50) can also pose obstacles to the use of mobile devices.

State of Research

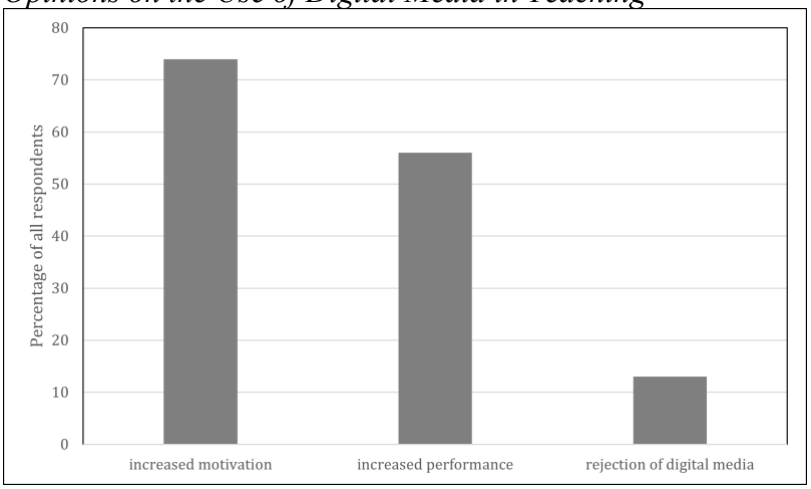
With the increased use of digital media in schools, especially since the beginning of the COVID-19 pandemic, the landscape of school learning has changed fundamentally. A survey conducted after the first phase of COVID-19 school closures found that a quarter of respondents reported experiencing more intensive learning activity as a result of the increased use of digital media (Huber et al., 2020, p. 23). COVID-19 caused the use of mobile devices in school learning to rise from 66% to 96% (Initiative D21 & TU Munich 2020, p. 3). Current data from the JIM study show that 52% of 18- to 19-year-olds regularly use smartphones and 47% use tablets in class (mpfs 2023, p. 58).

However, students use their smartphones not only for school purposes, but also for personal matters such as writing messages or looking up answers during exams. This leads to the challenge that the ability to learn can be disrupted by this diverse use (Synnott 2017, p. 162). O'Bannon and Thomas (2015) list barriers and difficulties that can be associated with smartphones in the classroom, including classroom disruption and learning barriers. According to Hattie (2009, p. 37), students should be able to achieve effective learning success through control over the learning process. Flexibility in mobile devices, temporal and spatial availability, control options and functions of these devices play a decisive role here.

From the students' perspective, the use of digital media in the classroom also seems to confirm these statements. According to a study by BITKOM (2023, p. 5), 74% of the 504 participants surveyed believe that the use of digital media in the classroom increases their motivation. Similarly, 56% believe that this leads to better grades. However, there is also a small minority (13%) who tend to reject digital media in the classroom. This concerns can be attributed in part to the potential for distraction and the growing desire for screen-free time (Friedrichs-Liesenkötter & Karsch, 2018). The opinions on the use of digital media in the classroom are shown in Figure 1.

Figure 1

Opinions on the Use of Digital Media in Teaching



According to Schmid (2022, pp. 165–168), students' attention span is highest in the first 20 minutes of a lesson. Attention span depends on a number of factors, such as interest and fatigue-related physiological conditions (Niegemann & Weinberger, 2020, pp. 139–140).

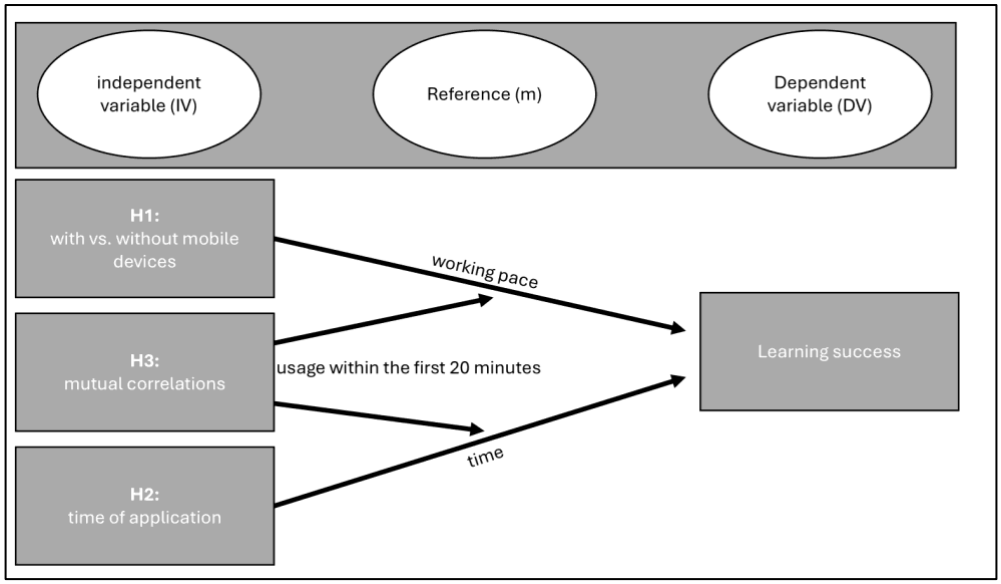
Current research largely focuses on the use of mobile devices in lessons at general education schools. Despite numerous studies on the effects of mobile devices in a school context, there is still a research gap regarding their use at vocational colleges in economics subjects. The analysis of the timing of mobile device use in the classroom also points to a lack of knowledge. The existing literature does not provide comprehensive information on how the timing of mobile device use influences learning success in vocational colleges offering economics subjects.

The combination of a lack of specific research for vocational colleges with an economics focus and the unexplored dimension of the timing of the use of mobile devices in the classroom represents a key research gap. Considering this gap is essential in the context of an increasingly digitalised world and the associated integration of technology in educational institutions. It can provide valuable insights into how mobile devices can be meaningfully integrated into teaching to promote the learning process.

Given these circumstances, there is a need for targeted research to explore the specific effects of mobile device use in vocational colleges in economics subjects and to understand the importance of the timing of use for learning success.

Figure 2

Research Model: Effects of Mobile Devices on the Learning Success of Students in Vocational Schools

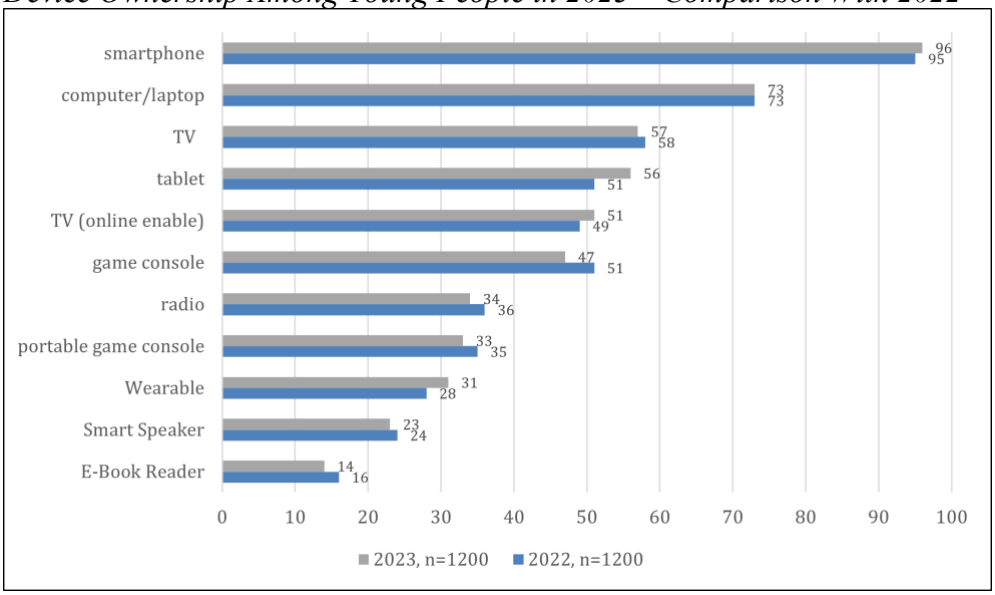


The use of mobile devices enables learners to study flexibly and independently of location and promotes self-regulated and self-directed learning (Aufenanger, 2020, p. 31). Mobile devices offer a wide range of possible applications in the classroom, as they have microphones and cameras and also enable collaborative work on learning content (cf. ibid., pp. 29–30). These functions support various types of coding – such as visual and auditory elements or symbolic and pictorial representations – and contribute to the use of multimedia learning resources, which have been shown to have positive effects on learning success (Herzig, 2014, p. 12). In particular, the combination of text and images or auditory and visual representations has been empirically confirmed to promote learning, as it reduces cognitive load and facilitates cognitive processing (cf. ibid., pp. 12–13). However, the question of the extent to which smartphones influence students' learning efficiency remains unanswered.

The ubiquitous spread of mobile devices among young people highlights their importance in everyday life. The results of the JIM Study 2023 underscore the widespread use of smartphones among school-age young people. Nearly all young people aged 12–19 own a smartphone (96%), while only 56% own a tablet (mpfs 2023, p. 5).

Figure 3

Device Ownership Among Young People in 2023 – Comparison With 2022



Source: JIM 2022, JIM 2023, figures in per cent, basis: all respondents, n = 1,200

Generation of Hypothesis

Empirical findings show that learners' initial motivation has a significant influence on their learning behaviour, learning performance and learning success (Stiensmeier-Pelster & Otterpohl, 2018, p. 569). The conceptual base for the integration of mobile devices into teaching is based on the work of Johnson (2019). Johnson suggests that the use of digital media in project-based teaching promotes increased interest, a greater focus on learning objectives and the application of deeper cognitive strategies (ibid., p. 98). According to Johnson (2019), deep learning strategies are characterised by the "elaboration of learning content". This phenomenon of deep cognitive strategies is primarily characterised by personal interest and manifests itself in connection with intrinsic motivation (Johnson, 2019, p. 87, Edelmann, 2003, p. 30). Students are very familiar with mobile devices from their everyday environment. Their use is associated with joy, pleasure and entertainment (Hirth et al., 2014, p. 139; Kleeberg-Niepage & Perzy, 2022, p. 426).

Schlicht's (2014) structural model for analysing learning success can be used to analyse the dimensions of learning success. This model considers learning success from the perspective of the pupils and understands learning as a multidimensional phenomenon comprising five essential elements: knowledge, abilities, skills, motivation and attitudes (Schlicht, 2014, p. 48). Knowledge, abilities and skills refer to "action plans relating to cognitive, sensorimotor, metacognitive and social processes" (Schlicht, 2014). Motivation, as a further element, encompasses emotional processes that relate to the will or intention to carry out an action. Studies show a correlation between student motivation and learning success (Stiensmeier-Pelster & Otterpohl, 2018, p. 569). The integration of digital media into teaching increases student motivation (Johnson, 2019, p. 87). It can therefore be assumed that the use of mobile devices for teaching purposes has a positive effect on learning success.

The fifth element, which encompasses students' attitudes, refers to long-term values that are both object- and situation-related and relate to their personal goals and motivations (Bilsky 2005, p. 301). These attitudes can influence how sustainable learning success is through the use of mobile devices. Students who are open to the use of digital learning tools may be more

willing to use these tools effectively and thus achieve better learning success in the long term. This leads to the following hypothesis.

H1: *Teaching with integrated mobile devices leads to greater learning success than teaching without mobile devices.*

The definition of a point in time during a lesson is based on the work of Goffman (1956, pp. 140–142; 1983, p. 16). He shows that a group of people who influence each other cognitively and socially adapts to temporal and spatial conditions and activities in order to achieve a given goal (Chian et al., 2021, p. 12). In the context of teaching, these points in time are called stages, phases or articulations (Grell & Grell, 1994, p. 104; Hoffmann et al., 2022, p. 78). Setting a point in time in a lesson is usually done using the phase model. A total of three phases form a scheme, and each phase has its own focus (Grell & Grell, 1994, p. 105, Krimmer et al., 2019, p. 49, Hoffmann et al., 2022, p. 76). It can be divided into three phases: introduction, development and consolidation (Meyer, 2017, p. 121).

The 15-minute model is used as a basis for defining the point in time at which mobile devices are used in order to achieve a balanced unit of beginning, middle and end (Hoffmann et al., 2022, p. 77). However, studies have shown that the three phases influence mental resources such as attention, motivation and efficiency (Baumeister & Vohs 2007, p. 126; Danziger et al., 2011, p. 1; Kleiner, 2011, p. 7). These study results have shown that, for example, in judgements, consumer behaviour and cognitive psychology, sequencing through phases has an influence on mental behaviour. It is therefore assumed that students' attention is strongest during the first 15-minute phase of the teaching process and then gradually decreases towards the end of the lesson (Schmid, 2022, pp. 165–168). This should make it possible to coordinate the actions of the students at specific points in time. The second hypothesis is based on this background.

H2: *Learning success at the start of the lesson is higher than learning success during the last 15 minutes of the lesson.*

In addition to their presumed potential to enhance learning success, smartphones also pose a risk of distraction. It has been demonstrated in young adults that the mere presence of a smartphone reduces attention and impairs cognitive performance (Beland & Murphy, 2016; Böttger et al., 2023; Skowronek et al., 2023). Al-Furaih and Al-Awidi describe the phenomenon of fear of missing out among students: “Fear of missing out describes the situation where a student cannot resist using their smartphone during lectures because of their desire not to miss anything that is happening, especially on social media” (Al-Furaih & Al-Awidi 2021, p. 2355). It is precisely those students who already have a low level of attention and little desire to learn who regularly look at their mobile phones. Mahsud et al. (2021) were also able to show that the prevailing culture of the country and the socio-demographic characteristics of individual students can significantly determine the level of attention.

The third hypothesis is that the risk of distraction from smartphones is lowest at the beginning of the lesson and that learning success is therefore highest at this point. This is justified by the fact that students had time to read and respond to their messages during the break. At the same time, it can be assumed that little new content has been uploaded to social platforms such as Instagram and TikTok that the pupils may have missed. The further the lesson progresses, the more the positive benefits of mobile devices for pupils evaporate due to the increasing potential for distraction.

H3: *The use of mobile devices within the first 15 minutes of the lesson is most successful.*

Methodology

A quasi-experimental framework is used for the study (Lehmann et al., 1998, p. 165). Variation is achieved on the one hand by distributing the work assignment with or without mobile devices, and on the other hand by choosing the time of output. This results in a 2 × 2 structure with four experimental groups (Aaker & Day, 1990, p. 317).

Table 1
Structure of the Experiment With Four Groups

		time condition	
		begin (< 0–15 min)	end (30–45 min)
mobile devices condition	yes (SP)		
	no (paper)		

Since there are numerous sources of interference and the schools may be highly autonomous, the design is based on repeated measurements (Lehmann et al., 1998, p. 152). This is also due to the fact that there are not enough homogeneous educational programmes at the six vocational schools studied to dispense with repeated measurements. There is no randomisation of the samples, and sources of interference are not controlled for by additional variables (Malhotra et al., 2013, p. 241). To ensure greater validity, the formal educational programmes of European Qualifications Framework (EQR) level four are selected at the vocational schools and the teaching material in the subject of economics is used (cf. European Qualifications Framework).

Depending on the assigned conditions, the classes receive a work assignment in paper form or for mobile devices. This creates a non-invasive way of collecting data that does not deviate too far from normal teaching. Therefore, the survey questionnaire also reflects the content focus of the lesson. Nine tasks are asked, divided into three levels of difficulty. These are based on the principle of arranging the transitions from simple to complex questions (Burns & Bush 1998, p. 303). The questionnaire was tested for comprehensibility and affordability in a pre-test (n = 14).

The paper-based assignment is adapted to the display area of a mobile device. If necessary, the assignment is printed on several sheets of paper, which are stapled together so that the worksheets cannot be placed side by side, thus preventing any advantage over the digital groups. The work assignment for processing on the device is provided as a PDF or via Forms. The tasks consist of solving closed (i.e. single or multiple choice, and cloze texts) and open tasks (i.e. text fields) based on an informational text or image. The larger proportion of closed questions serves to make data collection easier to code, in order to make the quantitative analysis more comparable and structured. This methodological approach helps to maintain the objectivity of the evaluation by minimising the problem of differences in interpretation and subjective influences in the analysis (cf. Lindner et al., 2018, pp. 241–242).

Worksheets and digital submissions are submitted or sent anonymously. Depending on the degree of difficulty of the task, the results are scored according to a fixed scheme in the form of a sample solution in order to measure the success of the work in the form of points. The study deliberately decided against collecting demographic data. This decision allows for a more targeted focus on direct influencing factors without being distracted by secondary variables. This focus increases the precision of the analysis and the overall efficiency of the study. There is no significant age difference between the groups studied.

Results of the Study

During the study period from March to June 2024, 16 classes were examined at six vocational colleges. Some of the classes (n = 4) were parallel classes, and some classes (n = 2) were tested twice. The total sample size was 243 students.

Evaluation Procedure

The points achieved were transferred to a data set (SPSS) for each task and added up as a total score (output). Missing and incorrect answers were coded separately. In 92 cases, the processing time was recorded. This reflects the measurement results of the four conditions of the study design: digital at the beginning of the lesson (n = 69) or at the end (n = 57), and paper at the beginning of the lesson (n = 57) and at the end (n = 60). The output achieved was tested for normal distribution using the Kolmogorov-Smirnov test ($D(243)$, $p > 0.05$). The distribution thus fulfils the condition of normal distribution, even though a histogram showed that the distribution is slightly skewed to the right. However, this does not pose a problem for the robustness of the unpaired t-tests (cf. Wilcox 2017, pp. 153–155). The output in the four experimental conditions was also normally distributed, with the exception of the group with devices at the end of the lesson, which is also skewed to the right. The application of the Winsorising procedure, in which the outliers are smoothed to the 5th and 95th percentiles, did not result in any improvement, so the outliers were not removed (Dixon, 1960, p. 388). The p-value was set at 5%.

Results for Hypothesis 1

Hypothesis 1 predicted a higher overall score in the group with mobile devices. A t-test with independent samples was performed for this purpose (Malhotra et al., 2013, p. 347). The two recoded groups show no significant deviation in the score ($t(241)$, $p = 0.29$). The mean values achieved for the devices ($M = 11.11$, $SD = 4.07$) and for paper ($M = 10.45$, $SD = 4.24$) were therefore not statistically influenced by this manipulation.

Table 2

Results for Hypothesis 1

	Levene's test of equality of variances		t-test for equality of means						95% confidence interval of the difference	
	F	Sig.	T	df	Sig. (1-tailed p)	Sig. (2-tailed p)	Mean difference	Std. error difference	Lower value	Upper value
Variances are equal	.965	.327	1.235	241	.109	.218	.65858	.53336	-.39206	1.70922
Variances are not equal			1.233	237.925	.109	.219	.65858	.53414	-.39367	1.71082

Follow-up tests on the group with mobile devices were then used to find other relationships. A t-test between the experimental groups of devices vs. paper with the independent variable of processing time (n = 97) shows that the groups with the devices submitted their answers 3.75 minutes earlier on average ((t95), p = 0.001). Cohen's effect size is large (d = 0.78). A cross-tabulation with a chi-square test was used to check the number of errors and empty answer fields (Mittag 2017, p. 101). The result shows that all groups made a similar number of errors overall (df(12), p = 0.76). However, it also shows that the device groups were more likely to leave more fields unanswered (df(9), p = 0.006).

Results for Hypothesis 2

Hypothesis 2 assumed that the time of entry into a group would result in a higher score than the time of securing results. An unpaired t-test was performed on the recoded groups (Malhotra et al., 2013, p. 347). There was no significant difference between the output of the conditions at the beginning (n = 126, M = 10.92) and at the end (n = 117, M = 10.64) (t(241), p = 0.59).

Table 3

Results for Hypothesis 2

	Levene's test of equality of variances		t-test for equality of means						95% confidence interval of the difference	
	F	Sig.	T	df	Sig. (1-tailed p)	Sig. (2-tailed p)	Mean deifference	Std. error difference	Lower value	Upper value
Variances are equal	4.376	.037	.530	241	.298	.596	.28358	.53473	-.76976	1.33692
Variances are not equal			.533	240.406	.297	.595	.28358	.53228	-.76494	1.33210

In further investigations of the relationships between them, significance could only be found for the difference between the two terminal device and paper groups at the end of the lesson (n = 57, M = 11.41 and n = 60, M = 9.90) (t(115), p = 0.034).

Results for Hypothesis 3

Hypothesis 3 focused on the most successful condition for output in the study design. It was assumed that the group using mobile devices at the beginning of the lesson would achieve the highest scores. An ANOVA test was used to test the four experimental conditions in relation to the independent variable of output (Mittag 2017, p. 270). The result is that the mean values are not significantly higher or lower in any of the groups ($F(3, 239) = 1.41$, $p = 0.24$).

Table 4
ANOVA

	Sum of Squares	df	Mean Square	F	Sig.
between Groups	72.648	3	24.216	1.407	.241
within Groups	4112.813	239	17.208		
total	4185.460	242			

However, the standard deviation in the terminal device group appears to differ at the end (SD = 3.41 vs. SD = 4.56, SD = 4.25, SD = 4.20), and the Levens test shows unequal variance in the groups ($p = 0.014$). An additional Welch ANOVA shows no significance ($p = 0.24$), so that different mean values can be assumed (Moder 2010, p. 187). Due to greater robustness, an independent t-test was performed between the two groups (Wilcox, 2017, p. 155). The groups of mobile devices at the end of the lesson ($n = 57$, $M = 11.42$) and paper at the end ($n = 60$, $M = 9.9$) differ significantly from each other ($t(115)$, $p = 0.035$). However, the effect size according to Cohen is rather weak ($d = 0.4$). Further tests to find an effect between the parallel classes did not yield any significant results.

Conclusion, Limitations and Outlook

This study project involved conducting an empirical study to investigate whether digital media improves pupils' learning outcomes. Overall, the use of mobile devices did not lead to any improvement or deterioration. The use of mobile devices does not automatically lead to better learning outcomes. Rather, it is crucial how these technologies are integrated into the learning process (Breiter et al., 2013).

However, this highlights important starting points for the targeted use of digital media. It was found that students tend to hand in their work earlier when using digital devices and that more questions remain unanswered. Pupils who worked exclusively on paper, on the other hand, achieved lower scores on average, even only slightly. At the same time, digital groups seem to be less vulnerable to occasional break-ins, which could indicate greater flexibility in digital work.

A key point is that digital media should not be seen as a substitute for traditional teaching methods, but rather as a supplement to them. The greatest benefit is achieved when digital devices are used specifically to make lessons more interactive, individualised and flexible. However, it is necessary to focus exclusively on the educational goals and not on the technology itself. In addition to didactic integration, the technical infrastructure in schools is another essential prerequisite. Not only are mobile devices needed, but also stable networks and regular training for teachers. This will allow the potential of digital media to be fully exploited.

One limitation of this work is that all of the research groups studied are influenced by school autonomy. This is further exacerbated by differences between educational programmes. In addition, potential sources of interference that could also affect learning performance were not

taken into account. Furthermore, as the study does not address the differences in performance between classes, this may lead to distortions in the results. Another limitation concerns the spatial restriction. It should be noted that all data collected comes from schools in the greater area of Aachen and the surrounding region, which limits the transferability of the results to other regions. In addition, the methodology of the t-test should be considered a limiting factor. In a follow-up test to hypothesis 1, unequal group sizes (n = 24 vs. n = 73) were used to examine closer relationships at the time of submission. The group size of only 24 may influence the reliability of the statement made about the time of submission. Reference must also be made to the cross table, which was created as a follow-up to check the error frequency. Two of the 20 cells have three and four entries respectively, which is less than the usual minimum number of five.

The use of mobile devices did not show any significant effects on students' learning success in this study. This underscores the need for further research aimed in particular at eliminating disruptive factors and achieving more differentiated results. A criteria-based analysis could reveal the teaching situations in which the use of mobile devices makes the most sense. The question also arises as to whether students today can be better reached through the use of mobile devices than through traditional teaching methods.

An important point that should be considered for future studies is the classification of the results in relation to the previous performance level of the classes studied. It would be useful to analyse whether classes with higher or lower performance levels benefit differently from the use of mobile devices. This could help to develop targeted strategies for different target groups. The interaction between pupils' technical skills and the use of digital media could also be relevant for future research. For example, the extent to which technical skills or familiarity with the devices influence learning outcomes could be investigated.

In addition, it would be valuable to consider more individualised approaches, such as the use of mobile devices to support specific learning groups, e.g. lower-performing or particularly motivated students. An in-depth investigation of the emotional and motivational aspects of device use – as suggested in the study – could provide further valuable insights.

Finally, it would be important to look at the future of digitalisation in schools, for example by examining the impact of fully digital classrooms on learning success and teaching quality. At the same time, consideration should be given to how the technical infrastructure and regular training of teachers can be further developed in order to better exploit the potential of digital media.

Declaration of Generative AI and AI-Assisted Technologies in the Writing Process

The author declares that no AI or AI-assisted technologies have been used to generate, refine, or correct the content in the manuscript. The ideas, design, procedures, findings, analyses, and discussion are originally written and derived from careful and systematic conduct of the research.

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Design of an Online Computational Thinking Educational Game Integrating Scaffolding and Card Battle Mechanics

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Abstract

Computational thinking, as a core competency for programming and problem-solving, has become a crucial skill in information education in recent years. Nonetheless, many current instructional activities and educational games designed to teach computational thinking frequently integrate additional components such as spatial concepts and path analysis. This integration can lead to increased extraneous cognitive load for learners. To address this issue, this study employs card battle games as the core mechanism, enabling learners to manipulate computational logic more intuitively and concretely through combining computational function cards, thereby visualizing abstract problem-solving processes. Additionally, scaffolding design is incorporated, including dual-dimensional scaffolding of "task condition instructions" and "problem-solving hints," providing step-by-step guidance and immediate feedback. A total of 30 learners participated in the empirical study. Paired sample t-test were conducted to examine differences in learners' computational thinking self-efficacy before and after the game intervention. Results showed that post-test scores were significantly higher than pre-test scores. Furthermore, learners demonstrated moderate to high levels of flow state, low extraneous cognitive load, and relatively high germane cognitive load, indicating that the game not only engaged students and reduced learning costs but also promoted active thinking. Regarding the scaffolding design and overall user experience, results showed that learners generally held highly positive attitudes. The research findings confirm that game-based design integrating scaffolding and card battle mechanics can effectively support computational thinking learning and enhance the learning experience.

Keywords: computational thinking, game-based learning, scaffolding, card games

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Introduction

Computational thinking (CT) is a fundamental cognitive skill underlying programming education and interdisciplinary systematic problem solving. In recent years, computational thinking has been recognized as one of the core competencies in global educational curricula (Liu et al., 2024). However, how to effectively support the learning of computational thinking remains a major challenge in educational practice. Traditional programming education often relies on text-based coding environments, which are particularly difficult for novices because learners must simultaneously grasp abstract logical structures and concrete syntactic rules.

To address these challenges, many educational settings have adopted block-based visual programming languages and game-based learning environments. Game-based learning (GBL) has been shown to effectively enhance learning motivation, engagement, and cognitive development (Barz et al., 2024). Nevertheless, many existing computational thinking educational games incorporate multiple cognitive demands, such as spatial reasoning, coordinate systems, and directional control, which inadvertently increase extraneous cognitive load. Prior research has indicated that visual complexity and the management of numerous blocks in visual programming environments may overload working memory (Khalid et al., 2025), thereby hindering the learning of computational thinking concepts (Hao et al., 2023). When acquired information cannot be transferred into long-term memory and instead overwhelms working memory, learning effectiveness in programming education is negatively affected (Ahn & Oh, 2024).

From the perspective of cognitive load theory (Sweller, 1988), effective instructional design should reduce extraneous cognitive load (cognitive demands unrelated to learning goals), manage intrinsic cognitive load (the inherent complexity of learning materials), and optimize germane cognitive load (cognitive resources devoted to schema construction). When educational games impose excessive extraneous load through complex spatial interfaces or cumbersome game mechanics, learners tend to allocate cognitive resources to navigating the game environment rather than understanding computational concepts. Therefore, optimizing cognitive load allocation in computational thinking educational games has become a critical issue in current programming and computational thinking research.

To overcome these instructional limitations, this study developed an innovative educational game using a card-battle mechanism as its core design. Unlike spatial movement-based learning games, card games allow learners to manipulate computational logic through concrete and controllable units—cards that represent specific computational functions. This design transforms abstract logic into tangible objects. By combining functional cards to construct computational sequences, learners can visualize and execute program logic step by step without bearing the cognitive burden of managing spatial coordinates or navigating virtual environments. Prior studies have demonstrated that concrete and manipulable objects facilitate learners' transition from concrete thinking to abstract conceptual understanding (Byrne et al., 2023).

In addition, a scaffolding system was incorporated to support learners with varying levels of proficiency. Drawing on Vygotsky's (1978) theory of the zone of proximal development, scaffolding provides temporary and adjustable learning support that enables learners to accomplish tasks slightly beyond their independent capabilities. This study adopted a dual-scaffolding framework (Hou & Keng, 2021), consisting of two components: (1) game instruction, which introduces basic functions and operational procedures, and (2) game hints,

which provide strategic guidance without offering direct solutions. This progressive cognitive scaffolding structure was designed to foster learner autonomy while preventing excessive cognitive load (Chou et al., 2024), thereby guiding learners toward independent problem solving.

This study employed a quasi-experimental design involving 30 fourth-year junior college students to examine the effectiveness of the proposed game. Multiple dimensions were investigated, including learning achivement, computational thinking self-efficacy, cognitive load, flow state, and game user experience, with the aim of providing empirical evidence for the instructional value of integrating card-game mechanics and scaffolding design in computational thinking education.

Method

The educational game developed in this study, Code Battle, was a web-based application designed using JavaScript. A turn-based card-battle system served as the core game mechanism. The objective of the game was to construct a program sequence of up to four instruction cards to execute computational logic and attack the opponent; the player who reduced the opponent's HP to zero first was declared the winner.

The card system comprised six types of cards: (1) attack cards, which inflicted damage on the opponent; (2) healing cards, which restored the player's HP; (3) draw cards, which allowed players to draw cards from the deck; (4) variable cards, which provided numerical parameters for the aforementioned action cards; (5) loop cards, which repeated the execution of the previous action; and (6) conditional cards, which triggered effects when specific conditions were met. The game included five progressive challenge levels, each corresponding to a distinct NPC opponent with unique combat strategies and skill sets.

The game interface provided real-time visual feedback, including execution animations, computation result panels, action logs, and dynamically updated health bars, enabling learners to clearly observe the execution process and outcomes of program logic. The core mechanics emphasized fundamental programming concepts: action cards required variable cards to execute (representing parameter passing), loop cards embodied iteration logic, and conditional cards demonstrated conditional execution. Through card combination and sequencing, learners were required to strategically construct effective programs to defeat their opponents.

Two scaffolding systems were integrated into the game. The game instruction scaffolding provided comprehensive explanations of card types, turn procedures, and supplementary rules through an instruction button. The game hint scaffold was automatically triggered when learners encountered difficulties (e.g., failing to clear a level after a certain number of turns), presenting pop-up hints that offered improvement suggestions and strategic directions.

The participants consisted of 30 fourth-year students from a junior college in northern Taiwan. A one-group pretest–posttest design was adopted, and the intervention was conducted within a single instructional session lasting approximately 100 minutes. Participants first completed pretests on learning effectiveness and computational thinking self-efficacy. This was followed by a 10-minute game introduction. Participants then engaged in approximately 60 minutes of gameplay at their own pace to challenge the five levels. The game system automatically recorded all interaction data, including the number of turns used, number of retries, time spent on each level, and win–loss outcomes. After gameplay, participants completed posttests on

learning effectiveness and computational thinking self-efficacy, as well as post-only questionnaires measuring flow state, cognitive load, scaffolding usage, and game user experience. Posttests and questionnaires required approximately 20 minutes to complete.

Paired-sample t-tests were conducted to examine pretest–posttest changes in learning effectiveness and self-efficacy. One-sample t-tests (test value = 3.0) were used to assess whether flow state, cognitive load, perceived scaffolding, and game user experience were significantly higher than the midpoint.

Results and Discussions

According to the paired-sample t-test results (Table 1), no statistically significant difference was found in learning effectiveness between the pre-test and post-test (pre-test: M = 10.43, SD = 1.91; post-test: M = 10.87, SD = 1.96; $t = 1.09$, p > .05, Cohen's d = 0.20). This result may be attributable to the limited duration of the single-session intervention, the difficulty progression of the test items, or participants' prior knowledge. However, the computational thinking self-efficacy scale showed a significant improvement (Table 2). The post-test score (M = 3.89, SD = 0.91) was significantly higher than the pre-test score (M = 3.58, SD = 0.97), $t = 2.56$, $p < .05$, Cohen's d = 0.47. This finding indicates that the game-based intervention effectively enhanced learners' confidence in their computational thinking abilities, likely through successful task completion experiences within the game environment.

Table 1
Paired-Sample t-Test Results for Learning Effectiveness (N = 30)

	Pre-test M	**Pre-test SD**	**Post-test M**	**Post-test SD**	***t***	***Cohen's d***
Learning Effectiveness	10.43	1.91	10.87	1.96	1.09	0.20

Table 2
Paired-Sample t-Test Results for Self-Efficacy (N = 30)

	Pre-test M	**Pre-test SD**	**Post-test M**	**Post-test SD**	***t***	***Cohen's d***
Self-Efficacy	3.58	0.97	3.89	0.91	2.56*	0.47

Note. *$p < 0.05$

The one-sample t-test results (Table 3) indicated that participants' overall flow state (M = 3.85, SD = 0.86) was significantly higher than the midpoint value ($t = 5.46$, $p < .001$). Further examination of individual flow state dimensions revealed that, within the flow antecedents category, clear goals (M = 3.95, SD = 0.97, $t = 5.38$, $p < .001$) and unambiguous feedback (M = 3.95, SD = 1.00, $t = 5.19$, $p < .001$) both reached significant levels, suggesting that the game design successfully provided explicit task objectives and immediate feedback mechanisms. In addition, challenge–skill balance (M = 3.85, SD = 0.93, $t = 5.03$, $p < .001$) and sense of control (M = 3.98, SD = 1.09, $t = 4.96$, $p < .001$) were also significant, indicating that the difficulty design enabled learners to perceive an appropriate level of challenge while maintaining control over their actions.

Regarding the flow experience dimensions, concentration on the task (M = 3.86, SD = 0.86, t = 5.47, p < .001) and autotelic experience (M = 4.08, SD = 1.03, t = 5.69, p < .001) were particularly prominent, demonstrating that learners were highly focused on the game tasks and experienced strong intrinsic motivation. In addition, transformation of time (M = 3.50, SD = 1.12, t = 2.44, p < .05) and loss of self-consciousness (M = 3.53, SD = 1.24, t = 2.36, p < .05) also reached significant levels. Overall, the flow experience results indicate that the game successfully created an immersive learning experience.

Table 3

One-Sample t-Test Results for Flow State (N = 30)

Dimension	M	SD	*t*	*Cohen's d*
Overall Flow State	3.85	0.86	5.46***	0.99
Flow Antecedents	3.85	0.93	5.03***	0.91
Challenge-Skill Balance	3.95	0.97	5.38***	0.98
Clear Goals	3.95	1.00	5.19***	0.95
Unambiguous Feedback	3.98	1.09	4.96***	0.91
Sense of Control	3.87	1.07	4.42***	0.81
Action-Awareness Merging	3.50	1.12	2.44*	0.45
Flow Experience	3.86	0.86	5.47***	0.99
Concentration on the Task	3.91	1.04	4.79***	0.87
Transformation of Time	3.53	1.24	2.36*	0.43
Autotelic Experience	4.08	1.03	5.69***	1.03
Loss of Self-Consciousness	3.63	0.98	3.53**	0.65

Note. *p < 0.05, **p < 0.01, ***p < 0.001, Test value = 3

The cognitive load analysis (Table 4) revealed an ideal pattern of cognitive load allocation. Although overall cognitive load (M = 3.38, SD = 0.74) was slightly higher than the midpoint (t = 2.83, p < .01, Cohen's d = 0.52), intrinsic cognitive load (M = 3.22, SD = 1.03) was close to the midpoint and did not reach statistical significance, suggesting that the inherent complexity of computational thinking concepts was at an appropriate level for learners. Importantly, extraneous cognitive load was significantly lower than the midpoint (M = 2.39, SD = 1.44, t = −2.32, p < .05), indicating that the card-battle mechanism effectively reduced cognitive demands unrelated to learning goals. Learners did not need to expend cognitive resources on complex spatial navigation or interface manipulation.

More notably, germane cognitive load was significantly higher than the midpoint (M = 4.25, SD = 0.80, t = 8.57, p < .001), suggesting that learners actively engaged in meaningful cognitive processing, including schema construction, integration of prior and new knowledge, and the development of automated procedural knowledge. This pattern of "low extraneous load and high germane load" represents the ideal state of effective instructional design and aligns with the core principles of cognitive load theory, which emphasize maximizing learning-related cognitive resources while minimizing irrelevant cognitive interference.

Table 4
One-Sample t-Test Results for Cognitive Load (N = 30)

Dimension	M	SD	*t*	*Cohen's d*
Overall Cognitive Load	3.38	0.74	2.83**	0.52
Intrinsic Cognitive Load	3.22	1.03	1.18	0.22
Extraneous Cognitive Load	2.39	1.44	−2.32*	−0.42
Germane Cognitive Load	4.25	0.80	8.57***	1.57

Note. *$p < 0.05$, **$p < 0.01$, ***$p < 0.001$, Test value = 3

Among the 30 participants, 24 learners (80%) used the game instruction scaffolding, 25 learners (83.3%) used the game hint scaffolding, and 22 learners (73.3%) used both types of scaffolding. The one-sample t-test results (Table 5) showed that participants' overall evaluation of scaffolding (M = 4.04, SD = 0.94) was significantly higher than the midpoint ($t = 5.21$, $p < .001$). Both the game instruction scaffolding (M = 3.98, SD = 0.99, $t = 4.67$, $p < .001$) and the game hint scaffolding (M = 4.09, SD = 1.03, $t = 5.51$, $p < .001$) received highly positive evaluations. These findings indicate that the scaffolding system effectively supported learners' understanding of game rules and problem-solving strategies. The high usage rates and positive perceptions suggest that learners regarded scaffolding as a valuable support tool that respected learner autonomy while providing necessary cognitive assistance.

Table 5
One-Sample t-Test Results for Scaffolding Usage

Dimension	M	SD	*t*	*Cohen's d*
Overall Scaffolding (N = 22)	4.04	0.94	5.21***	1.11
Game Instruction Scaffolding	3.98	0.99	4.67***	0.95
(N =2 4)	4.09	1.03	5.51***	1.10
Game Hint Scaffolding (N = 25)				

Note. ***$p < 0.001$, Test value = 3

The overall evaluation of game user experience (Table 6) was significantly higher than the midpoint (M = 4.18, SD = 0.74, $t = 8.69$, $p < .001$). Within the game feedback dimension, usefulness demonstrated the strongest performance (M = 4.31, SD = 0.74, $t = 9.62$, $p < .001$), indicating that learners highly recognized the game's contribution to computational thinking learning. Ease of use was also significant (M = 4.04, SD = 0.86, $t = 6.68$, $p < .001$), reflecting the user-friendly interface design and smooth operational flow state.

Within the game elements dimension, sense of control (M = 4.17, SD = 1.05, $t = 6.07$, $p < .001$), uncertainty (M = 4.10, SD = 0.92, $t = 6.53$, $p < .001$), and sense of achievement (M = 4.17, SD = 0.89, $t = 7.17$, $p < .001$) all reached significant levels. These results indicate that the game successfully integrated key gamification elements, allowing learners to experience challenge while maintaining control and to gain a sense of achievement through successful level completion, thereby sustaining learning motivation and engagement. The highly positive user experience evaluations further validate the quality and educational value of the game design integrating scaffolding and card-battle mechanisms.

Table 6
One-Sample t-Test Results for Game Experience Feedback (N = 30)

Dimension	M	SD	*t*	*Cohen's d*
Overall User Experience	4.18	0.74	8.69***	1.59
Game Feedback	4.20	0.72	9.10***	1.66
Usefulness	4.31	0.74	9.62***	1.76
Ease of Use	4.04	0.86	6.68***	1.22
Game Elements	4.15	0.85	7.41***	1.35
Sense of Control	4.17	1.05	6.07***	1.11
Uncertainty	4.1	0.92	6.53***	1.19
Sense of Achievement	4.17	0.89	7.17***	1.31

Note. ***$p < 0.001$, Test value = 3

Overall, the findings demonstrate that the card-battle-based educational game developed in this study achieved multifaceted outcomes. Although learning achievement did not show a statistically significant improvement, the significant increase in self-efficacy suggests that the game effectively enhanced learners' confidence, which is consistent with prior research indicating that game-based learning can improve learners' self-efficacy (Barz et al., 2024). The high evaluations of flow state and user experience reflect the game's ability to create an immersive learning environment (Lin & Hou, 2023). Furthermore, the ideal cognitive load pattern of low extraneous cognitive load and high germane cognitive load confirms that the card-based mechanism successfully reduced irrelevant cognitive demands and enabled learners to allocate cognitive resources toward understanding and applying computational thinking concepts. This finding echoes Chang and Yang's (2023) assertion that digital game-based learning can effectively regulate cognitive load. The high usage rates and positive evaluations of the scaffolding system further support the effectiveness of the dual-scaffolding framework (Hou & Keng, 2021). Collectively, these findings indicate that a gamified design integrating scaffolding and card-battle mechanisms holds strong potential for promoting computational thinking learning, enhancing learning motivation and self-efficacy, and optimizing cognitive resource allocation.

Conclusions and Limitations

This study developed an educational game that integrates scaffolding and a card-battle mechanism to enhance learners' computational thinking abilities and learning motivation. To successfully complete the challenge tasks in each level, participants were required to select appropriate card combinations based on computational logic concepts and to execute serialized program instructions to attack opponents and achieve victory. Through real-time visual feedback, learners were able to observe program execution processes, utilize scaffolding systems to understand game rules and problem-solving strategies, and deepen their understanding of computational thinking concepts through iterative trial and error. This process enabled learners to make effective strategic decisions, enhanced their flow state, and avoided excessive cognitive load during gameplay, thereby strengthening their mastery of programming logic and computational thinking.

Despite these contributions, several limitations should be acknowledged. First, the study employed a one-group pretest–posttest design without a control group, which limits causal

inference. Changes in learning effectiveness and self-efficacy may have been influenced by factors other than the game-based intervention. Second, the intervention duration was limited to a single session with approximately 60 minutes of gameplay. This relatively short exposure may have constrained the magnitude of learning effectiveness gains and prevented the assessment of long-term effects. Third, the current game levels primarily covered basic computational concepts, such as variables, conditions, and loops, and did not address more advanced computational thinking skills, such as functions.

Future research may extend this work in several directions. First, experimental designs incorporating both experimental and control groups could be adopted to compare the learning effectiveness of the card-battle game with traditional instruction or other gamified approaches, thereby enhancing internal validity and establishing causal relationships. Second, intervention duration could be extended across multiple sessions or several weeks to examine long-term learning effects and knowledge transfer. Third, additional levels covering advanced computational thinking concepts could be developed, along with adaptive difficulty adjustment mechanisms, to better accommodate learners with diverse skill levels. Through these research extensions, the educational value of integrating scaffolding and card-battle mechanisms in computational thinking education can be further validated and optimized.

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Student Perceptions of a Good Teacher: A Comparative Study of Finland and Singapore

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Abstract

While teaching quality is often treated as a universal construct, student perspectives reveal nuanced and context-specific understandings shaped by national, cultural, and demographic factors. Recognising these differences is essential for aligning pedagogical practices with learner expectations. In this study, we examined students' perceptions of good teaching in Finland and Singapore and conducted a qualitative comparative analysis of 80 open-ended essays written by 16-year-old students: 40 from students in the Integrated Programme at a Singapore junior college and 40 from one Finnish secondary school. Through thematic analysis, we identified recurring traits and values that students associate with good teaching. Analysis of the Singaporean data indicated that sincerity, passion and enthusiasm emerged as the top trait students seek in a good teacher (n = 16). Finnish students emphasised a teacher's compassionate kind and cheerful attitude (n = 34), and attentiveness to student voices and opinions (n = 12). The findings revealed contrasting cultural orientations in how students perceive effective teaching. Singaporean students tended to highlight traits that reflect care, dedication and competence, suggesting a view of the teacher as a committed and nurturing professional. Finnish students, however, emphasised interpersonal dynamics and emotional presence, pointing to a more egalitarian and relational understanding of the teacher's role. The findings challenge universalist assumptions about teaching excellence and underscore how educational values and societal norms shape students' expectations of pedagogical excellence. By foregrounding student perspectives, this research contributes to a more inclusive and context-sensitive understanding of quality teaching.

Keywords: good teaching, cross-cultural analysis, student perceptions

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Introduction

The question “What makes a teacher a good teacher?” is deceptively simple yet central to educational research. A substantial body of evidence demonstrates that teacher quality is one of the most influential school-based factors shaping students’ learning trajectories. Effective teachers contribute not only to students’ immediate engagement, achievement, and classroom experiences, but also to long-term outcomes such as educational attainment and labour-market success (Chetty et al., 2014; Kane & Staiger, 2012; Rivkin et al., 2005). These are all good reasons that justify the need to investigate what makes a good teacher so that teacher preparation programs can develop more effective practitioners.

Despite this recognised importance, what constitutes “good teaching” remains contested and highly subjective, varying significantly depending on who is judging. Given the students' position as primary stakeholders and direct recipients of pedagogical practices, their perspectives on teaching quality warrant scholarly attention. For effective teaching and learning to take place, academic literature offers insights into why students' perspectives on what makes a good teacher are most critical. Vermunt and Verloop (1999) have explored extensively and also highlighted the importance of congruence as opposed to friction between learning and teaching, with the former leading to effective learning. Considering how subjective the research focus of this study is, it is, thus, crucial that there is congruence in the perception of what makes a good teacher in every classroom.

On the same note, the empirical findings in Lindberg et al. (2013) demonstrate that perceived teacher-student congruence has positive effects on student satisfaction, where the alignment of students' preferences and teacher behaviour essentially contributes to the much sought-after joy of learning and interest in the subject. Smit et al. (2014) also found that students tend to thrive in more student-centred classrooms, feeling more autonomous, capable, motivated and less absent, which again highlights the importance of teachers aligning their perceptions of education to that of students. Notably, recent empirical evidence has suggested that alignment in the perceptions of teachers and students plays a crucial role in promoting effective learning, where the congruent perceptions of education lead to optimal learning (Könings et al., 2014). This underscores the importance of this research: it is paramount for educators understand the students' perspective of what makes a good teacher so as to align teacher behavior to become a good teacher in the eyes of their students to optimise learning outcomes.

However, it is also important to note that in the oft-cited papers by Hofstede (1986, 2001) it is shown that different cultures of different countries would have an effect on teaching and learning and, in turn, this would mean that cultures would differently impact students' perception on what makes a good teacher. Cultures vary across several key dimensions identified by Hofstede (1986, 2001): power distance (acceptance of hierarchy), individualism-collectivism (societal integration), uncertainty avoidance (tolerance for ambiguity), masculinity-femininity (achievement versus cooperation), and long-term orientation (temporal focus on future versus present). Different scores on these dimensions have profound implications on the teacher and student interactions and relationships.

Understanding cultural influences on educational perceptions is further justified by Biesta's (2009) framework which highlighted that one of the three main purposes of education is socialisation. With different cultures, the way of socialisation would differ, underscoring the importance of investigating how cultural differences affects varying education systems so that

students' varying perceptions of what makes a good teacher can be justified in context and better understood.

This study investigates the perceptions of what a good teacher is among Singaporean and Finnish students. Also, we are analysing cultural similarities and differences between two of the world's most renowned educational systems, which have consistently produced top-tier student outcomes despite their distinct educational systems. Our research question is: What are students' perceptions of good teaching in Singapore and Finland?

This paper aims to use Finland and Singapore as the two countries for comparisons simply because both countries are renowned for their top-tier education systems and yet, have vastly different approaches to education, and each system is inherently rooted in different cultures with different educational philosophies, contexts and societal values (Al-Thani, 2024). Singapore scored the highest PISA (Program for International Student Assessment) in 2022, ranking 1st in mathematics, science, and reading, while Finland ranked 5th, 3rd, and 4th, respectively, among OECD countries (OECD, 2023).

Singapore's education system follows a meritocratic approach and as such, there is great emphasis on academic rigor and achievement (Chong, 2014). With meritocracy as one of the key principles of governance, students' efforts and abilities, regardless of their socio-economic backgrounds are measured mainly by their grades in national examinations, which would go on to affect and determine their future career prospects and social mobility (Deng & Gopinathan, 2016). Singapore's Ministry of Education has also made it clear that their students' are to be equipped with 21st Century competencies to help students succeed in the unpredictable and everchanging world of the future (Ministry of Education, Singapore, n.d.).

The Finnish education system, on the other hand, is largely flexible, giving the teachers the trust and freedom to adjust their curriculum and pedagogical styles based on the needs of their students without standardised tests and instead emphasises on a work-life balance for both teachers and students with shorter school days and longer holidays (Al-Thani, 2024; Sahlberg, 2015). The Finnish system prioritizes equity, student well-being, and intrinsic motivation, reflecting broader societal values of egalitarianism and trust (Sahlberg, 2015). The Finnish comprehensive school system, which educates all students together until age 16 without academic tracking or streaming, institutionally embodies egalitarian values (Sahlberg, 2015). This structural feature contrasts sharply with Singapore's early streaming based on PSLE scores, creating fundamentally different educational experiences that may shape student expectations of teacher-student relationships.

Literature Review

Research reveals preferred teacher traits that transcend age and context. Tang (2025) analysed more than 75 papers investigating what constitutes a good teacher across educational levels and identified common characteristics including desirable personality, interpersonal skills, and clear instructional methods. Kutnick and Jules (1993) similarly found that across age groups, students value teachers' caring disposition, clear teaching style, and trustworthiness. Similarly in Estonia, friendly and caring are the top two personality traits students perceived in a good teacher and also in terms of pedagogical competence, they feel that teachers should be engaging and interactive while being able to be clear in their teaching as well (Läänemets et al., 2012). Overall, there are clear overlaps in students' perceptions across the board that point to a clear ideal on what students' think a good teacher should be like - to be caring and clear.

While these characteristics remain important, secondary school students place particular emphasis on relational and interpersonal dimensions of teaching. Beishuizen et al. (2001) found that secondary school students emphasised personality and interpersonal qualities. This relational emphasis amongst secondary students appears across cultural contexts. Studies in Rwanda revealed students viewing teacher-student relationships as highly important, along with holistic learning that involves inculcating positive values and teaching both cognitively and affectively (Carter et al., 2023). Similarly, Kurdish high school students identified four key determiners of effective teaching: technical and pedagogical knowledge, interpersonal skills, and good personality (Alzeebaree & Zebari, 2021). Secondary school students in Trinidad and Tobago valued teachers who are properly trained, motivated, aware of and responsive to student needs, and dedicated to engaging and equipping them for the future (Kutnick & Jules, 1993), emphasising teacher attentiveness and responsiveness as key dimensions of the teacher-student relationship. A study in Hong Kong further indicated that students highly value friendly and caring relationships with teachers, favouring enthusiastic and humorous educators. Interestingly, contrary to traditional Chinese cultural expectations of teachers as moral exemplars, these students placed little emphasis on viewing teachers as role models (Chan, 2018). Similarly in Estonia, the aforementioned study also did mention calm, positive and humourous as amongst the top 5 characteristics (Läänemets et al., 2012). Across cultures, despite variations in specific valued traits, a clear consensus emerges: secondary school students place significant emphasis on relational qualities and value positive relationships with teachers.

Nevertheless, upon further examination, there exists differences between the particular relational traits between different cultures. The concept of “cultures of learning” (Cortazzi & Jin, 1996; Jin & Cortazzi, 2006) draws attention to how cultural communities hold different expectations, interpretations, values, and beliefs about teaching and learning. Applying the aforementioned Hofstede's (1986) cultural dimensions framework to education, the way power distance (acceptance of hierarchy), individualism-collectivism (societal integration), uncertainty avoidance (tolerance for ambiguity), masculinity-femininity (achievement versus cooperation) and long or short term orientation (choice of focus for people's efforts) can be seen to fundamentally shape teacher-student dynamics and educational expectations. In high power distance cultures, students typically expect teachers to serve as authority figures who initiate all communication and possess definitive knowledge, whereas in low power distance cultures, students expect more egalitarian relationships where questioning teachers and collaborative dialogue are encouraged (Hofstede, 1986). Similarly, collectivist cultures may emphasise teachers who maintain group harmony and show preferential treatment based on relationships, whilst individualist cultures prioritise equal treatment and individual achievement (Hofstede, 2001).

However, systematic comparative research examining how students in contrasting cultural contexts perceive effective teaching remains limited. Most existing research either examines single cultural contexts, as reviewed above, or focuses on teachers' practices and institutional characteristics rather than students' own conceptions of teaching quality. Moreover, multi-cultural comparisons that analyse differences in perceptions and discuss how culture affects such expectations are scarce. This gap is significant given that Vermunt and Verloop (1999) demonstrated that congruence between teaching approaches and student expectations promotes effective learning, whilst friction between them can be destructive.

Research explicitly linking cultural variations in teaching conceptions to Hofstede's dimensions remains limited. Gudmundsdottir and Saabar (1991) describe how conceptions differ across

cultures: Chinese teachers as virtuosos treating all equally; American teachers as improvisers individualizing instruction; Norwegian teachers as egalitarian caregivers. Inan (2014) identifies Western-Eastern European differences in student perceptions, revealing culturally patterned preferences. However, these studies remain descriptive without examining how cultural dimensions shape perceptions.

Hence, considering Könings et al.'s (2014) findings that alignment between student and teacher perceptions is essential for promoting learning outcomes, the present research is essential for teacher professional development and policy implications, helping educators understand the importance of culture in shaping beliefs about what defines a good teacher. This study addresses this gap by comparing Singaporean and Finnish secondary students' perceptions of effective teaching and examining the degree of alignment with teachers' conceptions within each cultural context.

Singapore and Finland provide a compelling comparative case for examining these questions. Singapore's education system, characterised by high performance orientation and meritocratic values (Deng & Gopinathan, 2016), operates within a high power distance, collectivist cultural context. Skovholt and D'Rozario (2000) found that Singaporean student-teachers most valued caring, understanding, humor, and approachability—relational traits that may be more important than pedagogical competence in shaping perceptions of teacher quality.

Finland represents a contrasting paradigm: low power distance, high individualism, and egalitarian values (Sahlberg, 2015). Finnish education emphasizes teacher autonomy, trust, student-centred learning, and minimal testing. Direct research on Finnish students' perceptions of effective teaching is notably absent, creating a gap given the stark cultural contrasts with Singapore.

Good teaching in Finland is widely understood as a combination of strong pedagogical expertise, reflective professionalism, and a research-informed approach to classroom practice. Finnish teachers are expected to exercise considerable autonomy and to make informed decisions that support students' learning and wellbeing. This professional culture is reinforced by academically rigorous teacher education and a societal trust in teachers' competence. Research on Finnish teacher education also highlights the importance of teacher–student relationships and the ability to create supportive, learner-centred environments that promote both academic and socio-emotional development (Leite, 2018; Niemi & Lavonen, 2020).

From the perspective of a teacher–student interaction, studies show that effective teachers are those who build positive, respectful, and responsive relationships with their pupils (Leite, 2018; Mäkipää, 2021). Finnish teachers actively learn to improve their interactions with students, emphasising listening, emotional attunement, and the creation of a safe classroom climate.

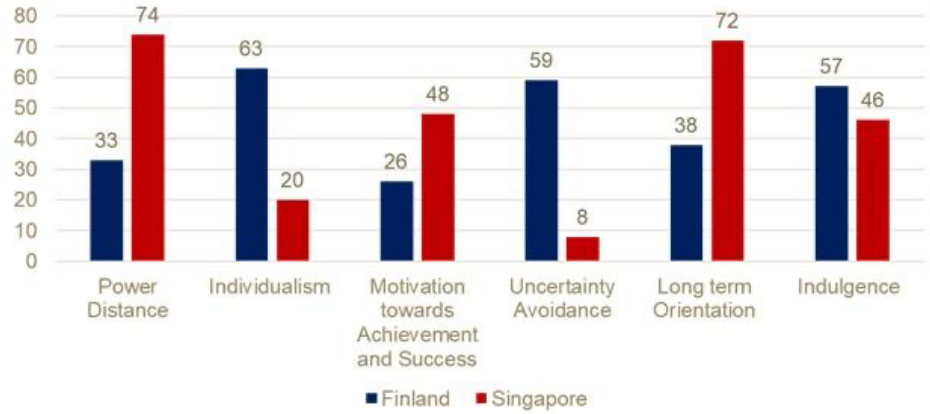
Mäkipää's study (2021) on upper-secondary students' experiences of assessment and feedback reveals that students value teachers who provide clear, fair, and constructive feedback, and who communicate expectations transparently. Students also emphasise the importance of teachers being approachable, supportive, and consistent in their interactions. Good teaching in Finland is not only defined by pedagogical skill and professional autonomy but also by the quality of everyday interactions that shape students' learning experiences.

Using Hofstede's Cultural dimensions as the theoretical framework for this paper, it is essential then to look specifically into the dimensions for each country. Figure 1 shows substantial

cultural differences between Singapore and Finland (Hofstede et al., 2010). Singapore scores higher on Power Distance (74 vs. 33), suggesting acceptance of hierarchical teacher-student relationships, while Finland prefers egalitarian dynamics. Singapore's higher Long-Term Orientation (72 vs. 38) emphasizes future rewards and deferred gratification versus Finland's present focus. Singapore's lower Individualism (20 vs. 63) reflects collectivist socialization prioritizing group harmony versus Finland's individualist autonomy. Singapore's higher achievement motivation (48 vs. 26) contrasts with Finland's cooperation values. These profiles frame how students perceive a good teacher.

Figure 1

Hofstede's Cultural Dimension Scores for Singapore and Finland (Hofstede et al., 2010)



Methodology

This study employed a comparative qualitative research design to investigate secondary school students' perceptions of what constitutes a good teacher in Singapore and Finland. The data consist of written responses from 40 secondary school students (aged 16) in Singapore and 40 secondary school students (aged 16) in Finland. Students were asked to describe what they associate with a "good teacher." The Singaporean data were collected in English, while the Finnish data were collected in Finnish and later translated by the second author into English for analysis. Participation was voluntary, and no identifying information was collected. Parents were informed about the research beforehand.

Data were gathered through classroom-based written prompts administered by teachers. This method was chosen to allow students to express their perceptions freely and anonymously, without the influence of interviewer presence or peer dynamics. The written format also ensured comparability across the two contexts.

The analysis followed Braun and Clarke's (2006) model, in which the process begins with familiarisation with the data, continues with systematic coding, and proceeds to the identification and refinement of broader themes. We began with a careful reading of all responses. Each response was then coded for the reasons students mentioned (e.g., maintains discipline, is cheerful, is friendly). After this initial coding, broader "umbrella themes" were identified under which several of the preliminary codes could be grouped.

Ethical principles guided all stages of the research. Participation was voluntary, and students were informed that their responses would be used anonymously for research purposes. No personal data were collected, and all responses were stored securely. The study adhered to

institutional ethical guidelines and respected the cultural and educational contexts in which the data were collected.

Findings

Tables 1 and 2 present the frequency of teacher characteristics identified by Finnish and Singaporean students respectively, organized into three categories: Relational & Interpersonal Qualities, Teaching Competencies, and Passion & Motivation.

As the instructions for the essay asked students to write about three traits that make teachers good teachers, the main idea of each body paragraph was extracted and the frequency for each trait was tabulated. Student responses varied considerably in their specific wording and level of detail, necessitating the grouping of semantically similar traits under broader umbrella terms.

Relational & Interpersonal Qualities encompassed codes related to how teachers interact with and treat students while teaching competencies captured codes related to pedagogical skills and subject knowledge. Similarly, Passion & Motivation included codes describing teachers' enthusiasm and commitment.

Finnish Students' Perceptions

Table 1 shows Finnish students most frequently valued compassion, kindness, and friendliness (n = 34), followed by listening to students' opinions (n = 12) and treating all equally (n = 11).

Table 1
Frequency of Teacher Traits Identified by Finnish Students

Umbrella terms	Traits	Frequency (n)
Relational and Interpersonal Skills	Compassionate, kind, cheerful, nice and friendly	34
Relational and Interpersonal Skills	Listens to students' opinions, cares about their ideas and thoughts	12
Relational and Interpersonal Skills	Treats all equally, does not have favourite students	11
Relational and Interpersonal Skills	Is not too strict, does not punish too easily	9
Relational and Interpersonal Skills	Does not give too much homework	9
Teaching competency	Communicates effectively, simplifies concepts, makes everyone understand	8
Relational and Interpersonal Skills	Patience	7
Relational and Interpersonal Skills	Empathy, EQ, understands and relates well	6

Teaching competency	Responsible, knows content well, knowledgeable, expertise, qualified, wise	6
Teaching competency	Uses various teaching techniques	6
Passion and Motivation	Sincerity, enthusiasm and passion	4
Relational and Interpersonal Skills	Gives breaks, gives in to students, sensitive to expectations	4
Teaching competency	Firm and strict, good classroom management skills	4
Relational and Interpersonal Skills	Does not humiliate or embarrass students	2

Singaporean Students' Perceptions

Table 2 shows Singaporean students most frequently cited passion and enthusiasm (n = 16), followed by caring (n = 12) and patience (n = 9).

Table 2
Frequency of Teacher Traits Identified by Singaporean Students

Umbrella terms	**Traits**	**Frequency (n)**
Passion and Motivation	Sincerity, enthusiasm and passion	16
Relational and Interpersonal Skills	Caring, giving moral support	12
Relational and Interpersonal Skills	Patience	9
Relational and Interpersonal Skills	Empathy, EQ, understands and relates well	8
Teaching competency	Engaging, communicates effectively	8
Teaching competency	Responsible, knows content well, knowledgeable, expertise, qualified, wise	7
Teaching competency	Communicates effectively, simplifies concepts	7
Relational and Interpersonal Skills	Compassionate, kind, cheerful, nice and friendly	6
Passion and Motivation	Love for learning, inspirational, motivates	4
Relational and Interpersonal Skills	Looks out for safety, emotional well-being, good observational skills	4
Relational and Interpersonal Skills	Extra guidance, support, caters to students, willing to help, mentor	4
Relational and Interpersonal Skills	Gives breaks, gives in to students, sensitive to expectations, listening	5

Relational and Interpersonal Skills	Mutual respect	4
Relational and Interpersonal Skills	Fair	4
Teaching competency	Firm and strict, good classroom management skills	4
Relational and Interpersonal Skills	Good role model	3
Teaching competency	Efficient - saves time	3
Teaching competency	Beyond textbook, current affairs	3
Teaching competency	Adapts to changing times	2
Passion and Motivation	Dedicated	1
Relational and Interpersonal Skills	Humility	1
Teaching competency	Instils creativity	1

Tables 3 and 4 provide representative quotes for each umbrella category (2-3 quotes per most frequently cited trait). Examples show how semantically similar responses were grouped despite diverse expression.

Table 3

Quotes From Students' Essays (Finland)

Umbrella Terms	Trait	Quotes from Essays
Relational and Interpersonal Skills	Compassionate, kind, cheerful, nice and friendly (n = 34)	*"Is nice for the pupils in the lessons, and helps when someone needs help."* *"A good teacher is kind, calm, and takes care of the pupils."*
Teaching Competency	Communicates effectively, simplifies concepts, makes everyone understand (n = 8)	*"A good teacher is one who understands the pupil's problems and challenges. They teach carefully and in a way that EVERYONE understands."* *"She goes through the topic many times and explains things in several different ways so that everyone will learn it."*
Passion and motivation	Sincerity, enthusiasm and passion (n = 4)	*"Knows how to have fun with the students"* *"Is enthusiastic and inspiring,"* *"clearly enjoys their work and being with the students."*

Table 4
Quotes From Students' Essays (Singapore)

Umbrella Terms	Trait	Quotes from Essays
Relational and Interpersonal Skills	Caring and giving moral support (n = 12)	*"...rather treat them with a motherly/fatherly attitude, loving and caring for them, just as a parent would"* *"A caring teacher builds trust with their students and ensures that everyone has someone to turn to whenever they feel hopeless."* *"A student can only learn well when they feel emotionally supported."*
Teaching Competency	Engaging and Communicates Effectively (n = 12)	*"A good teacher breaks down complex ideas into simple parts or even utilise fun and engaging methods to capture the students' interest in order to make understanding easier."* *"The lessons will include more activities, more demonstrations which are engaging"* *"Every student has a preferred learning style, and being able to communicate ideas to all effectively can be challenging. In my opinion, a good teacher encourages and supports all their students to take advantage of their learning style…"*
Passion and Motivation	Sincerity, Enthusiasm and Passion (n = 16)	*"...having genuine passion…"* *"Passion can drive one to be better"* *"When teachers demonstrate genuine care and enthusiasm, it signals to students that learning is meaningful and worth their effort."*

After categorising them into broader umbrella terms, Figure 3 indicates how Finnish students overwhelmingly emphasise the importance of interpersonal and relational skills (78.6%), with teaching competencies taking a distant second, and with passion and motivation taking only a small fraction of the chart (3.1%).

Figure 3
Distribution of Teacher Trait Umbrella Categories Identified by Finnish Students

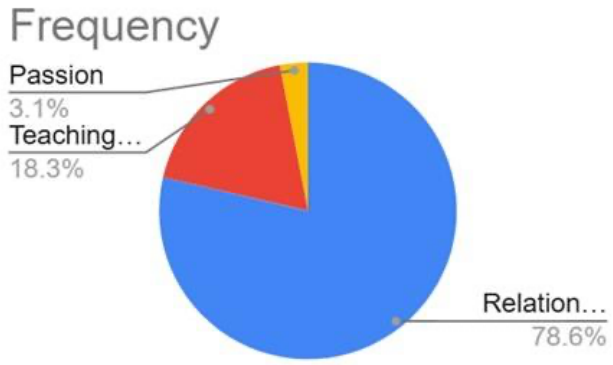


Figure 4
Distribution of Teacher Trait Umbrella Categories Identified by Singaporean Students

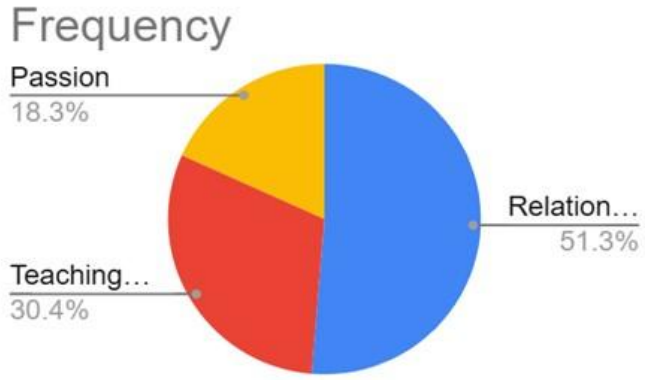


Figure 4 indicates that Singaporean students tend to focus on the relational and interpersonal skills the most (51.3%), followed by teaching competency and lastly, how passionate and motivated their teachers are (16.3%).

Three key patterns emerge from this comparison. First, while both groups prioritise relational qualities, Singaporean students also emphasise teaching competency substantially more than Finnish students (32.5% vs 18.5%). Second, Singaporean students uniquely identify passion and motivation as a defining teacher characteristic (16.3% of responses), while Finnish students rarely mention it (3.1%). Third, the specific relational and competency traits valued differ qualitatively between contexts in ways that appear culturally patterned. The following discussion examines these patterns through Hofstede's cultural dimensions framework.

Discussion

One notable similarity between the Finnish and Singaporean datasets is that the majority of characteristics identified by students in both contexts fall within the domain of interpersonal and relational qualities. These qualities not only emerged as the most frequently cited category but also constituted the largest proportion of responses in both countries (78.6% in Finland; 51.3% in Singapore). This pattern appears to be broadly consistent with existing literature, which suggests that secondary school students across diverse cultural contexts tend to place considerable importance on their interpersonal relationships with teachers (Alzeebaree &

Zebari, 2021; Artola Bonanno et al., 2024; Beishuizen et al., 2001; Carter et al., 2023; Chan, 2018).

Beyond the broad category-level similarity, specific traits also converged across contexts. Both groups valued patience (Finland n = 7; Singapore n = 9), empathy and understanding (Finland n = 6; Singapore n = 8), and effective communication (Finland n = 8; Singapore n = 8). These convergences suggest that certain teacher qualities, particularly those related to emotional attunement and pedagogical clarity, transcend cultural boundaries. This pattern aligns with Tang's (2025) meta-analysis, identifying caring disposition and clear teaching as universally valued characteristics across educational levels and contexts.

This cross-cultural convergence on relational qualities establishes what might be considered a pan-cultural baseline for effective teaching: students across contexts fundamentally value teachers who demonstrate care, patience, and clear communication. However, the relative emphasis on these qualities (78.6% vs 51.3%) and their specific manifestations differ substantially between contexts. While Finnish and Singaporean students share a foundational preference for caring teachers, the following analysis reveals that cultural values shape how caring is defined, demonstrated, and prioritised relative to other teacher characteristics.

Differences

Nature of Relational Qualities (Hierarchical vs Egalitarian Care)

Although both groups prioritised relational qualities, the nature of valued relationships differed in culturally patterned ways. Finnish students emphasised traits reflecting egalitarian, low-stress classroom environments, which aligns with Hofstede's (1986) prediction that low power distance cultures (Finland, PDI = 33) favour approachable, facilitative teachers who encourage student voice and dialogue. In such contexts, teachers may be perceived as facilitating dialogue for students to express their thoughts and ideas, rather than adopting a predominantly authoritative role in which emphasis is placed primarily on the teacher's voice over that of the students. The findings of this study support previous research from Artola Bonanno et al. (2024) that has shown that while cross-cultural research confirms that positive teacher qualities (caring, compassionate, patient) are universally valued across educational contexts, such universal constructs manifest differently across cultures, suggesting the need to examine how caring is defined rather than simply noting its presence. Finnish students' emphasis on teachers listening to their opinions and not having favorites may reflect the European pattern identified by Artola Bonanno et al. (2024), where teacher-student relationship measures uniquely assess whether teachers “see students as individuals” is similar to the students' perception on how a good teacher would be listening to students' opinions, caring about their ideas and thoughts (n = 12) and treats all equally (n = 11). This is also in line with Välimaa (2021) which details how strong egalitarian attitudes that place much weight on equality and equity are core to the Finnish culture.

Moreover, these preferences can also be understood through the broader egalitarian ethos that characterizes Finnish society, which places a strong normative emphasis on minimizing hierarchical differences, promoting mutual respect, and ensuring that all individuals are treated with equal dignity. In educational settings, teachers would interact with students as relatively equal partners in communication, avoid overt displays of authority, and distribute attention and support fairly. In Finnish classrooms, this low power distance manifests in practices such as students addressing teachers by first names and collaborative decision-making about classroom

rules. Such norms explain why Finnish students in this study valued teachers who listen, avoid favoritism, and maintain a relaxed, non-hierarchical classroom climate (Välimaa, 2021).

Singaporean students, conversely, conceptualised teachers as authoritative figures who provide care and guidance, with teachers valued as role models (n = 3), which is a trait absent from Finnish responses. This reflects high power distance expectations (Singapore, PDI = 74) where care and authority coexist: teachers occupy positions of higher standing precisely because they are central pillars of support and bear responsibility for students' well-being and academic progress and provide care, guidance, and emotional or academic support when needed, aligning with paternalistic leadership styles in high PDI cultures (Hofstede, 1986; Polatcan et al., 2025; Qian & Walker, 2021). Notably, few Singaporean students mentioned teachers listening to them (n = 5), suggesting student voice is less emphasized than in Finland.

All in all, this pattern from the collected data indicates that while both groups value caring teachers, Finnish students seek reciprocal, horizontal relationships whilst Singaporean students expect hierarchical care emanating from authority. This suggests variation in how students in the two contexts perceive the relational role of teachers within the classroom despite both placing much importance on relational and interpersonal qualities in teachers they deem good.

Teaching Competency Emphasis (Future-Oriented vs Present-Focused)

There appears to be a stronger emphasis on teaching competency among Singaporean students compared to their Finnish counterparts. This finding seems to align with broader understandings of the educational cultures of the two systems. Given the prominence of meritocracy within the Singaporean education system, it may be unsurprising that students place value on teachers' instructional effectiveness, pedagogical variety, classroom management, subject knowledge, and clarity of explanation (Chong, 2014). From the Finnish perspective, the relatively diminished emphasis on teaching competency may reflect the high degree of institutional trust characteristic of the Finnish education system, as documented in previous research (Al-Thani, 2024; Sahlberg, 2015; Välimaa, 2021). Within this context, teacher competence appears to be regarded as a foundational expectation rather than a differentiating factor that distinguishes exemplary educators from their peers.

Beyond the quantitative difference in emphasis on teaching competencies (Singapore 32.5% vs Finland 18.5%), the specific types of competencies valued differed qualitatively. Singaporean students uniquely emphasized future-oriented, adaptive competencies: going beyond textbooks to cover current affairs (n = 3), adapting to changing times (n = 2), instilling creativity (n = 1), and being efficient (n = 3). These traits, absent from Finnish responses, align with Singapore's high Long-Term Orientation (LTO = 72), which emphasises “deferred gratification of needs accepted” and “perseverance, sustained efforts toward results” (Hofstede, 2001, p. 367). This cultural orientation manifests in explicit educational policy: Singapore's Ministry of Education emphasizes equipping students with 21st-century competencies to navigate an “unpredictable and everchanging world of the future” (Ministry of Education, Singapore, n.d.; Tan et al., 2017). Teacher education is deliberately designed to prepare educators who can develop future-ready learners (Liu, 2024, p. 34). Students appear to internalize these culturally-embedded policy priorities, valuing teachers who demonstrate the forward-thinking adaptability their culture and education system explicitly promote.

Finnish students emphasized present mastery and established pedagogical competencies – communicating effectively (n = 8), using various teaching techniques (n = 6), and possessing

subject knowledge (n = 6) - without mentioning innovation or future-orientation. This pattern aligns with Finland's moderately lower Long-Term Orientation (LTO = 38), where “immediate gratification of needs expected” and “quick results expected” characterize cultural norms (Hofstede, 2001, p. 367). Students' preferences for reduced homework (n = 9), relaxed discipline (n = 9), and breaks (n = 4) further reflect this present-focused orientation, where current comfort and clarity take precedence over intensive future preparation. This cultural orientation aligns with Finland's education policy, which explicitly prioritizes student well-being and work-life balance (Sahlberg, 2015), creating reinforcement between cultural values and institutional practices.

Passion and Motivation

The most striking difference between the two countries' datasets is the difference in emphasis placed on passion and motivation. Singaporean students identified passion and enthusiasm as the single most important characteristic differentiating good from average teachers (n = 16, representing 16.3% of all mentions), with students explicitly linking teacher passion to heightened engagement, interest, and effort in making lessons engaging. Finnish students, by contrast, rarely mentioned passion (n = 4, 3.1% of mentions), suggesting it is relatively unimportant in their conceptions of good teacherhood. Student responses indicated that Singaporean students perceived passionate teachers as more likely to invest effort in making lessons engaging and interesting, suggesting that passion may be valued not only as an affective quality but also as one that indirectly enhances instructional effectiveness.

This pattern aligns with research demonstrating that motivational sources differ systematically between collectivist and individualist cultures. In collectivist societies like Singapore (IDV = 20), extrinsic motivational drivers, such as support from students' microsystems within the Bronfenbrenner's ecosystem, are stronger predictors of achievement than in individualist societies, where intrinsic motivation and one's passion predominate as motivational factors (Bronfenbrenner, 2000; Li et al., 2021). Furthermore, Iyengar and Lepper (1999) demonstrated that individualist children are more intrinsically motivated by personal choice, whereas collectivist children are more motivated by in-group sources of inspiration. Looking specifically to cultures similar to Singapore, empirical research in collectivist Asian contexts supports this interpretation. In China, teachers' enthusiasm and passion are crucial in predicting students' sense of belonging in school, which in turn is a factor that highly affects their academic achievements (Anderman, 2003; Chen et al., 2024; Xue, 2024). This suggests that in collectivist Confucian Heritage Culture societies like Singapore, teacher passion functions as a collective motivational force that strengthens teacher-student bonds whilst inspiring group-oriented achievement.

Conversely, Finnish students' minimal emphasis on passion (n = 4) and overwhelming preference for teachers who are kind, cheerful, and friendly (n = 34) reflects both individualist reliance on intrinsic motivation (IDV = 63) and feminine cultural values (MAS = 26) that prioritize modesty, calm support, and egalitarianism (Hofstede, 2001). It is nevertheless noteworthy that studies conducted among Finnish teachers indicate that the primary reason for entering the teaching profession in Finland is precisely a sense of passion and an intrinsic calling for the work (Virtanen et al., 2025).

Limitations and Future Research

This study has a few limitations. First, data were collected from only one school per country (40 students from each), limiting generalizability. While Finnish schools are generally characterized as largely homogeneous due to comprehensive schooling policies that avoid early tracking (Sahlberg, 2015), Singaporean secondary schools differ in academic level as students are enrolled based on their scores on the national standardized test, the PSLE (Primary School Leaving Examination). The socio-economic backgrounds of students may also differ between schools. Although family background affects academic performance in both countries, the achievement gap between disadvantaged and privileged students is wider in Singapore than in Finland (Lim, 2018; OECD, 2018). These factors could influence school culture and students' perceptions of teaching and learning.

Second, this study interprets patterns through Hofstede's cultural dimensions framework, which characterizes national averages and may not apply uniformly to all individuals within a culture. Cultural dimensions provide useful interpretive lenses but cannot fully capture individual variation or rapidly evolving cultural values, particularly among younger generations. In Finland, for example, the cultural backgrounds represented among students are becoming increasingly diverse each year (Keski-Mäenpää et al., 2025), and this development is accompanied by a broadening of conceptions of what constitutes good teaching.

Future research should collect data from a variety of schools across different academic levels and socio-economic contexts. Future research should also test whether the patterns identified here generalise across broader samples of different cultures and employ qualitative interviews to explore how students themselves interpret and reason about the teacher qualities they value.

Conclusion

This paper clearly demonstrates that while there are baseline similarities across cultures, there are inherent differences in students' perceptions of what makes a good teacher, and much of these differences can be explained by cultural variation. Finnish students (PDI = 33, LTO = 38) emphasise egalitarian relationships, present comfort, and being heard, while Singaporean students (PDI = 74, LTO = 72) value passionate teachers who provide hierarchical care and future-oriented instruction. Hofstede's cultural dimensions framework (Hofstede et al., 2010) is a useful theoretical lens for comprehending these nuanced differences. This study extends the application of Hofstede's framework to student perceptions of teaching quality, demonstrating that Power Distance Index and Long-Term Orientation meaningfully predict what students value in teachers across different cultural contexts.

The implications of these results also point to the importance of aligning students' expectations with teacher practice. In Finland, where it is most important for students to feel heard, it is essential that national and school-level policies are structured to enable greater democracy in classrooms and schools, allowing students to have wider ownership and control of their own learning. In Singapore, where passion in teachers is most important to students, it is vital that national and school-wide policies are designed to prevent teacher burnout and the extinguishing of passion in teachers, but instead provide them space to cultivate and sustain their passion.

Declaration of Generative AI and AI-Assisted Technologies in the Writing Process

The author declares that Claude, AI-assisted writing software, was used in proofreading and refining the language used in the manuscript. The usage was limited to correcting grammatical and spelling errors and rephrasing statements for accuracy and clarity. The author further declares that, apart from Claude, no other AI or AI-assisted technologies have been used to generate content in writing the manuscript. The ideas, design, procedures, findings, analyses, and discussion are originally written and derived from careful and systematic conduct of the research.

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Design and Preliminary Evaluation of a Psychological Counseling Training Game Using Generative AI Virtual Characters Based on Situational Learning as a Case Study

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Abstract

Recommendations for teaching strategies in psychological counseling training suggest conducting repetitive and realistic training, which is relatively costly. Digital simulation and game-based learning are expected to provide highly motivating, iterative practice opportunities that are low-cost and unrestricted by time or location. This study employed our team's scenario-based Generative AI (GenAI) character technology module to design an educational game for training psychological counseling in bullying cases. Players assume the role of teachers who must interact with AI-generated bullied students within a time limit. The game objectives involve understanding the facts surrounding the bullying incident and implementing appropriate interventions. All 20 participants were active teachers in Taiwan. Findings indicate high levels of flow engagement and significant improvements in counseling self-efficacy. Participants reported high perceived usefulness and ease of use, expressing willingness to replay the game. Qualitative feedback revealed over half felt it enhanced counseling skills (50%) and provided realistic scenarios (50%). Preliminary findings indicate that this educational game enables low-cost, repeated practice of counseling essentials, making it suitable as a preparatory exercise before real-person case simulations. Future enhancements could include increased interactive sophistication and more learning feedback to improve training utility and realism.

Keywords: generative AI, game-based learning, psychological counseling training, school bullying, situated learning, self-efficacy

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Introduction

Bullying is a widespread problem in schools around the world (Burger et al., 2015). From a social ecological perspective, the social context in which bullying occurs is not solely defined by individual perpetrators or victims (Yoon, 2004), but also involves peers (such as bystanders, reinforcers, and defenders) and educators (Salmivalli, 2010). When bullying occurs in schools, immediate intervention by peers or educators can successfully halt the behavior (Veenstra et al., 2014). Victims often remain passive, leading to a sense of helplessness over time (Craig et al., 2007). Teachers can collaborate with victims to enhance and support their well-being by boosting their self-confidence (Field, 1999). Burger et al. (2022) research indicates that teacher interventions significantly influence students' adoption behaviors and bullying-related roles, aiding in the development of more precise subsequent intervention strategies. These findings hold important practical implications for future teacher training and the professional development of practicing educators.

Simulation-based instruction has become an indispensable component of modern teaching, providing a safe learning environment. While simulations cannot replace real-world experiences, they serve as a valuable supplement to traditional teaching methods. They enable students to make mistakes and learn from them within a controlled setting, thereby enhancing learners' skills and behaviors (Münch et al., 2025). Lim et al. (2025) research indicates that many teacher training programs still struggle to effectively bridge theoretical knowledge with practical application in real-world scenarios. Gen AI-enhanced character simulations offer heightened realism and immersion, with AI agents capable of more dynamic interactions. This facilitates learners' contextual understanding of problem-solving and boosts motivation for learning. Chien et al. (2024) noted that integrating generative AI as non-player characters (NPCs) into role-playing activities serves a scaffolding function, guiding learners toward reflection (Chien et al., 2024).

Carneiro & Backes (2023) demonstrated that gamified learning promotes interaction, immersion, and expression, thereby enhancing learning outcomes and skill development. Game elements evoke learners' engagement, motivation, and sense of accomplishment (Kapp, 2012). Furthermore, integrating narrative scenarios grounded in situated learning theory (Brown et al., 1989) with simulation games can boost learner motivation and intensify flow experiences (Chien et al., 2022).

Our research team has developed a ChatGPT-NPC scaffolding system for educational games (Chen & Hou, 2024). These scaffolding leverages RAG technology to integrate plugin modules such as character profiles, knowledge content text settings, similarity analysis, and off-topic diagnostic questioning. These enhance conversational authenticity while providing multiple real-time scaffolding instructional frameworks. This novel learning mechanism features GenAI portraying a bullying victim, with players assuming the role of teachers. Interactions occur via handwriting or voice input on mobile devices or computers, with the AI responding via text-based feedback. This mechanism fully records interactions for learners to review and reflect repeatedly. By engaging in scenario-based interactions with the "bullied student" constructed by generative AI, learners gain deeper insight into the context surrounding bullying incidents. They practice appropriate intervention and management strategies within simulated scenarios, thereby strengthening their professional judgment and response capabilities.

Methods

The objective of this game is to assist the story's protagonist, Kai (a 13-year-old GenAI character), in articulating the narrative context of his bullying experiences. Based on this understanding, players must identify appropriate counseling interventions and response strategies. Figure 1 displays the interface presented to learners on mobile and computer screens. Additionally, Figure 2 illustrates the interface shown during learners' dialogues with the GenAI character.

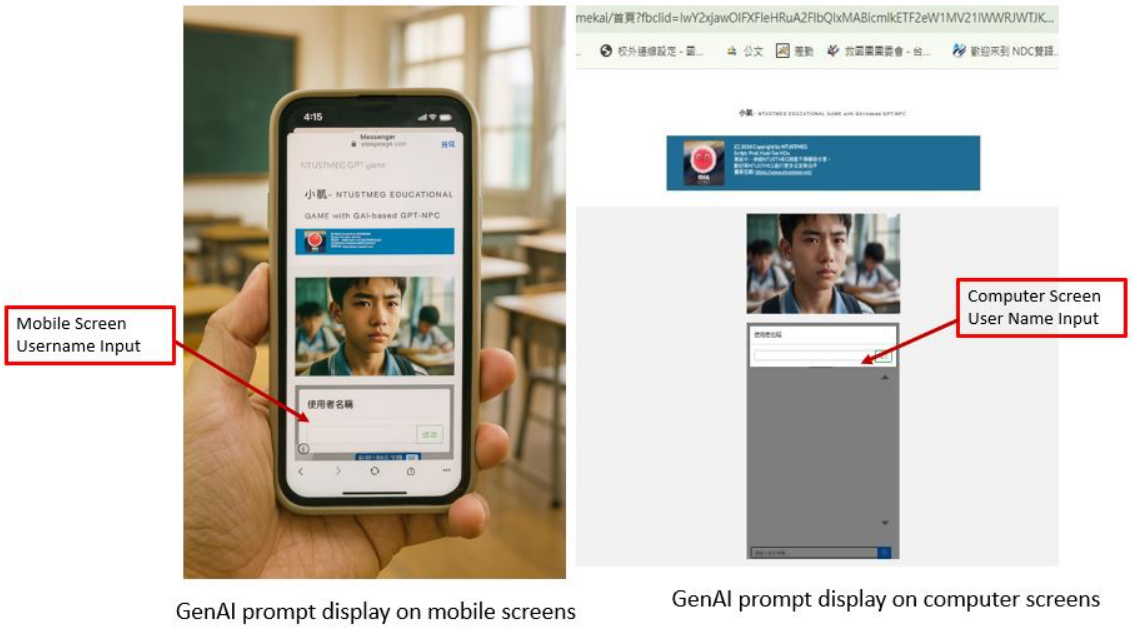
This study is a pilot investigation involving 20 practicing teachers in Taiwan. Participants ranged in age from 22 to 60 years old. Each individual used a mobile phone or computer, with the total experimental duration being 40 minutes: 10 minutes for story introduction, game rules, and digital platform orientation; 20 minutes for questionnaire completion; and 20 minutes for learner interaction with the GenAI character. The study examined self-efficacy, flow, perceived usefulness, usability, and game elements. The self-efficacy scale was adapted from the self-efficacy section of Pintrich (1991) “A manual for the use of the motivated strategies for learning questionnaire (MSLQ)” and modified to align with this study's context, yielding internal consistency (Cronbach's $\alpha = 0.952$). Flow experience was measured using Kill's (2006) Flow Scale, administered via the Chinese version translated by Hou and Li (2016) and modified to align with this study's terminology, with internal consistency (Cronbach's $\alpha = 0.941$). Game usefulness and usability were measured using a modified version of Davis' (1989) Technology Acceptance Model, with internal consistency (Cronbach's $\alpha = 0.923$). Game elements were assessed using Hou's (2016) scale, modified to align with this study's context, with high internal consistency (Cronbach's $\alpha = 0.843$). This study investigated the effects of flow, self-efficacy, game elements, and game usage feedback during learner interactions with the GenAI character. Additionally, an open-ended question was explored to gain deeper insights into identifying clues and developmental contexts related to the character (Kai) experiencing bullying within the scenario.

Figure 1

Screenshots of This Game on PC and Mobile Devices



Figure 2
Dialogue Between the Learner and the GenAI Character During Interaction in the Game



Results and Discussions

According to the single-sample Wilcoxon Singed-Rank analyses (e.g., Table 1 and Table 2), investigating participants' flow (M = 4.04, SD = 0.58), game acceptance (M = 4.22, SD = 0.49), game Usefulness (M = 4.37, SD = 0.43), game ease of use (M = 4.22, SD = 0.74), and game elements (M = 3.95, SD = 0.65), the means were significantly higher than the median of the scales (i.e., 3). It means that the game mechanism is easy to operate and readily accepted and enhances the learners' flow.

Additionally, learners mentioned postive feedbacks, such as: “It was quite a novel experience today,” “The game provided a very authentic situational feel during participation,” and “AI interactions, akin to operating a simulator, effectively enhance coaching skills and identify areas for improvement—a brilliant design.” Qualitative feedback indicates learners experienced novelty, authentic situational immersion, and enhanced learning outcomes through the game. Based on the above analysis, preliminary findings indicate that this generative AI mechanism effectively aids participants in developing counseling knowledge and skills while providing a realistic scenario experience throughout the engagement process.

Table 1
The Mean and Standard Deviation of Learners' Flow

(N = 20)				
	M	*SD*	*Z*	*Sig.*
Overall Flow	4.04	0.58	3.92***	< .000
Flow antecedents	4.08	0.60	3.81***	<. 000
Challenge-skill balance	4.10	0.66	3.66***	< .000
Goals of an activity	4.12	0.81	3.60***	< .000
Unambiguous Feedback	3.97	0.57	3.71***	< .000
Control	4.25	0.66	3.80***	< .000
Playability	3.95	1.01	3.03**	0.002
Flow experience	4.04	0.58	3.92***	< .000
Concentration	4.30	0.58	3.95***	< .000
Time distortion	3.88	0.94	2.97**	0.003
Autotelic experience	4.01	0.66	3.74***	< .000
Loss of self-consciousness	3.72	0.94	2.77**	0.006

**p < 0.01, ***p < 0.001

Table 2
The Mean and Standard Deviation of Learners' Game Feedback, and Game Elements

(N = 20)				
	M	*SD*	*Z*	*Sig.*
Game Feedback	4.22	0.49	3.92***	< .000
Game Usefulness	4.37	0.43	3.93***	< .000
Game Ease of Use	4.22	0.74	3.79***	< .000
Game elements	3.95	0.65	3.83***	< .000

***p < 0.001

Conclusions and Limitations

This study designed a scenario-based GenAI generative AI character technology module, creating an educational game for training psychological counseling in bullying cases. The goal is for participants to interact with an AI-generated bullied student character, aiming to understand the facts surrounding the bullying incident and implement appropriate interventions. Learners can understand the context of bullying incidents and implement appropriate interventions by interacting with the AI-generated bullied student character. Participants demonstrated high levels of flow engagement and high self-efficacy during gameplay. They reported high perceived usefulness and ease of use, expressing willingness to replay the game.

In summary, this game mechanism holds potential for training teachers to counsel bullied students. It enables low-cost, repeated pre-training sessions for teachers counseling bullied students. Future iterations could enhance interaction refinement and provide more learning feedback to improve training effectiveness and realism. Future research should test counseling approaches with diverse student populations to validate this hypothesis. Designing experimental and control groups is also recommended to enhance the study's validity. Furthermore, when applying GenAI to psychological counseling contexts, careful consideration of relevant ethical issues is essential to ensure the technology's use aligns with professional standards and educational objectives.

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Critical Reflection: Fostering Transformative Learning in Digital Drama Pedagogy

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Abstract

This study analyzes students' critical reflections in the Drama and Digital Production Studies course to examine changes in their learning experiences. Data from students' written reflections were analyzed using an AI-driven Student Reflection Analyzer. Findings show transformative learning, with improved practical skills (editing, acting, production management), stronger teamwork, and greater awareness of logistical, technical, and managerial challenges. Students also offered suggestions for curriculum improvements, such as peer collaboration activities, editing workshops, and combining digital and live staging. These results highlight the value of blending theory with practice, using interactive methods, and promoting critical reflection in digital drama education.

Keywords: critical reflection, digital drama, learning experience, interactive learning, digital production

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Introduction

Digital technology has transformed education, particularly in art and literature. Drama, formerly confined to stage performances, now incorporates digital media. This change impacts drama production, staging, and university teaching methods. Students need drama theory plus skills in cinematography, video editing, production management, and digital teamwork. It shifts the literature and drama curriculum from basic knowledge to appreciating, creating, and producing digital works (Marantika, 2014). Students' critical reflections on digital play production are vital. They track skill development and technology's effects on art (Stang & Steen, 2023).

This research examines AI-supported student reflections via app.briskteaching.com. Reflection helps understand learning, spot challenges, and develop solutions (Harvey et al., 2025; Hatfield, 2016). It analyses critical reflections from the Drama and Digital Production Studies course to uncover changes in learning experiences. This AI method aligns with trends in personalized learning and tech-enhanced cognition (Harini et al., 2025). By studying perceptions, challenges, solutions, and suggestions, it advances reflection theory and interactive digital drama teaching.

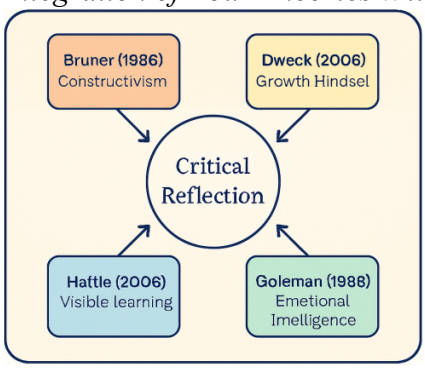
Literature Review

Reflection theory, defined by Dewey, involves active, persistent, and careful consideration of beliefs or knowledge, their origins, and future effects to support meaningful learning (Mohamed et al., 2022). Student reflections reveal this transformative process. Schön's reflection-in-action connects experiences to theory (McAleese, 1994), enabling critical reflection to evaluate learning and shape academic and professional identity. Bruner posits that individuals construct knowledge through experience rather than passive reception (Pea & Gomez, 1992). In digital drama, students build understanding through production, editing, and staging (Davis, 2011; Ma & Yuping, 2025). Project-based learning fosters varied skills. Dweck's growth mindset views challenges as opportunities for growth, outperforming avoidance (Heslin & Keating, 2016; Legrand et al., 2022). This aligns with Hattie's visible learning, where critical reflection indicates deep learning.

Goleman’s emotional intelligence theory emphasizes teamwork, communication, and empathy as essential social skills in digital drama production (Suleman et al., 2019). Its core components include self-awareness, self-regulation, empathy, and social skills. Students encounter challenges in teamwork, role assignment, and time management. Reflections indicate that project success requires technical proficiency alongside emotional regulation. Critical reflection connects experiences to emotional growth through interactions, fostering “felt knowledge” that integrates intellectual and emotional insights (Putri, 2018). This framework illustrates how critical reflection interacts with growth mindset and emotional intelligence in digital drama learning.

Student reflections in drama and digital production enable transformative learning via constructivism, growth mindset, visible learning, and emotional intelligence (Jamissen et al., 2017; Molloy & Crotty, 2024). This study examines these reflections to evaluate gains in academic, technical, and social skills and provides recommendations to enhance digital literature and drama curricula. The following figure depicts relationships among these four theories and critical reflection.

Figure 1
Integration of Four Theories With Critical Reflection



Critical reflection is central to this framework, driving changes in students' learning experiences. It draws on four theories: Bruner's constructivism, Dweck's growth mindset, Hattie's visible learning, and Goleman's emotional intelligence. These theories show how reflection builds deep academic knowledge and essential personal and social skills for the digital era. Reflection connects theory to practice, transforming learning in Drama and Digital Production Studies. This integration creates a robust analytical framework and highlights areas for targeted teaching improvements to enhance student learning (Sa'ida, 2024).

Table 1
Theoretical Links to Critical Reflection as a Transformative Pedagogical Process in Drama Studies

Theories & Figures	Key Concepts	Contribution to Critical Reflection	Impact on Learning Experience Transformation
Bruner (1996) Constructivism	Learning as a process of constructing meaning through experience	Encourage students to interpret drama/digital experiences personally and socially	Students are actively building new understandings, not just receiving information
Dweck (2006) Growth Mindset	Belief that ability can evolve through effort and strategy	Providing space for critical reflection on failure as a learning opportunity	Students are more willing to experiment in digital productions and dramas
Hattie (2009) Visible Learning	The effectiveness of learning can be measured through concrete evidence and feedback	Critical reflection focuses on the evidence of visible learning outcomes	Students are able to assess their progress and improve their learning strategies
Goleman (1995) Emotional Intelligence	Self-awareness, empathy, emotion regulation, social skills	Critical reflection includes an emotional dimension in teamwork and production	Students are more adaptive, collaborative, and able to manage emotional dynamics in the creative process

Dweck's growth mindset stresses that abilities grow through effort, strategies, and persistence (Khunaprom & Chansirisira, 2023; "Mindset: The New Psychology of Success," 2006), viewing technical and artistic challenges as opportunities rather than barriers. Hattie's visible learning highlights feedback and data (Arnold, 2011; Wisniewski et al., 2020), with reflection

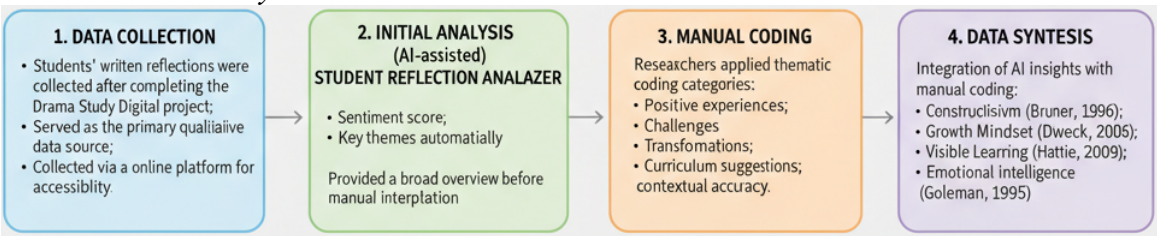
helping students assess strategies for clear improvement. Goleman's emotional intelligence emphasizes self-awareness, empathy, and emotion regulation in teamwork (Díaz, 2021; GÜL, 2020). Reflection in digital drama examines personal and group emotions, building technical skills with adaptability, collaboration, and resilience. These theories make critical reflection the core link between theory, practice, and student transformation.

Methodology

This qualitative descriptive study examines students' critical reflections from their own perspectives (Nurhasanah & Maspuroh, 2021). It explores the meanings they assign to learning experiences, challenges, and transformations in the Drama and Digital Production course. These reflections provide primary data revealing critical thinking, self-evaluation, and transformative insights. Participants were more than 37 students from the Indonesian Language and Literature Education Program at Universitas Singaperbangsa Karawang's Faculty of Teacher Training and Education. Selected via purposive sampling (Human, 2017; McDonagh & Finneran, 2017; Stratton, 2024), they showed high participation in digital production groups, active involvement in staging projects, and willingness to reflect.

Figure 2

Research Data Analysis Flow



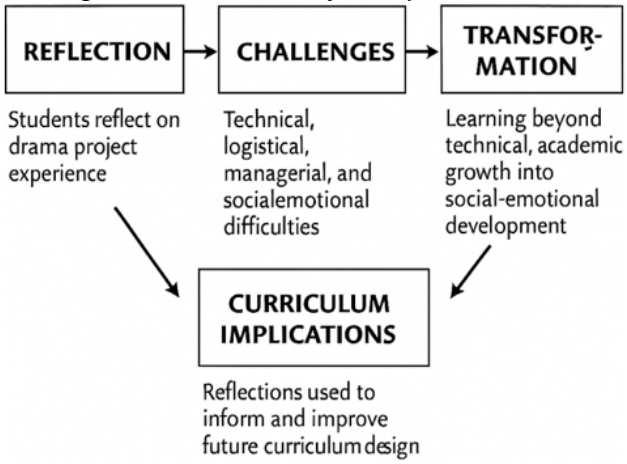
Data analysis followed Miles and Huberman's three-phase model. First, data reduction categorized student reflections into themes. Second, data display used tables, diagrams, and quotes to present findings and enhance validity. Third, conclusion drawing connected results to constructivism, growth mindset, visible learning, and emotional intelligence. This qualitative-interpretive approach identified patterns, themes, and theoretical links.

Results

The conceptual framework includes four key components. First, students' critical reflections explore perceptions, emotions, and self-evaluations in digital drama learning (Lemon, 2015). Second, reflections identify logistical, technological, and managerial challenges that foster deep learning when overcome. Third, these challenges drive transformations in academic, technical, and social domains, aligning with growth mindset theory, which views difficulties as growth opportunities (Fadel et al., 2015). Fourth, transformations guide Digital Literature and Drama curriculum design, as noted by Gosper and Ifenthaler. The diagram below presents the framework's analysis results:

Figure 3

Conceptual Framework of Analysis Flow and Research Results



The framework shows how growth mindset, constructivism, visible learning, and emotional intelligence theories support student development in digital drama education. Student reflections exceed basic descriptions to promote personal change and curriculum improvements. They address post-digital critical pedagogy and skills for artistic and digital production (Sung et al., 2024). Most students enjoyed the Drama and Digital Production course, deeming it rewarding and valuable. They appreciated teachers' enthusiastic, interactive, story-based methods that enhanced learning. Many viewed editing as personal “me time” for reflection, aligning with constructivism's focus on real experiences (Bakar & Ismail, 2020). Integrating theory and practice sustained high motivation.

Reflections highlighted three main challenges: logistics, technology, and management. These reveal needs for better artistic and project skills in digital drama. As Hattie explains in visible learning, authentic challenges build strong skills. Students progressed academically, technically, and socially. They exhibited a growth mindset by viewing challenges as opportunities for improvement (Heslin & Keating, 2016; Kroeper & Murphy, 2017). This promoted teamwork, empathy, and resilience, consistent with emotional intelligence’s emphasis on empathy and group communication (Olsson, 2024). Students suggested larger groups, editing workshops, resource sharing, and hybrid live-digital performances. These match Schön’s “reflection-on-action”: reviewing past actions to guide future practice (Schön, 1987). Overall, reflections inform curriculum revisions for cognitive and emotional growth.

Discussion

The study’s findings consistently support the constructivist principle, demonstrating that effective learning occurs through the active construction of knowledge by students based on their empirical experiences (Bakar & Ismail, 2020)s. Moreover, students’ critical reflection reveals a ‘growth mindset,’ wherein they perceive challenges as opportunities for learning and growth (Kroeper & Murphy, 2017).

Table 2
Interconnection Between Theoretical Frameworks, Key Concepts, and Their Relevance to Research

Theory	Key Concept	Relevance to Research
Bruner, Constructivism	Knowledge construction through active experience	Students construct understanding by engaging in digital drama production
Dweck, Growth Mindset	Challenges as opportunities for learning	Reflections show students reframing difficulties as growth opportunities
Hattie, Visible Learning	Reflection as self-assessment and feedback	Student reflections act as evidence of learning and provide feedback for curriculum improvement
Goleman, Emotional Intelligence	Empathy, teamwork, communication	Success in digital drama projects depends on social-emotional skills

Building on Table 2, Bruner's constructivism holds that learners build knowledge through hands-on experiences. In digital drama production, students deepen theoretical understanding via creative tasks. Dweck's growth mindset (Heslin & Keating, 2016) views challenges as growth opportunities; students' reflections reframe technical, logistical, and collaborative issues as catalysts for personal and skill development. Hattie's Visible Learning (Weißbach & Kulgemeyer, 2024) stresses reflection for self-assessment and feedback, providing evidence of learning, informing teaching improvements, and making progress visible. Goleman's emotional intelligence (Olsson, 2024) emphasizes empathy, teamwork, and communication, skills vital alongside technical ones in digital drama, as reflections confirm. Integrating theory and practice boosts conceptual and technical mastery, while team interactions build emotional intelligence via better conflict resolution, communication, and empathy.

Reflection as a Catalyst for Transformation

Student reflection transcends mere descriptions of experiences; it also encompasses the expression of emotional responses and critical awareness (Chick et al., 2009; Gachago et al., 2013). For instance, students' positive experiences with teachers, such as feelings of "pleasure to teach" and "moved," signify the formation of supportive emotional bonds that can intensify intrinsic motivation during the learning process (Nikolić-Vesković, 2023). Conversely, students' perception of the editing process as "me time" suggests that challenging technical activities can serve as a means of personal expression (Amadio, 2009; "Making, Creative Learning, Technocentrism, and Hope," 2024). This phenomenon aligns with the concept of a growth mindset, wherein difficulties are interpreted as opportunities for growth (Mendoza & Yan, 2025). Students' reflections demonstrate their ability to transform obstacles into meaningful learning experiences (Chira et al., 2019; Fiss et al., 2020).

Integration of Theory and Practice

Some students highlighted the significant contribution of the instructor's theoretical clarifications. One student described the material presented as "full of flesh", indicating that the theoretical content was perceived as rich, relevant, and of high practical value. However, the student also affirmed that practical experience in the field provides a more concrete and in-depth understanding (Masciadrelli et al., 2020). This combination of theory and practice is consistent with Bruner's constructivist approach, which emphasizes the construction of knowledge through active engagement in experience (Kitagawa, 2020; Metsämuuronen &

Räsänen, 2018). Consequently, digital drama learning that integrates theoretical studies with actual production has demonstrated effectiveness in enhancing conceptual understanding and practical skills (Burn, 2011; Liyanawatta et al., 2021).

Social Dynamics and Emotional Intelligence

Students' reflections highlight the key role of team collaboration in digital production. One student noted that challenges like time and resource limits can be overcome through communication and mutual understanding. Digital production success depends not only on technical skills but also on team interactions. These findings align with Goleman's emotional intelligence theory (Olsson, 2024), which stresses empathy, communication, and collaboration for group effectiveness. In short, digital drama learning builds emotional management and conflict resolution skills in a social setting.

Students' Constructive Suggestions as Curriculum Innovation

Students' reflections provide practical suggestions for improvement. For example, they recommend larger groups to balance workloads and cue sheets for better team coordination. These ideas show students' ability to identify problems and propose solutions, aligning with Schön's reflection-on-action. Questionnaire analysis reveals four key findings: digital drama pedagogy teaches literature while building emotional and social intelligence in a collaborative environment. Reflections record experiences, promote self-transformation, and shape curriculum development. They also show shifts in students' learning and identities as future educators and artists. Research confirms that reflective practice in project-based learning boosts self-awareness, resilience, emotion regulation, teamwork, empathy, communication, and leadership (Karim et al., 2025).

The table below summarizes the primary research findings in a structured overview (Fahmi et al., 2021).

Table 3
A Comprehensive Summary of Research Findings

Aspects	Key Findings	Theoretical Discussion
Positive Experience	Students feel happy, excited, memorable	Constructivism
Challenge	Logistics, technical, managerial	*Visible Learning*
Transformation	Academic, technical, social	*Growth Mindset* and EQ.
Student Suggestions	Larger groups, workshops, work screenings	*Reflection-on-action* (Schön, 1987)

The summary table demonstrates that students' reflections on their experiences, challenges, and solutions emphasize critical reflection's central role as a bridge between learning and personal transformation. This process enables students to reframe challenges as growth opportunities, integrate theory with practice, strengthen social-emotional skills, and propose curriculum enhancements. Thus, critical reflection should form a core pedagogical strategy in literature and digital drama education, equipping students with adaptive skills for 21st-century demands.

Conclusion

This study shows that students' critical reflections in the Drama and Digital Production course link to changes in academic, technical, and social areas. Challenges in logistics, technology, and management build skills like problem-solving, project management, and collaboration. Interactive methods, discussions, quizzes, demonstrations, and historical narratives, increase engagement. Reflections offered suggestions such as larger groups, editing workshops, screenings, and hybrid digital-live performances. Thus, reflection acts as an assessment tool and catalyst for curriculum changes.

Theoretically, results match constructivism's emphasis on hands-on learning, growth mindset's view of challenges as growth opportunities, visible learning via critical reflection, improved self-awareness, and emotional intelligence in arts education, especially empathy and communication. In practice, use a balanced curriculum blending theory, practice, and reflection; apply varied interactive methods for engagement; provide resources on time management, teamwork, and documentation; and add screenings or presentations. Future research should compare reflections in digital vs. traditional drama, measure reflection's impact on soft skills, and test AI for reflection analysis.

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A ResNet-Based Deep Learning Model for Automated Scoring of Elementary Students' Chinese Calligraphy

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Abstract

This study proposes an automatic scoring approach for calligraphy images using the deep learning model ResNet. The evaluation criteria are grounded in calligraphic aesthetics, emphasizing stroke techniques and the holistic relationships of character structure. The dataset consists of elementary students' handwriting samples and corresponding expert ratings. After preprocessing and model training, the system generates predicted scores. Experimental results show that the model achieves a low mean absolute error (MAE = 2.6) and a high quadratic weighted kappa (QWK = 0.898), indicating strong consistency between the automated scoring and expert evaluations. The proposed system provides real-time feedback and reduces teachers' assessment workload. Future work will expand the dataset and refine the scoring dimensions to enhance the model's applicability in calligraphy education.

Keywords: ResNet model, convolution, automatic calligraphy evaluation, elementary visual arts education

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Introduction

Calligraphy education plays an important role in elementary visual arts and language learning by cultivating cultural understanding and aesthetic perception through brushwork and structural balance. According to the Ministry of Education (2018a, 2018b), calligraphy is integrated into both Language Arts and the Arts domain within the 12-year basic education curriculum guidelines to enhance students' aesthetic literacy. However, as noted in the Ministry of Education's (2024) latest medium-term plan for aesthetic education, promoting calligraphy in modern classrooms faces challenges due to the subjectivity of assessment. Yang (2009a) identifies various dilemmas in elementary calligraphy teaching, particularly the inconsistency in feedback, while Yang (2009b) emphasizes the need for objective assessment tools to measure students' progress accurately.

Historically, Chinese calligraphy has evolved through distinct periods, with works from the late Qing to the Japanese colonial period reflecting significant social changes in Taiwan (Huang, 2010). Foundational theories, such as those discussed in Sun's (2003) history of Chinese calligraphy and Kang's (1920) classic treatise, provide the aesthetic standards used for evaluation today. In recent years, researchers have attempted to bridge art and science. Fu (2010a, 2010b) provides principles for the scientific analysis of calligraphy, while Fu (2010c) explores the artistic thoughts behind Tang Dynasty masterpieces.

Research Methodology

The evaluation criteria for this study are grounded in established calligraphic theories. We specifically focus on the structural configurations characterized by masters like Ouyang Xun (Peking University Calligraphy Research Center, 2015a, 2015b). Studies on the "Jiucheng Palace Sweet Spring Inscription" by Xu (2010a) and the structural analysis of Ouyang Xun's style by Xu (2010b) inform our model's feature extraction layer. Furthermore, the design of our assessment rubrics incorporates the curriculum auxiliary manuals provided by Qiu et al. (2006) and the grading standards for junior high school calligraphy developed by Cai (2015).

The dataset acquisition was influenced by current regional educational practices, such as the student calligraphy competitions organized by the Cultural Affairs Bureau of Taichung City Government (2023). This ensures that the training data reflects contemporary student handwriting levels. The methodology also considers the historical influence of calligraphy exhibitions and societies, as explored by Xu (2011), to ensure the model accounts for stylistic variations.

Calligraphy Samples and Participants

This stage involved the systematic collection of 2,000 physical calligraphy samples, all executed on standardized paper with a uniform grid structure to ensure experimental consistency. These physical works were subsequently digitized into high-resolution PDF format, establishing a robust empirical foundation with the structural integrity required for subsequent computer vision analysis.

CNN-Based Automated Evaluation Module Design

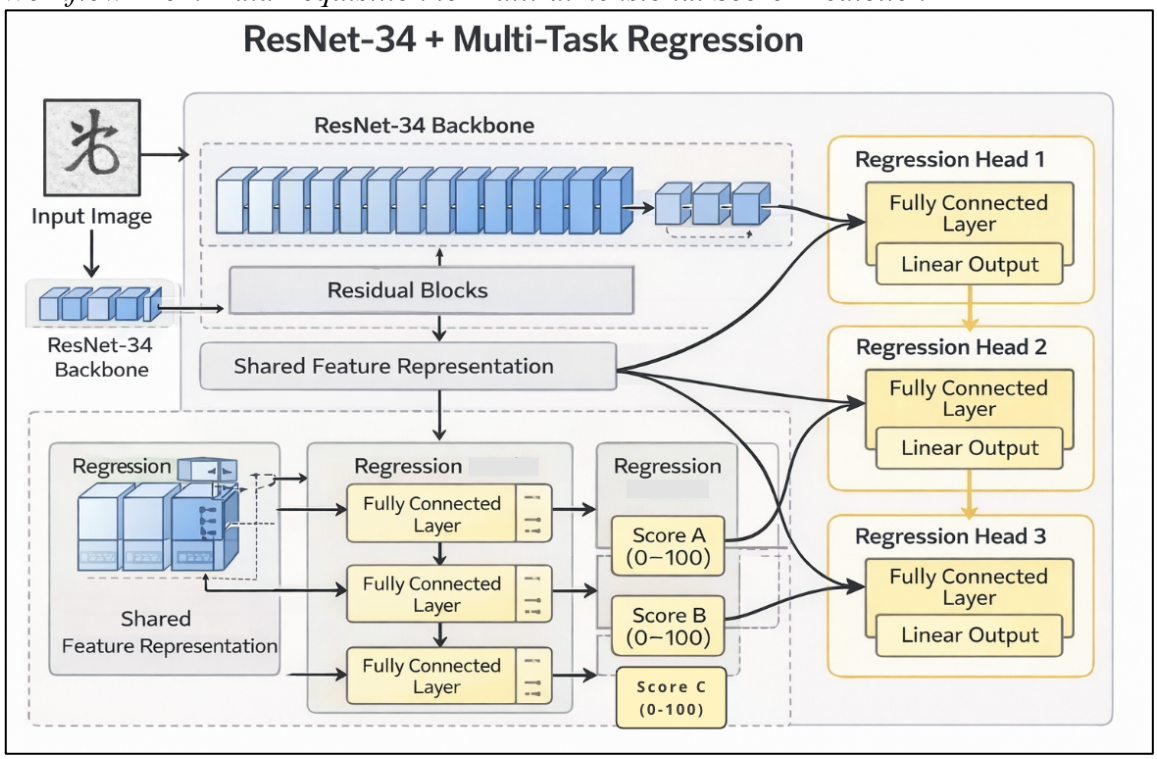
The proposed methodology is structured into three integrated phases: image preprocessing, feature learning, and model execution. Initially, scanned calligraphy images were converted to

grayscale and normalized to eliminate color-induced variance, with each character resized to a fixed resolution and centrally aligned to ensure visual consistency across the dataset. Subsequently, a convolutional neural network (ResNet-34) was employed to extract hierarchical visual features, enabling the model to learn representations ranging from low-level stroke patterns to high-level structural configurations.

This ResNet-34 backbone was fine-tuned on the calligraphy dataset to perform regression, outputting continuous score predictions based on the identified features. To enhance model stability and reduce training noise, visually ambiguous or low-quality calligraphy samples were excluded from the final training set, ensuring the reliability of the automated evaluation framework.

Figure 1

The Proposed Automated Calligraphy Evaluation Framework, Illustrating the Four-Stage Workflow From Data Acquisition to Multi-dimensional Score Prediction



Expert Manual Evaluation

The establishment of the ground truth involved three calligraphy experts, each possessing extensive pedagogical experience. The evaluation process was conducted through an independent scoring protocol, where each expert appraised the same dataset of calligraphy samples based on a set of predefined standardized criteria. To ensure objectivity and minimize individual bias, the scores were subsequently aggregated, and their arithmetic mean was adopted as the authoritative reference standard (ground truth) for both model training and performance benchmarking.

Consistency Assessment: QWK and MAE

Model efficacy was determined by comparing predicted scores against expert ratings. Mean Absolute Error (MAE) quantified prediction deviation, while Quadratic Weighted Kappa

(QWK) examined the statistical consistency and categorical alignment between the AI outputs and expert evaluations.

This dual-metric approach ensures both the accuracy and pedagogical validity of the system.

Results

Based on the 2,000 calligraphy samples evaluated in this study, the average Quadratic Weighted Kappa (QWK) between the model-predicted scores and expert ratings was approximately 0.75. In some cases, the QWK exceeded 0.80, indicating that the proposed ResNet-34–based model can produce evaluations closely aligned with expert judgment in elementary calligraphy assessment.

A small number of samples showed larger discrepancies between model predictions and expert scores, mainly due to subtle variations in stroke execution or complex structural arrangements within characters. In a few cases, irregular writing patterns or visually ambiguous features made consistent evaluation more difficult. Although automated evaluation can substantially reduce teachers' assessment workload, these results underscore the importance of expert review and refinement to ensure reliable assessment quality.

Table 1
Development of a Multi-Dimensional Calligraphy Evaluation System Using ResNet-34 Deep Learning Architecture

Dataset	N	QWK	MAE
Calligraphy samples	2000	0.75	2.63

Conclusion

This study proposed a ResNet-34–based automated calligraphy evaluation method for intermediate elementary students, using deep learning to predict scores from calligraphy images under an educational assessment framework. Many model predictions showed close agreement with expert ratings, effectively reducing teachers' evaluation workload while maintaining assessment consistency.

Although the model may still exhibit limitations when handling visually ambiguous writing patterns or highly complex structural arrangements, further refinement of training data and feature learning strategies is expected to improve performance. Rather than replacing expert judgment, the proposed approach functions as an assistive assessment tool, enhancing efficiency and reliability in classroom practice. Future work may extend this framework to larger datasets, additional script styles, and multi-level feature analysis, further supporting the integration of artificial intelligence into art education assessment.

Declaration of Generative AI and AI-Assisted Technologies in the Writing Process

The author declares that Gemini, an AI-assisted writing software, was used in proofreading and refining the language used in the manuscript. The usage was limited to correcting grammatical and spelling errors and rephrasing statements for accuracy and clarity. The author further

declares that, apart from Gemini, no other AI or AI-assisted technologies have been used to generate content in writing the manuscript. The ideas, design, procedures, findings, analyses, and discussion are originally written and derived from careful and systematic conduct of the research.

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Understanding Study Motives for Student-Centred Curriculum Design in Logistics

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Abstract

The logistics sector has to master the so-called twin transition. This simultaneous transformation towards sustainability and digitalisation is challenging, as it requires a sufficient number of suitably qualified labour. Higher education institutions play a key role in this, having typically adapted the curricula of their logistics degree programmes to emphasise topics related to the twin transition. However, this does not necessarily guarantee that enough young people will be attracted to these programmes and choose to study logistics. In order to successfully accomplish the twin transition, the study motives of potential students must also be considered when designing curricula. Therefore, a survey was carried out among first-year students of bachelor's and master's programmes in logistics at an Austrian university of applied sciences to identify their reasons for studying. A multidimensional approach is taken, combining different dimensions of motives for studying, such as self-transcendent, self-oriented and extrinsic motives. This allows the results to be compared with motivational mindset profiles as defined in the literature. The results suggest that there are two distinct groups of logistics students. One group mainly wants the study programme to help them achieve their career goals. The other group also wants to improve their own personal situation, but additionally that of society. When designing a student-centred curriculum, both groups should be given due consideration.

Keywords: study motives, motivational mindsets, logistics

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Introduction

The logistics industry plays a vital role in any economic system by ensuring that goods are available in the right quantities, at the right time and in the right place. In recent years, the twin transition — the combination of digitalisation and environmental sustainability — has grown in importance in logistics (Radaviciute & Meidute-Kavaliauskiene, 2025). Innovation within the framework of the twin transition potentially offers opportunities to increase the efficiency and effectiveness of logistics processes and reduce the ecological footprint. New occupational fields and job profiles that are emerging as a consequence, require new skills in the workforce (Graf et al., 2025). Higher education institutions have an important role to play in this regard by adapting their curricula accordingly (Gajsek & Mrugalska, 2026). On the one hand, it must be ensured that the skills relevant to the professional field are taught in the study programs. On the other hand, potential students should be motivated to study logistics so that sufficient skilled workers are available to master the twin transition. To achieve this, a student-centred curriculum design is an important foundation. Student centred learning, teaching and assessment respects and attends to the diversity of students and their needs (ENQA et al., 2015). A starting point for a good understanding of the students and their needs is to examine the motives behind their choice of study program. This paper therefore examines the study motives of logistics students.

Methodology

There are two basic approaches to gaining an understanding of the study motives of logistics students (Howard & Hoffman, 2017): The first option is a variable-centred approach, which essentially analyses the relationship between two variables, for example, between a study motive and academic success (e.g. Kennett et al., 2013). In contrast, the person-centred approach involves forming distinct groups of students based on their study motives (e.g. Wormington et al., 2012). When designing a student-centred curriculum, it is essential to know which student groups are represented in the program in order to address the specific needs of these groups. It seems plausible to assume that study motives are an essential determinant of students' needs in relation to their studies. For example, if someone chooses a particular study program in order to contribute to environmental issues later on, the curriculum should give these topics due consideration. This not only contributes to the choice of study programme, but also motivates students to pursue their studies and complete them successfully. Thus, this paper takes a person-centred approach to identify characteristic groups of students.

A survey of first-year logistics students is used to identify characteristic groups of students based on their study motives. The theoretical basis for forming characteristic groups of students is the concept of motivational mindsets according to Hudig et al. (2020), which defines motivational mindsets based on the importance of certain dimensions of study motives. Three dimensions of study motives are considered relevant, namely self-transcendent motives, self-oriented motives, and extrinsic motives. Self-transcendent motives are defined as a desire to learn in order to make a positive contribution to the world. Students want to gain skills that they can use in their future jobs to help others (Yeager et al., 2014). In short, the student wants to improve society. Self-oriented motives refer to the desire to study in order to expand one's knowledge of the world, become an independent thinker and learn more about one's own interests (Yeager et al., 2014). In other words, the student aims to be enabled. Extrinsic motives for going to university focus on getting a good, well-paid job in the future, as well as having fun and making new friends (Yeager et al., 2014). Essentially,

the student strives to improve the own situation. Hudig et al. (2020) conducted a survey among first-year university students and used cluster analysis to identify four meaningful motivational mindsets, which they refer to as high impact mindset, low impact mindset, social impact mindset, and self impact mindset. Table 1 shows how these motivational mindsets result from the combination of the importance of the dimensions of study motives. The results were adapted to achieve a simplified representation for the benefit of logical consistency. For the high impact mindset, all three dimensions of study motives are relatively important. The study program is chosen to become enabled to improve one's own situation and society. For the low impact mindset, none of the dimensions of study motives are important. Basically, for that person, the reason for studying is unclear. For the social impact mindset, self-transcendent and self-oriented motives are relatively important, i.e., the study program is chosen to become enabled to improve society. For the self impact mindset, self-oriented and extrinsic motives are relatively important. Therefore, the study program is chosen to become enabled to improve one's own situation.

Table 1

Theoretical Framework

		Dimensions of study motives		
		Self-transcendent motives	**Self-oriented motives**	**Extrinsic motives**
Motivational mindsets	**High impact mindset**	Important	Important	Important
	Low impact mindset	Not important	Not important	Not important
	Social impact mindset	Important	Important	Not important
	Self impact mindset	Not important	Important	Important

Note. Adapted from Hudig et al., 2020

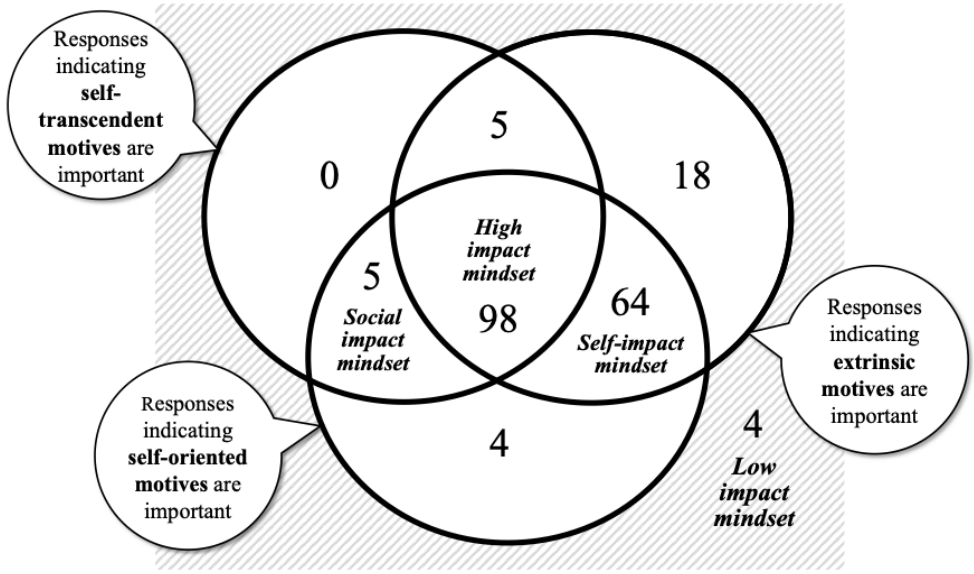
The work of Hudig et al. (2020) refers to Business Administration Bachelor's degree students in the Netherlands. This paper surveys students of bachelor's and master's programmes in logistics at an Austrian university of applied sciences. The same concept of motivational mindsets is applied to find out whether different results can be observed for logistics students.

Findings

A survey was conducted among first-year students in logistics in 2023, 2024, and 2025, resulting in 198 evaluable questionnaires. The questionnaire asked three questions for each of the dimensions of study motives. For self-transcendent motives, they relate to the importance of “doing something for the environment,” “interest in sustainability,” and “contributing to society,” and for self-oriented motives, they refer to the importance of “personal development,” “being able to pursue career aspirations,” and “developing new things.” The questions on extrinsic motives relate to the importance of achieving “high income,” “job security,” and “high reputation.” The importance was rated on a 5-point Likert scale (1 = very important, 5 = very unimportant). A dimension of study motive is considered to be “important” for a respondent if the mean value of the ratings of the corresponding three questions is less than 3.

Figure 1 summarizes the results. The three circles represent the three dimensions of study motives. Of particular interest are the overlapping areas of the circles, as motivational mindsets result from the combination of the importance of the dimensions of study motives. The numbers indicate the responses that consider the respective dimension or combination of dimensions to be "important." The number outside all circles means that no dimension of study motives is "important." For example, the area where all three circles overlap represents the high impact mindset, i.e., the motivational mindset for which self-transcendent motives, self-oriented motives, and extrinsic motives are considered "important." With 98 respondents, this is the dominant motivational mindset, followed by the self-impact mindset with 64 respondents. The other two motivational mindsets only have 5 and 4 respondents, respectively. All other areas that are not defined as motivational mindsets also play a subordinate role. Only 18 students, for whom extrinsic motives are exclusively "important," form a noteworthy, albeit subordinate, group.

Figure 1
Empirical Results



The results confirm the importance of high-impact and self-impact mindsets, but not low-impact and social-impact mindsets. The figures also show that there is no need to define further mindsets.

Conclusion

The results suggest that logistics students can be divided into two distinct groups. Almost half of the students have a high-impact mindset. This indicates that they believe that studying will improve both their own situation and that of society. Nearly one third of students have a self-impact mindset, meaning they believe studying mainly enables them to improve their own situation. These results differ from those in the literature, as neither the social impact mindset nor the low impact mindset played an important role among the students under study. It can be hypothesised that the results are specific to logistics students. A logistics degree programme typically aims to be of great value for future career development and logistics is currently undergoing a transformation in which sustainable business practices are becoming increasingly important. Against this background, the results appear plausible. For programmes in logistics and related subjects, this means that practical relevance and

sustainability must be properly incorporated into the curricula. A notable limitation of this study is that it only surveyed students who had already decided to study logistics. To reach other interested groups in the future, the motives of students who decided against studying logistics should also be examined.

Declaration of Generative AI and AI-Assisted Technologies in the Writing Process

The authors declare that DeepL Translator and Deep Write were used to assist with translation, correct grammatical and spelling errors, and rephrase statements for accuracy and clarity. No other AI or AI-assisted technologies were used to generate content.

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Innovative Simulation-Based Investigation of Traditional Chinese Medicine on Ovarian Cancer Cell Lines: A Professional Learning Model for Biomedical Science

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Abstract

Multidrug resistance and cancer recurrence remain critical challenges in ovarian cancer therapy. To address these issues through innovative, practice-based biomedical education, this study integrates simulation-based learning using ovarian cancer cell lines to explore the therapeutic potential of Pien Tze Huang (PZH), a traditional Chinese medicine. Building on prior research into high-grade serous ovarian cancer, we focused on endometrioid ovarian carcinoma using cisplatin-sensitive (A2780s) and cisplatin-resistant (A2780cp) cell lines. Students engaged in professional laboratory simulations including colony formation to assess PZH's time- and dose-dependent effects on cell proliferation and migration. Immunohistochemistry using PD-L1 antibody (Dako 22c3) and Leica BOND detection system enabled learners to investigate molecular expression patterns without ethical or safety concerns associated with human tissue. Results revealed enhanced collateral sensitivity in resistant cells and reduced IC50 values following prolonged PZH expo-sure, suggesting modulation of cell cycle and PD-L1 expression. This innovative simulation-based approach offers a safe, ethical, and trend-forward model for biomedical science education, empowering students with hands-on experience in cancer pharmacology and molecular diagnostics. It promotes critical thinking, technical proficiency, and professional readiness in a con-trolled, reproducible environment, bridging the gap between theoretical knowledge and clinical application.

Keywords: simulation-based learning, ovarian cancer cell lines, Pien Tze Huang, PD-L1 expression, immunohistochemistry

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Introduction

Ovarian cancer is a significant global health issue, with epithelial carcinoma comprising approximately 90% of cases. Among these, endometrioid carcinoma is a common subtype. The World Ovarian Cancer Coalition (2022) projects over four million deaths by 2040, with high incidence in regions like Northern Africa and Eastern Asia. While traditionally affecting middle-aged women, recent data show rising cases among premenopausal females, making it the third most prevalent carcinoma in women (Koppikar et al., 2023).

Despite the common use of CA125 test for follow-up, its limitations in screening restrict its utility. Other biomarker tests suffer from a lack of specificity. Treatment is further complicated by multidrug resistance to platinum-based drugs. Cancer, which often presents late, contributes to high mortality with median survival under 3.5 years, and remission typically occurs within 1 to 1.5 years post-chemotherapy (Garzon et al., 2020).

To address these challenges, this study introduces a simulation-based teaching model for biomedical science students, centered on the therapeutic potential of Pien Tze Huang (PZH), a traditional Chinese medicine with anti-inflammatory and anti-carcinogenic effects (Huang et al., 2016). PZH has demonstrated efficacy in colorectal (Gou et al., 2023), breast (Yan et al., 2023), lung (Chen et al., 2022), and bone cancers (Zhang et al., 2013). This research investigates its effects on endometrioid ovarian carcinoma using A2780s (cisplatin-sensitive) and A2780cp (cisplatin-resistant) cell lines. The study aims to: (1) assess time- and dose-dependent effects of PZH on cell viability and migration; (2) compare responses between sensitive and resistant cell lines. It utilizes cell culture, processing and immunohistochemistry test using PD-L1 antibody, quantified using Tumor Proportion Score (TPS) and staining intensity.

This simulation-based model offers students hands-on experience in cancer pharmacology, cell culture handling and immunohistochemistry, without ethical concerns of using real human tissue. It integrates medicine with laboratory techniques for image analysis, fostering critical thinking and technical skills in a re-producible, professional setting. The study contributes to PD-L1 research as a biomarker and immunotherapy target, encouraging interdisciplinary exploration and innovation in biomedical education.

Literature Review

Understanding ovarian cancer requires not only studying tumor biology but also building strong training models for students and researchers. The way cancer cells are grown in the lab can change how they respond to drugs. For example, A2780 ovarian cancer cells show different multidrug-resistance (MDR) behaviors when grown in flat 2D dishes compared to 3D cultures. This means that the learning environment must teach students how culture conditions can affect drug testing and interpretation (Koshkin et al., 2021). Since ovarian cancer often comes back after chemotherapy, training models that highlight resistance mechanisms are important for preparing learners to think critically about treatment challenges (Garzon et al., 2020).

Traditional Chinese Medicine (TCM), especially PZH, provides another teaching opportunity. PZH has been shown to influence immune signaling in sepsis models through bile acid–mediated pathways (Li et al., 2024). In cancer studies, PZH and related compounds can trigger cell death and reduce tumor growth (Chen et al., 2022; Gou et al., 2023; Yan et al., 2023; Zhang et al., 2013). These findings can be turned into training exercises where students practice dose–

time viability assays, migration studies, and immunohistochemistry to see how TCM compounds affect cancer cells (Xu et al., 2025). However, learners must also understand how routine lab steps, like trypsinization, can change cell proteins and influence results if not carefully standardized (Huang et al., 2010).

Checkpoint biology is another area where training is essential. PD-L1 testing is widely used to guide immunotherapy. Studies show that antibodies like Dako 22C3 can be used across different staining platforms if protocols are adjusted, which is a valuable lesson in assay reliability (Ilie et al., 2017). Teaching students how to measure PD-L1 consistently prepares them for real-world applications, especially as new therapies such as bispecific CAR-T cells targeting PD-1 and C-Met are developed (Yang et al., 2025).

Together, these studies support a simulation-based training framework. By combining lessons on MDR, TCM compounds like PZH, standardized lab techniques, and checkpoint assays, learners can practice connecting biology, pharmacology, and immunology. This approach not only improves reproducibility but also helps future biomedical scientists understand how research decisions impact cancer treatment outcomes (Gou et al., 2023; Yan et al., 2023).

Methodology

Cell Lines

This study used cisplatin-sensitive A2780s and cisplatin-resistant A2780cp hu-man ovarian cancer cell lines to evaluate the therapeutic effects of PZH on endometrioid ovarian carcinoma. A2780s, derived from untreated patients, models drug sensitivity, while A2780cp, developed via prolonged cisplatin exposure, models resistance through enhanced drug efflux. The well-characterized lines allow students to study drug responses mechanisms safely without human tissues. Using these models supports simulation-based biomedical education by enabling hands-on experience in cancer pharmacology and biomedical research, fostering professional skills and critical analysis.

Culture Medium

Complete medium was prepared using Dulbecco's Modified Eagle Medium (DMEM; Cat. 11965-084) supplemented with 10% fetal bovine serum (FBS; Cat. A56707-01) and 1% antibiotic-antimycotic (Cat. 15240062). DMEM provides essential nutrients, vitamins, salts, and high glucose, supporting the growth of mammalian cells, including the ovarian cancer lines used. Sodium bicarbonate buffers pH to physiological levels (7.0–7.4) under 5–10% CO_2, with phenol red serving as a pH indicator; yellowing signals acidity or CO_2 shifts, prompting me-dium changes. FBS enriches the medium with growth factors and proteins, with formulation following reference standard (Koshkin et al., 2021).

Cell Culture

A2780s and A2780cp ovarian cancer cell lines were thawed at 37°C using a water bath, then cultured in flasks under standard conditions (37°C, 5% CO_2). Cells were passaged at 70–80% confluence based on doubling times: A2780s (2–5 days) and A2780cp (5–7 days), reflecting slower growth due to cisplatin resistance (Xu et al., 2025). PBS (Cat. 10010023) was used to rinse cells before adding 0.25% trypsin-EDTA (Cat. 25200-056) for detachment. Over-trypsinization was avoided to preserve surface proteins like PD-L1 (Huang et al., 2010). Cells

were centrifuged (200g, 5 min), resuspended, and subcultured with even distribution. Morphologically, A2780s showed epithelial traits; A2780cp appeared round.

PZH Preparation

PZH stock solution was prepared at 20 mg/ml by dissolving 300 mg of powder in 15 ml PBS (pH 7.4) and sonicated for 30 minutes at 70 Hz to ensure complete dissolution (Li et al., 2024). To preserve stability and prevent freeze-thaw damage, stocks were stored at 4°C in the dark or used promptly. Using PBS at physiological pH protects active components and prevents osmotic stress, simulating oral ingestion. Before application, the solution was warmed to 37°C, centrifuged, and diluted with pre-warmed medium for cell treatment. This method instructs students in precise, reproducible drug preparation essential for cancer research. The microscopic images of cell morphology were obtained from Figure 1 and 2.

Figure 1
Microscopic Photo of A2780s Cell Morphology

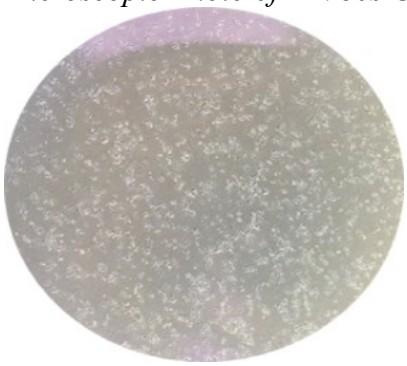
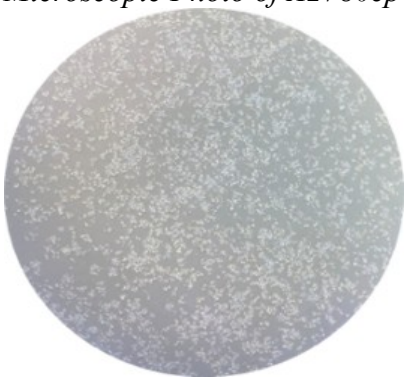


Figure 2
Microscopic Photo of A2780cp Cell Morphology



Colony Formation Assay

The colony formation assay evaluated cancer cell growth by measuring colony development in vitro. For this, 2,000 cells were evenly seeded per well in 6-well plates with 1.5 ml complete medium, using manual counting verified by an auto-mated cell counter (LUNA II) to ensure accuracy and viability. After 24 hours, cell adhesion was confirmed before applying PZH in six concentrations (0 to 1500 μg/ml) diluted in 500 μl warmed medium, added without removing existing medium. Half maximal inhibitory concentrations, the concentrations of PZH that reduce the number of cell colonies by 50% (IC50) in A2780s and A2780cp cell lines were determined. This method teaches students the precise cell handling and dose-response testing

critical for cancer research. Arrangement of the 6-well plate for colony formation assay was shown in Table 1.

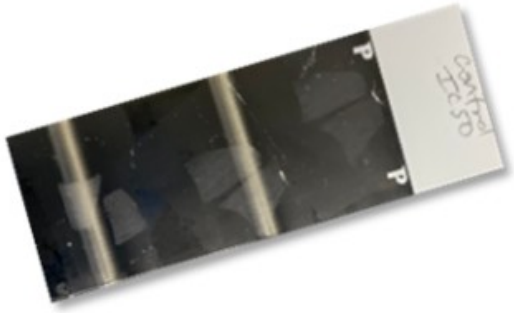
Table 1
Arrangement of the 6-Well Plate for Colony Formation Assay

Well 1	Well 2	Well 3
PZH 0 µg/ml (control) 0 µl PZH with 500 µl of complete medium	**PZH 300 µg/ml** 30 µl PZH with 470 µl of complete medium	**PZH 600 µg/ml** 60 µl PZH with 440 µl of complete medium
Well 4	Well 5	Well 6
PZH 900 µg/ml 90 µl PZH with 410 µl of complete medium	**PZH 1200 µg/ml** 120 µl PZH with 380 µl of complete medium	**PZH 1500 µg/ml** 150 µl PZH with 350 µl of complete medium

Cell Block Preparation, Tissue Processing and Sectioning

To prepare cell blocks for staining, ovarian cancer cells (A2780s and A2780cp) were treated with PZH at control (0 µg/ml) and IC50 doses (1200 µg/ml for A2780s, 900 µg/ml for A2780cp) at 70% confluence. After 24 hours, cells were fixed with 10% buffered formalin for 30 minutes, scraped, and centrifuged. HistoGel (3%) was liquefied, cooled to 37°C, and mixed with the pellet to form a firm gel block, avoiding overheating to preserve protein integrity. The gel block was trimmed, wrapped, and processed using the Epredia processor, ensuring deep tissue penetration for uniform fixation. After wax infiltration, blocks were embedded in molds with care to avoid sample carryover. Sections were cut at 4µm, floated in a 50°C water bath, and mounted on poly-L-lysine-coated slides to pre-vent detachment during IHC staining (Agilent Technologies, 2021). Control and IC50 samples were placed on the same slide (Figure 3).

Figure 3
Tissue Sections on Positively Charged Slides



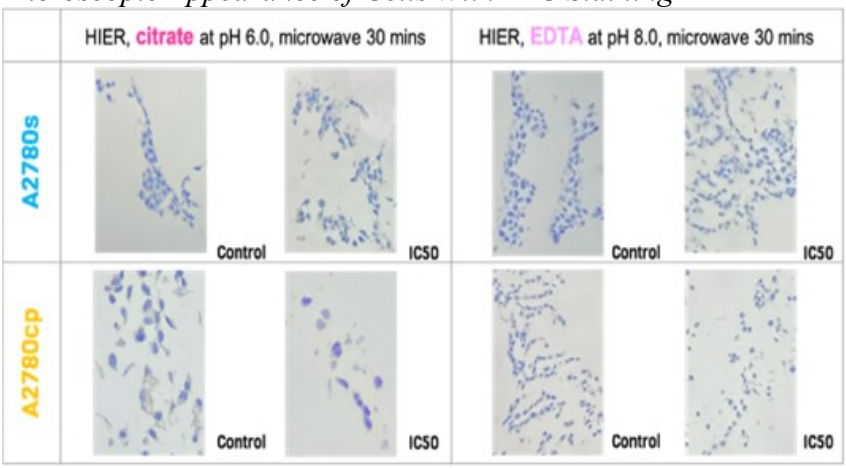
H&E Staining and IHC Staining of PD-L1

Before PD-L1 IHC staining, H&E stain was performed to confirm specimen quality and presence of over 100 viable tumor cells. Slides were dewaxed, rehydrated, and stained with Harris hematoxylin and eosin to visualize cell structures and ensure suitability for IHC. Enzyme-based retrieval was avoided to protect PD-L1 epitopes. IHC staining followed Leica's Bond Polymer Refine protocol (DS9800), using Dako's PD-L1 Clone 22C3 antibody (M3653) at 1:50 dilution. Detection involved HRP-linked polymer and DAB substrate, followed by

hematoxylin counterstaining which showed in Figure 4. Tonsil tissue served as a positive control (Agilent Technologies, 2021). PD-L1 was expressed in control A2780s and A2780cp blocks, but reduced in A2780cp treated with PZH at IC50, suggesting downregulation of PD-L1 (Yang et al., 2025).

Figure 4

Microscopic Appearance of Cells With IHC Staining

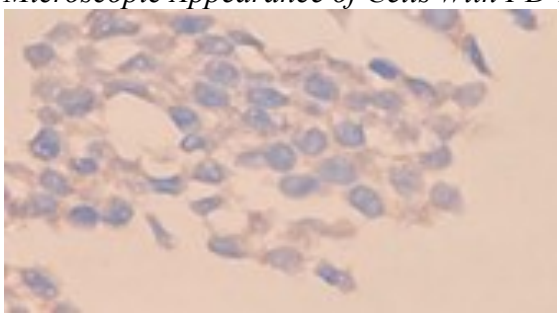


Results

This study used colony formation assays to determine IC50 of PZH in cisplatin-sensitive A2780s and cisplatin-resistant A2780cp ovarian cancer cell lines. Results showed lower IC50 values at 48 hours than at 24 hours for both lines, indicating a time-dependent effect. A2780cp had lower IC50 values than A2780s, suggesting greater sensitivity to PZH despite its drug-resistant nature. Statistical analysis using F-tests and type II t-tests confirmed significant differences in IC50 between 24 and 48 hours for both cell lines ($p < 0.05$), and between A2780s and A2780cp at 24 hours. H&E staining was used to confirm sample adequacy before PD-L1 IHC staining was performed on a total of 12 cases. Due to extensive cell death at 48 hours, IHC was only performed on 24-hour samples. This decision taught students to critically assess specimen quality and interpret viability-linked biomarkers like PD-L1. The workflow emphasized hands-on learning in experimental design, statistical analysis, and histological validation, the core competencies in biomedical science education.

To validate PD-L1 immunohistochemistry (IHC), tonsil tissue was used as an internal positive control, following the Dako 22c3 interpretation guide (Agilent Technologies, 2021). Known for PD-L1 expression in germinal centers, tonsil samples confirmed reagent and system reliability. Staining intensity was graded from 1+ to 4+, with our control showing a strong 4+ dark brown membrane signal. This step taught students the importance of internal controls to ensure reproducibility and accuracy in IHC protocols. After confirming cell block quality via H&E staining, IHC was performed on A2780s and A2780cp cell blocks using the optimized protocol. PD-L1 expression was observed in both control and IC50-treated samples at 24 hours, suggesting baseline expression in ovarian cancer cells (Figure 5). This aligned with previous findings [12], where PD-L1 was detected at medium levels in A2780s via flow cytometry.

Figure 5
Microscopic Appearance of Cells With PD-L1 Expression



Tumor Proportion Score (TPS) was calculated using the Dako formula: TPS (%) = (PD-L1-stained viable tumor cells / total viable tumor cells) × 100% Only mem-brane-stained, viable cells were counted, excluding cytoplasmic and necrotic cells. All samples exceeded the minimum 100-cell threshold, ensuring valid scoring. A2780s consistently showed 1+ intensity and 100% TPS across trials. A2780cp also showed 100% TPS, but with reduced staining intensity post-PZH treatment (from 3+/2+ to 1+), indicating a possible downregulation of PD-L1.

Students learned to assess staining quality, quantify biomarker expression, and interpret semi-quantitative data. The experiment also confirmed antibody-platform compatibility, confirming that Dako 22c3 could be used with the Leica BOND system under specific conditions: 1:50 antibody dilution, overnight incubation at 4°C, citrate buffer (pH 6.0), and extended incubation steps. This rein-forced the importance of protocol optimization and adaptability in translational research.

Discussion

This study revealed that PZH had greater efficacy at 48 hours than at 24 hours, with significantly lower IC50 values in both cisplatin-sensitive (A2780s) and cisplatin-resistant (A2780cp) ovarian cancer cell lines. Students learned that prolonged drug exposure enhances therapeutic impact, possibly due to cumulative stress, reactive oxygen species (ROS) buildup, and activation of apoptotic pathways like caspase 2 and 3. These findings highlight the importance of time-dependent drug action and cell cycle coverage in cancer pharmacology.

A2780cp showed greater sensitivity to PZH than A2780s, introducing students to the concept of collateral sensitivity, where drug-resistant cells become vulnerable to unrelated compounds. This was linked to altered metabolism, slower proliferation, and stress adaptation. Students also explored how glycosylation differences and signaling pathway modulation (e.g., PI3K/Akt, NF-κB) may influence drug uptake and resistance reversal.

The study emphasized hands-on learning in experimental design, statistical analysis, and staining interpretation, encouraging students to connect traditional medicine with modern cancer biology and explore mechanisms behind drug efficacy and resistance. Students explored how PZH may influence PD-L1 expression and cancer cell death through molecular pathways. Ginsenosides in PZH, such as Rg3 and Rb1, were shown to suppress cytokines like IL-6 and IL-8 via NF-κB and MAPK/p38 inhibition, promoting apoptosis. A2780cp cells exhibited lower p38 levels than A2780s, possibly linked to drug resistance. This introduced learners to the role of signaling pathways in immune evasion and cancer progression.

Minimal changes in PD-L1 expression observed via IHC led to discussions on microRNA regulation, especially miR-424, and its impact on PD-L1 levels. Stu-dents learned how cytokines like IFN-γ activate JAK/STAT signaling, influencing PD-L1 expression and immune response. To validate these findings, students proposed molecular assays such as qPCR and Western blotting. They are suggest-ed to further practice RNA extraction, cDNA synthesis, and protein quantification, reinforcing skills in experimental design, biomarker analysis, and pathway investigation. This hands-on approach deepened their understanding of how tra-ditional compounds like PZH interact with modern cancer biology.

Conclusion

This study showed that PZH reduced cell growth in both A2780s and A2780cp ovarian cancer cell lines in a time- and dose-dependent manner. The colony formation assay revealed lower IC50 values at 48 hours compared to 24 hours, highlighting the importance of prolonged drug exposure. Interestingly, the cisplatin-resistant A2780cp cells were more sensitive to PZH than the cisplatin-sensitive A2780s, introducing students to the concept of collateral sensitivity. PD-L1 immunohistochemistry confirmed baseline expression in both cell lines, with reduced staining intensity in A2780cp after PZH treatment, suggesting possible downregulation.

Implications

The findings suggest that PZH may have therapeutic potential in overcoming drug resistance in ovarian cancer, while also serving as a valuable teaching tool. Students learned how traditional medicine can be studied with modern biomedical techniques, gaining skills in cell culture, drug preparation, statistical analysis, and immunohistochemistry. This hands-on training reinforced critical thinking about drug efficacy, biomarker expression, and the complexity of cancer pharmacology.

Limitations

The study was limited by focusing on only two cell lines. PD-L1 changes were minimal and assessed only at 24 hours due to extensive cell death at 48 hours, which restricted deeper analysis of time-dependent biomarker regulation.

Recommendations

Future student-led experiments should expand to additional ovarian cancer cell lines and include molecular techniques to validate PD-L1 regulation and pathway involvement. Longer treatment durations and combination studies with other drugs could help clarify the mechanisms of collateral sensitivity. Incorporating assays for apoptosis, ROS generation, and signaling pathways (e.g., PI3K/Akt, NF-κB, JAK/STAT) would provide a more complete picture. From an educational perspective, integrating these advanced methods into training will further strengthen biomedical research skills and prepare students for translational cancer studies.

Declaration of Generative AI and AI-Assisted Technologies in the Writing Process

The author declares that the AI-assisted writing software of Microsoft Copilot, was used in proofreading and refining the language used in the manuscript. The usage was limited to

correcting grammatical and spelling errors and rephrasing statements for accuracy and clarity. The author further declares that, apart from that, no other AI or AI-assisted technologies have been used to generate content in writing the manuscript. The ideas, design, procedures, findings, analyses, and discussion are originally written and derived from careful and systematic conduct of the research.

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Teachers' Anxiety and Students' Expectations Toward Generative AI in Education: Evidence From a Two-Wave National Survey in Japan (2024–2025)

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Abstract

Generative AI is increasingly being adopted in education for lesson preparation, instructional material development, and feedback support, while also raising concerns about academic integrity, fairness in assessment, and data protection. This study examines the structure of teachers' and students' expectations (perceived benefits) and anxieties (perceived risks) regarding pedagogical uses of generative AI, and how these perceptions changed over time. We conducted two nationwide repeated cross-sectional online surveys in Japan in March 2024 and March 2025. In both waves, ten benefit items and ten risk items were measured on five-point Likert scales, and differences between teachers and students as well as year-to-year changes were compared. Perceived benefits were generally high in both groups, but students consistently reported higher levels than teachers, with a larger increase from 2024 to 2025. In contrast, teachers reported relatively higher concerns in governance-related domains, including output accuracy and reliability, cheating and plagiarism, privacy, and the risk of being wrongly suspected of misconduct, whereas students expressed comparatively stronger concerns about face-to-face learning and the changing role of teachers. Overall, the findings suggest that the diffusion of generative AI in education is characterized by the parallel salience of perceived benefits and anxieties rather than a simple trade-off.

Keywords: generative AI, education, teachers and students, risk and benefit perception, repeated cross-sectional survey

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Introduction

The educational use of generative AI is rapidly expanding across contexts such as lesson preparation, instructional material development, feedback support, and support for exploratory learning. In recent years, general-purpose conversational AI has become available in educational settings, heightening awareness of its potential for both learner support and teacher support. At the same time, these technologies are not merely instruments for efficiency or labor-saving; they also bring to the fore issues that bear on the reliability and fairness of education, including misinformation and bias, academic misconduct, copyright, protection of personal data, and accountability.

In this regard, policy documents issued by international organizations and governments point in broadly convergent directions. UNESCO (2023) notes that while generative AI can expand possibilities for education and research, it entails risks related to learner data protection, transparency, bias, age-appropriate use, and educational institutions' capacity to validate and evaluate tools, and it emphasizes the need for institutional arrangements grounded in human-centered and rights-based principles. Japan's Ministry of Education, Culture, Sports, Science and Technology (MEXT) (2024), in its Guidelines on the Use of Generative AI in Primary and Secondary Education (Ver. 2.0), does not advocate uniform prohibition or mandatory use; rather, it assumes appropriate use aligned with educational objectives and calls for careful attention to information security, personal data protection, copyright, and fairness in assessment. OECD (2023) likewise treats the impact of generative AI not as a matter confined to individual classrooms but as a coherent governance challenge for the education system as a whole. In addition, the U.S. Department of Education's Office of Educational Technology (2023) underscores the importance of maintaining "human in the loop" decision-making. Taken together, generative AI in education is positioned as a domain in which the realization of educational benefits and institutional responses to accompanying risks must be advanced in tandem.

This institutional attention is also driven by the expansion of actual use in educational practice. According to Pew Research Center (2025), the share of U.S. adolescents aged 13–17 who reported having used ChatGPT for schoolwork increased from 13% in 2023 to 26% in a fall 2024 survey. This indicates that generative AI is increasingly permeating educational practice as a learning-support tool. At the same time, issues such as the authenticity of submitted work, the credibility of assessment, and the incorporation of misinformation warrant further examination through policy analysis and empirical research.

A central point, therefore, is that "expectations" and "anxieties" regarding generative AI cannot be reduced to a single evaluative dimension; the two can become salient in parallel. In particular, teachers and students occupy contrasting positions and bear different responsibilities. Teachers, as key actors responsible for institutional operation, are likely to be especially sensitive to risks tied to fairness in assessment, academic integrity, information management, and accountability. Students, by contrast, may more readily experience the benefits of learning support and assistance with assignment production, while also harboring concerns that the labor-saving use of AI may weaken processes of thinking and trial-and-error that deepen understanding, leaving learning at a more superficial level, as well as concerns about AI use being regarded as misconduct. Accordingly, to design learning environments appropriately in the era of generative AI, it is necessary to capture teachers' and students' perceived benefits (expectations) and perceived risks (anxieties) within a common analytical framework.

Motivated by this problem awareness, the present study aims to provide empirical evidence, grounded in the perceptions of educational stakeholders, for debates on how educational practice and institutional design should be reconfigured in an educational environment where the diffusion of generative AI is assumed, including the integration of task design, assessment design, information management, and rules for use.

Literature Review

Recent scholarship on the pedagogical use of generative AI can be broadly classified into three strands: (1) empirical studies focusing primarily on students' perceptions and patterns of use, (2) review and conceptual work that surveys educational opportunities and challenges associated with generative AI, and (3) studies examining teachers' perspectives, including research that directly compares teachers and students. Taken together, research on generative AI in education has expanded rapidly; however, studies that simultaneously capture both stakeholder differences in perceptions and their changes over time remain limited.

First, empirical research has largely centered on students' perceptions and usage practices. Chan and Hu (2023), drawing on a survey of university students in Hong Kong, reported that students tend to evaluate generative AI positively, recognizing benefits such as learning support, writing assistance, and idea generation, while also expressing concerns about accuracy, privacy, ethics, and potential effects on self-development. Stöhr et al. (2024) similarly analyzed adoption and perceptions of AI chatbots in higher education, documenting that increased use and expectations of effectiveness coexist with concerns about impacts on learning. Ravšelj et al. (2025), based on a large-scale international online survey of 23,218 higher-education students across 109 countries and territories, found that students primarily used ChatGPT for brainstorming, summarization, and literature search, while also demonstrating awareness of limitations and issues related to ethics and regulation. Collectively, these findings suggest that, among students, generative AI is relatively strongly perceived as a useful learning-support tool, whereas among teachers, more cautious responses may be prevalent due to concerns about fairness in assessment, academic misconduct, and potential impacts on the quality of learning.

Second, review and conceptual studies locate this duality within a broader theoretical context. Kasneci et al. (2023) argue that while large language models in education may enable personalized learning support and increased learner engagement, such benefits are inseparable from challenges including output limitations and inaccuracies, bias, potential misuse, and the need for ongoing human oversight and critical thinking. Schei et al. (2024), in a scoping review of 24 empirical studies on higher-education students' use of AI chatbots, confirmed growing scholarly attention to the topic and highlighted the lack of observational studies as well as the need for sustained and more fine-grained research capable of capturing effects on learning processes and outcomes. In other words, prior work has begun to treat generative AI not merely as an object of technology acceptance, but as an issue tied to the reconfiguration of learning processes, assessment, and educational practice; nevertheless, empirical verification remains at a developing stage.

Third, studies addressing teachers' perceptions and teacher–student comparisons are increasing, but the quantitative evidence base remains relatively limited. Shata and Hartley (2025), examining higher-education faculty, identified factors associated with adoption and non-adoption of generative AI and showed that faculty attitudes and behavioral intentions are shaped not only by perceived usefulness but also by trust and social influence. This suggests that teachers' perceptions are formed within social and organizational contexts that condition

judgments about reliability, appropriateness, and institutional fit. Haroud and Saqri (2025), in a comparative study of students and teachers in Moroccan higher education, reported that acceptance and evaluation of generative AI are not uniform across groups: students tended to rate usefulness more positively, whereas teachers adopted a more cautious stance, particularly regarding potential impacts on thinking skills and interpersonal competencies that are essential for learning. However, such comparative studies often remain confined to specific countries, institutions, and higher-education contexts, limiting their generalizability across educational stages and institutional settings.

In light of the above, at least three gaps remain in the literature. First, much of the empirical evidence is student-centered, and studies that compare teachers and students within a common analytical framework remain insufficient. Second, most existing studies rely on one-time cross-sectional surveys, and few examine year-to-year changes using the same measurement instrument. Third, research has tended to focus on higher education, and evidence is still limited on how perceived benefits (expectations) and perceived risks (anxieties) can be measured simultaneously across broader educational contexts, including secondary education. Accordingly, there is clear scholarly value in research that targets both teachers and students, uses a unified question design to capture expectations and anxieties in tandem, and examines how these perceptions evolve over time. Responding to this gap, the present study aims to connect debates on generative AI in education not to abstract, generalized arguments for or against adoption, but to evidence-informed discussions of implementation and institutional design grounded in stakeholder perceptions within educational settings.

Research Concept

Drawing on the research gaps identified in the previous chapter, this study conceptualizes perceptions of the educational adoption of generative AI along two dimensions, namely perceived benefits and perceived risks, and examines differences between teachers and students as well as changes over time. The central premise is that attitudes toward generative AI should not be captured on a single pro–con continuum; rather, they are better understood as a multifaceted perceptual structure in which expectations and anxieties can coexist. In other words, as generative AI diffuses, it may heighten expectations regarding learning support and efficiency while simultaneously making salient concerns related to fairness in assessment, information management, and the quality of learning. Based on this premise, the present study positions the educational use of generative AI not merely as technology acceptance, but as a form of social transformation that implicates both educational practice and institutional governance.

To capture this perceptual structure, we conducted two waves of a nationwide repeated cross-sectional survey in Japan using an identical study design in 2024 and 2025. The first wave was administered from March 21 to March 25, 2024, and the second from March 12 to March 19, 2025. Respondents included students aged 15 and above and teachers employed across a wide range of educational institutions, including junior high schools, high schools, vocational schools, professional training colleges, universities, graduate schools, and other educational settings, thereby covering key stakeholders in education. Both waves were implemented as online surveys. To ensure data quality, responses with extremely short completion times or highly uniform response patterns were excluded. As a result, the 2024 survey yielded 6,939 valid responses out of 8,769 submissions (4,323 students and 2,616 teachers), and the 2025 survey yielded 7,231 valid responses out of 9,044 submissions (4,725 students and 2,506 teachers). In addition to securing samples in the several-thousand range in both waves,

administering the surveys in March in both years enhanced comparability across waves (see Table 1).

The analysis focuses on perceived benefits and perceived risks regarding generative AI. For perceived benefits, we used items related to expanding possibilities for education and learning, improving learning outcomes, future usefulness, and changes in learning paradigms. For perceived risks, we used items related to accuracy, cheating and plagiarism, privacy, the value of face-to-face education, and concerns about AI replacing teachers. Presenting these items on the same scale to both teachers and students enables examination within a common analytical framework of (1) differences between the two groups, (2) changes from 2024 to 2025, and (3) which domains of perceived benefits and perceived risks are more likely to change over time. A key feature of this design is that benefits and risks are not treated as separate evaluations, but are observed concurrently as perceptions that may develop in parallel.

Because this study employs a two-wave repeated cross-sectional design, interpretation should emphasize describing how stakeholders' perceptual structures are distributed and in what direction they shift during the diffusion phase of generative AI, rather than attributing changes to within-individual causal processes. Nevertheless, maintaining an identical question design across waves allows the study to indicate the direction of perceptual change, which is difficult to capture in one-time surveys. Through this design, the present study provides an empirical framework for examining structural differences between teachers' and students' perceptions and their year-to-year changes, based on two-wave comparisons that measure perceived benefits and perceived risks using the same instrument.

Table 1

Overview of the Survey

2024 / 2025	2024 Survey	2025 Survey
Respondents	Students: Aged 15 and above (equivalent to high school level) Teachers: Employed at junior high schools, high schools, vocational schools, professional training colleges, universities, graduate schools, and other educational institutions	
Method	Online questionnaire (web-based survey)	
Participants	Total respondents: 8,769 Valid responses: 6,939 • Teachers: 2,616 – Junior high school teachers: 533 – High school teachers: 730 – University/graduate school faculty: 361 – Other school teachers: 992 • Students: 4,323 – High school students: 2,184 – University/graduate school students: 1,688 – Other students: 451	Total respondents: 9,044 Valid responses: 7,231 • Teachers: 2,506 – Junior high school teachers: 481 – High school teachers: 673 – University/graduate school faculty: 396 – Other school teachers: 956 • Students: 4,725 – High school students: 2,432 – University/graduate school students: 1,724 – Other students: 569
Survey period	March 21–25, 2024	March 12–19, 2025

Results

This chapter describes the distribution and changes in perceived benefits (expectations) and perceived risks (anxieties) toward generative AI, based on the two-wave surveys conducted in 2024 and 2025. The analysis focuses on comparisons of mean scores between teachers and students, as well as year-to-year changes within each group.

Results for Perceived Benefits

We first examine perceived benefits (Q1), which asked respondents how they believe education and learning will change with the introduction of generative AI. In both 2024 and 2025, the mean scores for all ten items among both teachers and students were generally above the midpoint of the five-point Likert scale (3). This indicates that, overall, teachers and students shared a moderately positive evaluation of the educational use of generative AI. To assess group differences between teachers and students for each item, we conducted Mann–Whitney U tests (two-tailed) separately for 2024 and 2025 (see Table 2).

Item-level patterns show that the highest scores in both years were observed for "Ensuring Ethical and Proper Use of Generative AI" (Q1.9). The mean scores were 4.08 for teachers and 3.95 for students in 2024, and 4.17 for teachers and 4.30 for students in 2025; in both years, the differences were statistically significant. Statistically significant differences were also observed for items such as "Transformed Learning Paradigms via Generative AI" (Q1.8), "Transformed Daily Life" (Q1.6), and "Expanding Possibilities in Education and Learning" (Q1.1). By contrast, "Transformed Teacher–Student Dynamics" (Q1.3) and "Proactive Integration of Generative AI in Education" (Q1.10) showed statistically significant differences as well, but their mean levels were relatively lower than those of the other items (see Table 2).

Table 2

Survey Results on Perceived Benefits of Generative AI in Education

No.	Item (statement)	Year	Attribute	Mean	SD	Variance	P-value
Q1.1	Expanding possibilities in education and learning	2024	Teacher	3.42	1.02	1.04	***
			Student	3.60	1.09	1.19	
		2025	Teacher	3.50	0.94	0.87	***
			Student	3.80	0.93	0.87	
Q1.2	Improved Teaching and Learning Outcomes	2024	Teacher	3.23	0.99	0.98	***
			Student	3.45	1.11	1.23	
		2025	Teacher	3.30	0.93	0.86	***
			Student	3.58	1.03	1.05	
Q1.3	Transformed Teacher-Student Dynamics	2024	Teacher	3.22	1.00	1.01	***
			Student	3.27	1.17	1.38	
		2025	Teacher	3.22	0.98	0.95	***
			Student	3.33	1.13	1.27	
Q1.4	Enhanced cognitive abilities through usage	2024	Teacher	3.11	1.00	1.00	***
			Student	3.37	1.11	1.22	
		2025	Teacher	3.03	0.98	0.96	***
			Student	3.46	1.04	1.08	
Q1.5	Enhanced Future Career Prospects	2024	Teacher	3.35	0.99	0.98	***
			Student	3.55	1.10	1.21	
		2025	Teacher	3.39	0.98	0.97	***
			Student	3.75	0.97	0.95	

Q1.6	Transformed Daily Life	2024	Teacher	3.58	0.96	0.92	***
			Student	3.76	1.10	1.20	
		2025	Teacher	3.63	0.90	0.81	***
			Student	3.96	0.96	0.92	
Q1.7	Expectations for Evolving Generative AI	2024	Teacher	3.32	1.05	1.10	**
			Student	3.38	1.14	1.30	
		2025	Teacher	3.35	1.04	1.09	***
			Student	3.56	1.09	1.20	
Q1.8	Transformed Learning Paradigms via Generative AI	2024	Teacher	3.66	0.98	0.96	**
			Student	3.69	1.10	1.22	
		2025	Teacher	3.69	0.94	0.89	***
			Student	3.94	0.95	0.90	
Q1.9	Ensuring Ethical and Proper Use of Generative AI	2024	Teacher	4.08	1.04	1.08	***
			Student	3.95	1.15	1.32	
		2025	Teacher	4.17	0.97	0.94	***
			Student	4.30	0.93	0.87	
Q1.10	Proactive Integration of Generative AI in Education	2024	Teacher	3.08	1.04	1.09	***
			Student	3.29	1.12	1.25	
		2025	Teacher	3.11	1.02	1.05	***
			Student	3.41	1.08	1.17	

Note. ***p < .001, **p < .01, *p < .05, †p < .1, ns = not significant.

Results for Perceived Risks

Next, we examine perceived risks (Q2), which asked respondents about anxieties and concerns regarding the relationship between generative AI and education and learning. For many items, mean scores were at or above the midpoint of the scale, indicating that both teachers and students viewed generative AI not only in terms of potential benefits but also as involving nontrivial risks. Unlike perceived benefits (Q1), however, some items fell below the midpoint depending on the domain. Specifically, among teachers, the mean score for "Potential loss of in-person educational value" (Q2.3) was 2.89 in both 2024 and 2025, and the mean score for "Concerns Over AI Replacing Teachers" (Q2.4) was 2.71 in both years, suggesting relatively low levels of concern for these two items. To examine teacher–student differences for each risk item, we conducted Mann–Whitney U tests (two-tailed) separately for 2024 and 2025 (see Table 3).

By contrast, relatively high mean scores were observed for "Ensuring the accuracy and reliability of AI outputs" (Q2.7), "Concerns over AI-generated content being flagged as misconduct" (Q2.6), "Concerns Regarding Over-Reliance on Generative AI" (Q2.1), and "Concerns over Data Privacy and Institutional Security" (Q2.5). For example, in 2025, mean scores for Q2.7 were 4.02 for teachers and 4.06 for students; for Q2.6, 3.85 for teachers and 3.78 for students; and for Q2.1, 3.73 for teachers and 3.82 for students. All of these items therefore registered relatively high levels of concern (see Table 3).

Table 3

Survey Results on Perceived Risks of Generative AI in Education

No.	Item (statement)	Year	Attribute	Mean	SD	Variance	P-value
Q2.1	Concerns Regarding Over-Reliance on Generative AI	2024	Teacher	3.63	1.02	1.05	n.s.
			Student	3.62	1.13	1.28	
		2025	Teacher	3.73	0.98	0.97	***
			Student	3.82	1.06	1.13	
Q2.2	Risks of Unintentional Plagiarism or Cheating	2024	Teacher	3.53	1.05	1.10	***
			Student	3.22	1.27	1.61	
		2025	Teacher	3.63	1.02	1.05	***
			Student	3.35	1.29	1.67	
Q2.3	Potential loss of in-person educational value	2024	Teacher	2.89	1.12	1.25	***
			Student	3.06	1.26	1.60	
		2025	Teacher	2.89	1.09	1.19	***
			Student	3.02	1.29	1.66	
Q2.4	Concerns Over AI Replacing Teachers	2024	Teacher	2.71	1.11	1.24	***
			Student	3.17	1.26	1.59	
		2025	Teacher	2.71	1.07	1.15	***
			Student	3.18	1.29	1.67	
Q2.5	Concerns over Data Privacy and Institutional Security	2024	Teacher	3.57	0.99	0.97	***
			Student	3.42	1.18	1.39	
		2025	Teacher	3.64	0.96	0.92	***
			Student	3.52	1.15	1.33	
Q2.6	Concerns over AI-generated content being flagged as misconduct	2024	Teacher	3.75	1.01	1.03	***
			Student	3.57	1.16	1.35	
		2025	Teacher	3.85	0.97	0.94	n.s.
			Student	3.78	1.12	1.25	
Q2.7	Ensuring the accuracy and reliability of AI outputs	2024	Teacher	3.95	1.01	1.02	***
			Student	3.77	1.13	1.27	
		2025	Teacher	4.02	0.95	0.89	**
			Student	4.06	1.03	1.06	
Q2.8	Concerns over the use of personal input for AI training	2024	Teacher	3.18	1.01	1.03	***
			Student	3.21	1.18	1.40	
		2025	Teacher	3.25	1.00	1.00	*
			Student	3.29	1.20	1.45	
Q2.9	Concerns over the decline of interpersonal communication skills	2024	Teacher	3.45	1.08	1.17	†
			Student	3.37	1.23	1.50	
		2025	Teacher	3.50	1.05	1.11	*

			Student	3.37	1.25	1.56	
Q2.10	Concerns over the reduction of human-to-human interaction	2024	Teacher	3.38	1.11	1.22	†
			Student	3.31	1.26	1.60	
		2025	Teacher	3.45	1.07	1.14	***
			Student	3.30	1.28	1.65	

Note. ***p < .001, **p < .01, *p < .05, †p < .1, ns = not significant.

Summary of Results

In summary, first, perceived benefits (Q1) were generally above the midpoint of the five-point scale for both teachers and students, with students showing higher levels and a broader year-to-year increase. Second, perceived risks (Q2) were also at or above the midpoint for many items; however, the direction of group differences varied by item, and year-to-year changes were not uniform across domains. Third, while teachers and students differed in both average levels and patterns of change for perceived benefits and perceived risks, both groups were found to recognize generative AI in education in a balanced manner, acknowledging both potential benefits and potential risks rather than adopting a uniformly positive or negative stance.

Discussion

The findings of this study indicate that perceptions of generative AI in education are best understood not as a unidirectional relationship in which greater perceived benefits entail lower anxiety, but rather as a multifaceted structure in which perceived benefits and perceived risks coexist and can develop in parallel. As shown in Chapter 4, students consistently reported higher perceived benefits (Q1) than teachers, and all benefit items increased from 2024 to 2025 among students. By contrast, for perceived risks (Q2), teachers reported relatively higher levels on items related to cheating and plagiarism, privacy, being wrongly suspected of misconduct, and output accuracy and reliability. This pattern can be interpreted as reflecting role differences: students are primary users who can readily experience generative AI as a learning-support tool, whereas teachers function as institutional actors responsible for assessment, fairness, and accountability. The coexistence of strong perceived benefits alongside persistent concerns among students has also been documented in prior studies such as Chan and Hu (2023), Stöhr et al. (2024), and Ravšelj et al. (2025). The present study demonstrates that these patterns extend to the Japanese context when teachers and students are examined within a common analytical framework. Moreover, while the direction of teacher–student differences is broadly consistent with the pattern reported by Haroud and Saqri (2025), the two-wave comparison in this study adds novelty by indicating that such differences are not necessarily fixed and may shift as diffusion progresses.

Importantly, teachers' relatively higher perceived risks are more plausibly interpreted as rational vigilance grounded in educational governance rather than simple technology aversion. The items on which teachers reported higher levels of concern, including cheating and plagiarism (Q2.2), data privacy and institutional security (Q2.5), concerns about AI-generated content being flagged as misconduct (Q2.6), and accuracy and reliability of AI outputs (Q2.7), are directly linked to fairness in assessment and institutional operation. This is consistent with Shata and Hartley (2025), who showed that Teacher perceptions and adoption intentions are shaped not only by perceived usefulness but also by trust, barriers, and institutional context. In

addition, major policy and guidance documents, including those from the U.S. Department of Education's Office of Educational Technology (2023), the European Commission (2022), and Japan's MEXT (2024), emphasize human judgment, transparency, data protection, and appropriate governance arrangements for educational uses of AI. The concerns observed among teachers in this study align with these public frameworks. Furthermore, systematic reviews on generative AI and academic integrity identify authenticity, plagiarism, misconduct detection, and the redesign of assessment as central challenges, which is consistent with the relatively stronger salience of these issues among teachers.

Meanwhile, increases in perceived benefits were broader and more pronounced among students, with particularly large gains in items related to expanding possibilities, future usefulness, impacts on daily life, and changes in learning paradigms. This suggests that, as generative AI diffuses and usage experience accumulates, perceived benefits may shift from abstract expectations toward more concrete perceptions of utility. At the same time, several risk items also increased among students, including over-reliance (Q2.1), being wrongly suspected of misconduct (Q2.6), accuracy and reliability (Q2.7), and concerns about personal input being used for AI training (Q2.8). This underscores that rising perceived benefits do not necessarily imply declining anxiety. This ambivalent pattern is consistent with Kasneci et al. (2023), who argue that opportunities and challenges of large language models in education are inseparable. It also accords with Bender et al. (2021), who noted that language models can produce outputs that appear plausible yet are inaccurate, making heightened concern about reliability theoretically reasonable as use expands. Accordingly, the present study shows that even when students are receptive to generative AI, such receptiveness should not be reduced to simple optimism; rather, students may increasingly experience concrete benefits while continuing to hold anxieties and concerns in parallel.

Based on these findings, the scholarly contributions of this study can be summarized as follows. First, by comparing teachers and students using a common measurement instrument, the study clarifies stakeholder asymmetries rooted in their differing roles and responsibilities. Second, it provides empirical evidence, grounded in stakeholder perceptions in educational settings, that perceived benefits and perceived risks do not substitute for one another but can become salient and deepen concurrently. These contributions help shift debates on generative AI in education from abstract questions of whether to adopt the technology to implementation-oriented questions of how to combine task design, assessment design, information management, and rules for use. The central value of this paper lies in concretizing the coexistence of benefits and concerns identified in prior work through a large-scale nationwide repeated cross-sectional survey in Japan, capturing both teacher–student differences and year-to-year changes.

Conclusion

This study empirically examined teachers' and students' perceptions of the pedagogical use of generative AI from two perspectives: perceived benefits (expectations) and perceived risks (anxieties). The results show that perceived benefits were generally high among both groups, but students consistently reported higher levels, with more pronounced year-to-year increases. In contrast, perceived risks were relatively higher among teachers in domains closely related to institutional operation, including cheating and plagiarism, privacy, output accuracy, and the risk of being wrongly suspected of misconduct, whereas students expressed comparatively stronger concerns about face-to-face learning and changes in the role of teachers. These patterns suggest that perceptions of generative AI are not characterized by a simple relationship

in which increasing benefits reduce anxieties; rather, perceived benefits and anxieties can become salient in parallel. This constitutes a key contribution of the present study.

At the same time, several limitations remain. First, the analyses have yet to fully incorporate factors such as school type, frequency of use, and the extent of institutional rule development, and thus the specific conditions that amplify expectations or anxieties have not been sufficiently identified. Second, the present study primarily describes item-level trends and does not statistically validate underlying dimensions of benefit and risk perceptions, such as those related to operational systems, governance, or norm formation. These issues should be addressed in future research through more fine-grained modeling and analysis.

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Embedding Health Education Through Governance, Space, and Student Conduct: Lessons From South Korea's School Nutrition Policy for SDG3 and 4

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Abstract

South Korea's school meal and nutrition programs improve student health and performance. The OECD ranks Korea among top PISA countries for educational equity, and Universal Free Lunch Program results show higher test scores and less underperformance. Since 2009, Korea has run policies like the Green Food Zone and Sugar Reduction Plan. These shape what students learn and where they eat, showing an integrated, lifelong health education model. This study uses qualitative methods, combining content analysis of policy documents, curriculum guidelines, and interviews with education and nutrition staff. It examines how Korea's health education works as behavioral governance, applying Michel Foucault's governmentality framework to show how governments shape behavior indirectly through institutions, daily practices, and norms instead of force. Analysis of spatial regulation, curriculum, and community role shows how these policies guide choices and build lasting awareness. Findings show students are learners and health-conscious citizens shaped by institutional structures, suggesting such policies act as governance tools within education. Korea's experience offers lessons for Indonesia, which launched a national free meal program in 2025 for over 82 million students to reduce stunting and support rural communities. Korea Health Promotion Association collaborates with Banda Aceh's local government and community health centers to run child growth monitoring, nutrition support, and health education programs tackling non-communicable diseases and early childhood development gaps. This illustrates an effective model of sustained public-private community partnership between Korea and Indonesia, highlighting how integrated health and nutrition strategies can help bridge regional health inequalities and advance SDGs 3 and 4.

Keywords: school nutrition policy, governmentality, behavioral governance, Universal Free Lunch Program (UFLP), Children's Food Safety Zone (Green Food Zone)

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Introduction

Child nutrition is increasingly treated as a public health concern and, at the same time, as a condition that shapes learning, cognition, and educational equity. Nutritional status in childhood shapes students' physical development and concentration, influences school participation and classroom engagement, and can widen or narrow achievement gaps over time. School-based nutrition policies are often discussed as welfare arrangements that reduce hunger and improve short-term intake. In practice, however, they also function as institutional designs that organize how children encounter food, health knowledge, and everyday routines, shaping longer-run conduct and capacities linked to SDG 3 and SDG 4 (United Nations General Assembly, 2015).

A key premise of this study is that schools are not neutral spaces. Habits form through repetition, norms become "common sense," and students learn not only through instruction but through the structure of daily life. School nutrition policy can therefore be read as embedded health education: it shapes what is available, what is visible, and what is repeatedly practiced. This shifts attention away from health education as textbook content alone and toward the spaces, routines, and signals through which health-related conduct is learned before explicit teaching even begins.

Drawing on Michel Foucault's concept of governmentality (Foucault, 1991), this paper analyzes how health education can operate through institutions, environments, and norms rather than through coercion. Governmentality highlights governing as the practical organization of settings and expectations that guide how people act and understand themselves. Applied to school nutrition policy, governmentality helps clarify how health education may function as behavioral governance: an indirect form of conduct-shaping that makes certain choices easier, more normal, and more repeatable than others. Rather than remaining passive recipients of assistance, students emerge as subjects who gradually internalize expectations of self-care and health responsibility through institutional cues and patterned practice.

South Korea offers a particularly instructive case for this analysis in light of its sustained attention to educational equity in the PISA context (OECD, 2023). As noted in the Abstract, OECD data consistently positions Korea among the top PISA countries for educational equity (OECD, 2023). Here, "rank" is used as shorthand for comparative patterns reported in PISA indicators and equity-related distributions, not as an official causal ranking claim by the OECD (OECD, 2023). The expansion of the Universal Free Lunch Program (UFLP) has been contextualized within broader improvements in student performance and reduced underperformance. However, these quantitative indicators tell only part of the story.

While such outcome indicators are often cited in policy discussions, they do not explain how the system governs conduct. Therefore, this study looks beyond the test scores to examine the policy architecture. The framework includes publicly funded free school meals grounded in Korea's school-meal legal and administrative framework (School Meals Act, 2019), reinforced by complementary measures that work outside the classroom as well as within it. Two examples that illustrate this wider policy logic are the Children's Food Safety Protection Zone (often referred to as a "Green Food Zone") (Special Act on Safety Management of Children's Dietary Lifestyle, 2021), which regulates aspects of the food environment around schools within designated areas, and the Ministry of Food and Drug Safety's national sugar-intake reduction policy package (often presented as a "Sugar Reduction Plan") (Ministry of Food and Drug Safety, 2021), aimed at reducing excessive sugar consumption.

This leads to a central question: How can governments shape students' health behavior without force, through governance, space, and student conduct within daily school life? By examining South Korea's school nutrition policy through governmentality, the paper argues that the policy's significance rests on how it structures a routine-based learning environment in which health conduct is cultivated, alongside its role in nutritional provision. In particular, it emphasizes spatial regulation in and around schools, the daily routines through which repeated meal practices normalize health behavior, and the formation of norms that position students as health-conscious citizens through institutional expectations and cues. Ultimately, this perspective treats nutrition policy as a governance technology that embeds health learning in everyday school life, instead of leaving health to individual choice alone or treating nutrition policy as welfare only.

The policy relevance of this analysis extends beyond Korea, especially to countries currently expanding large-scale meal programs. Indonesia provides a timely and consequential context for translating lessons from Korea's institutional design. Indonesia launched a nationwide free meal initiative in 2025 (MBG) (The Associated Press, 2025), targeting roughly 82 million students (Reuters, 2025) under a multi-year plan aimed at reducing stunting and strengthening human capital aligned with "Golden Indonesia 2045." The scale of MBG makes implementation design and governance capacity central concerns. The Indonesian context also underscores the need to tackle multiple health challenges simultaneously, including persistent child stunting and rising risks associated with dietary change and non-communicable diseases. This, in turn, suggests that success depends on more than food distribution alone.

Recent cooperation between Korea and Indonesia provides practical grounding for this governance-centered interpretation. Publicly documented initiatives led by the Korea Association of Health Promotion in Banda Aceh illustrate a partnership approach centered on child growth monitoring, nutrition support, health screening, and community-linked health education infrastructure (including coordination with local government and community health centers) (Korea Association of Health Promotion, 2025). Such efforts resonate with the paper's argument that school-based nutrition initiatives are most sustainable when connected to monitoring systems and community-linked governance, rather than treated as isolated feeding interventions. Korea's experience is used here as an analytic case for clarifying what is being governed, where governance is enacted, and how governance becomes durable through repetition, routine, and feedback mechanisms.

Ultimately, reframing school nutrition policy as embedded health education and behavioral governance helps clarify how education systems can operationalize SDG 3 and SDG 4 together. The Korean case demonstrates how health learning can be "lived" through the organization of school spaces and routines, and why the institutional design of meal programs matters as much as formal curriculum content. This framing also offers a structured lens for thinking about Indonesia's MBG and similar initiatives as opportunities to build governance arrangements that support long-term health capability, equity, and educational participation.

Methodology

A qualitative case study design is used to examine how school nutrition policy can operate as embedded health education through institutional routines and spatial governance. Drawing on Michel Foucault's concept of governmentality, the analysis interprets governing as an indirect process that works through environments, norms, and everyday practices rather than through explicit coercion. South Korea serves as the primary case because it provides an institutionally

consolidated setting in which school meals, child health, and educational routines are closely connected through national and local governance instruments.

To broaden policy relevance without claiming direct equivalence across contexts, Indonesia's MBG is introduced as a contemporary implementation environment for cautious policy learning on governance design and scalability. Accordingly, any mentions of "improved performance" in the paper are treated as policy-discourse framing and background context, while the study's evidence and claims remain interpretive (documentary analysis and interviews) rather than outcome-evaluative (Foucault, 1991).

The analysis is guided by three linked questions concerning how governments shape students' health-related behavior without force through school space, routines, and everyday conduct; how school meal policies become educational in effect as embedded health education rather than remaining welfare-only provisions; and which governance design features visible in the Korean case can inform reflection on Indonesia's MBG as an administrative and policy-architecture challenge without implying a simple transfer of policy content.

Two complementary forms of qualitative evidence underpin the study. Documentary material specifies policy intent, implementation architecture, and governance instruments surrounding school nutrition and child health. Interview evidence from education and nutrition staff is used to clarify how policy logics are interpreted and enacted in practice and to triangulate documentary interpretations of routines, responsibilities, and monitoring expectations at the operational level. The interviews function as supplementary interpretive material rather than a basis for representative claims or statistical generalization, strengthening credibility by adding grounded institutional perspectives to claims derived primarily from policy texts.

Documentary sources were selected purposively, prioritizing publicly available and institutionally authored materials that explicitly describe governance instruments, responsibilities, monitoring arrangements, and the spatial or behavioral assumptions embedded in policy design. The document set includes legal and regulatory texts, ministerial guidelines, national strategy documents, curriculum-related guidance, and official institutional reports. International organization materials are used as contextual references when they clarify broader objectives or framing, but they do not constitute the core evidentiary base of the analysis.

Analytically, governmentality is operationalized as a set of observable governance logics traceable across policy design and institutional practice. The documents are read as governance blueprints that reveal how standards, routines, monitoring, and spatial-arrangements structure everyday life in schools, while interview accounts illuminate how those routines and norms are translated into practice, including how students encounter regulated food environments, standardized meal practices, and health-oriented cues.

A consistent coding logic is applied across both the documentary corpus and interview material to keep interpretation disciplined and transparent. Coding focuses on how policies define the target of intervention, embed health-related norms into school life, and distribute responsibilities among ministries, schools, local governments, and related institutions. Particular attention is given to language and provisions that indicate governance through space and routine, including regulation of food environments near schools, standardization of nutritional guidelines and meal provision, and institutional practices that make health-related conduct repeatable and socially expected within everyday school rhythms.

Rigor is strengthened through triangulation across multiple document types and by tying interpretive claims to identifiable policy instruments and operational routines. Interview material is used to corroborate, nuance, or challenge implications drawn from documentary evidence, helping prevent the analysis from relying solely on formal policy rhetoric. Where policy language is aspirational, it is treated as part of governance discourse and intention, without equating stated goals with confirmed outcomes; outcome-related claims are addressed separately in the Results and Findings section.

Indonesia's MBG is discussed as an analytically cautious extension that supports policy learning without asserting comparability. It provides a structured bridge from the Korean case to a policy environment where scale and administrative complexity make governance architecture especially salient, and it is used to reflect on design issues common to large-scale school meal programs, including coordination, routinization, monitoring capacity, and the relationship between welfare delivery and educational effects. This extension does not function as a second empirical case producing independent findings, but as a framework for disciplined reflection on how governance insights may travel across contexts.

Data Collection & Key Findings

The study employs a qualitative case study approach, combining documentary analysis with interviews to trace how school nutrition policy in South Korea operates as a welfare provision and as a governance mechanism shaping everyday conduct. Purposive sampling was used to capture policy intentions, institutional designs, implementation routines, and monitoring logics that show how healthy eating is constructed and stabilized within schools and surrounding food environments.

Policy and regulatory texts form the core documentary base. These materials define the scope and rationale of school nutrition governance through national strategies on student health and diet, standards for school meal provision, and frameworks addressing food environments around schools. Reading these texts clarifies how nutrition is framed as a public responsibility, how risk and responsibility are distributed across institutions, and how the boundary of education extends beyond the classroom into everyday spaces of consumption.

Beyond policy texts, operational guidelines and institutional manuals were also analyzed to examine how governance is translated into routine practice. School meal operation guidance, nutrition and health education materials, and implementation instructions specify daily procedures and standardize expectations. This material makes it possible to trace how routines are formalized, how compliance is embedded in administrative processes, and how repeated meal practices become a stable setting through which habits are cultivated over time.

Interviews with education and nutrition staff complement the documentary analysis and strengthen interpretive validity. Rather than serving as a basis for statistical generalization, the interviews provide contextual grounding on how policies are enacted in everyday settings, how responsibilities are understood across institutional actors, and how routines and monitoring expectations are experienced in practice. This triangulation helps connect formal policy design to the institutional processes through which students encounter regulated spaces, repeated meal practices, and normalized health cues.

Analytically, the combined materials are interpreted through a governmentality lens associated with Michel Foucault, with attention to how space, routine, and norm formation structure the

conditions of possible action. The analysis therefore treats healthy eating less as an individual preference and more as an outcome shaped by designed environments, repeated practices, and institutional expectations.

The findings suggest that South Korea's school nutrition policy functions through spatial governance that extends educational authority beyond the school interior into surrounding food environments. By shaping what is available and salient near schools, governance reorganizes the conditions under which students encounter food choices, shifting nutrition from a matter of personal willpower to a matter of structured access, visibility, and constraint embedded in everyday geography.

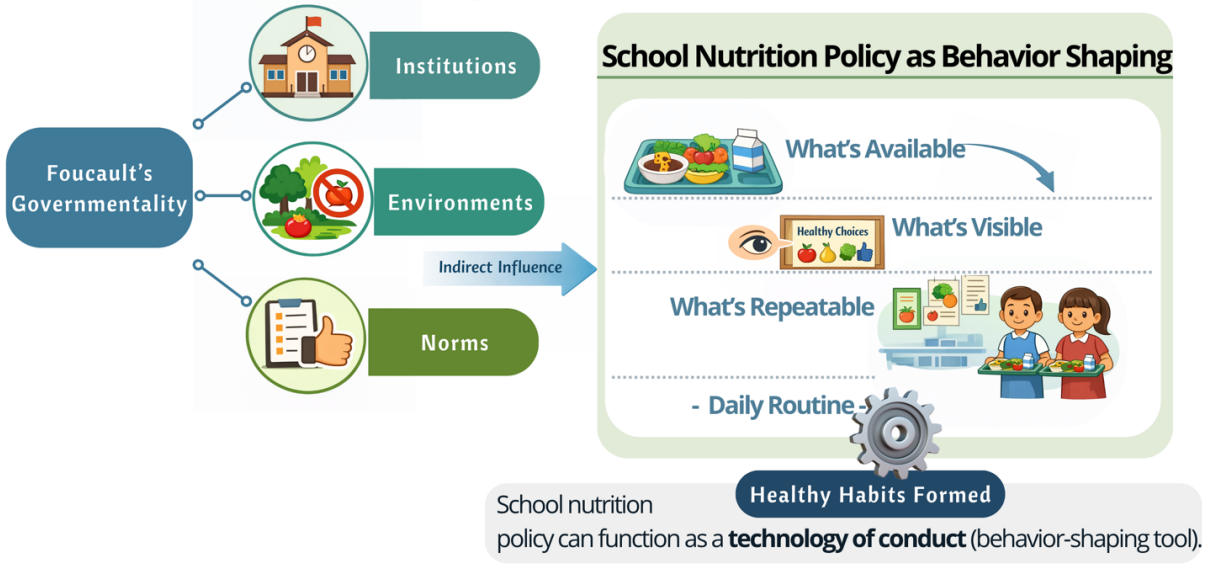
Routinization strengthens the policy's behavioral effects because school meals operate as a repetitive and standardized practice that supports habit formation over time. Since eating occurs daily within an institutional framework, the educational force of the policy depends less on episodic campaigns and more on predictable rhythms produced through repeated practice, administrative standardization, and stable implementation routines.

Norm formation is reinforced through institutional language, guidance, and monitoring that link health to responsibility and define desirable conduct in practical terms. In this way, school nutrition policy contributes to subject formation by encouraging students to internalize health-oriented norms through environments that make certain practices easier, routines that make them repeatable, and evaluative systems that make them measurable and governable.

Results and Findings

The analysis finds that South Korea's school nutrition policy operates not merely as a welfare-oriented meal provision system but as a form of behavioral governance embedded in everyday schooling. Across policy designs and implementation logics, "health education" is produced as an effect of institutional arrangements rather than a stand-alone classroom lesson. In this framing, the core mechanism is not persuasion or coercion, but the indirect shaping of conduct through structured environments and repeated practices. This supports the study's central claim that nutrition policy can function as a "technology of conduct," where what students learn about health is continuously reinforced by how school life is organized.

Figure 1
School Nutrition Policy as Behavior Shaping Through Governmentality



Spatial regulation constitutes the foundational layer of this governance. Spatial regulation extends the educational boundary beyond the classroom by treating the food environment itself as a policy instrument. Korea's policy architecture indicates that what is available, visible, and accessible to students is actively shaped through institutional and regulatory design, including the regulation of food environments around schools and the structuring of cafeteria settings inside schools. As a result, cafeterias operate as "living labs" in which nutrition learning is enacted through daily exposure to curated options, informational cues, and standardized routines. The key insight is that the environment performs pedagogical work before formal instruction occurs, because it sets the default conditions under which choices are made.

Complementing spatial regulation is the governance of routine. The policy logic repeatedly positions everyday repetition as a pathway to durable habit formation, suggesting that health learning is stabilized through frequency and predictability rather than episodic instruction. When balanced meals, regulated food options, and consistent school-based practices are encountered as part of normal school life, "healthy conduct" becomes less a matter of individual willpower and more a patterned outcome of institutional design. In this sense, routine is not simply operational; it functions as an educational mechanism that embeds health-oriented norms into ordinary conduct, reducing the need for moralized pressure while increasing the likelihood of sustained behavioral internalization.

Embedded within this architecture is the production of students as governed subjects. Policy language, guidance, and monitoring do more than describe desired outcomes, functioning instead as active engines of norm formation. They define what responsible conduct looks like and where responsibility is located, gradually positioning students as health-conscious actors within an institutional setting. Expectations of self-care are not delivered as moral pressure alone. They are embedded in cues, routines, and evaluative practices that make certain behaviors socially legible as normal and responsible within school life.

Finally, the linkage to Indonesia helps clarify the transferability of these insights. Indonesia's nationwide free meal initiative launched in 2025 at large scale makes a familiar implementation issue especially visible: meal provision by itself does not guarantee sustained health capability

unless monitoring, education, and community linkage are built into the system. Publicly documented cooperation in Banda Aceh illustrates one practical pathway, where a partnership involving local government and community health centers supports growth monitoring, nutrition support, hygiene environment checks, and screening or awareness activities, alongside discussions of mobile enabled approaches. This suggests that the policy lesson is primarily institutional. It lies in the governance capacity organized around meals, including measurement, support, and reinforcement as a repeatable local system, rather than in a single program design to be copied across contexts. In this respect, the findings suggest that Korea's experience is relevant to Indonesia not as a blueprint to copy, but as an evidence-informed logic for embedding health education into institutional life in ways that can simultaneously advance SDG 3 and SDG 4.

Implications & Conclusion

This study treats school nutrition policy as part of how education systems govern everyday life, not simply as a welfare instrument that delivers meals. When health is framed only as individual choice, policy discussion often narrows to information delivery and short-term persuasion. The Korean case points to a different policy logic. Health learning accumulates through institutional settings that students inhabit daily, so the relevant question becomes less what children are told to know and more what they repeatedly do, see, and internalize as normal.

What stands out in the Korean case is the extent to which design features outside the classroom carry educational force. Regulations around food environments and the organization of school cafeterias shape exposure and practice, while routine meal provision turns those practices into repetition. In that context, healthier conduct can be learned through participation in ordinary school rhythms rather than through moralized pressure. The durability of the intervention comes from this quiet accumulation of practice that makes certain choices easier to sustain.

This framing also shifts how students appear within nutrition policy. They are not simply recipients of a benefit. They are gradually positioned as health-conscious actors through cues, routines, and institutional expectations that define what responsible conduct looks like in school life. The aim is not to eliminate choice, but to structure the conditions under which students come to experience healthier conduct as ordinary and self-directed within a regulated environment.

From this perspective, the most transferable lesson from Korea is not a menu or a single program component. The Indonesian context makes these implications more than an abstract interpretation. Indonesia's nationwide free meal program introduced in 2025 creates an opportunity to reach students at scale during formative years, but it also raises a familiar implementation risk that delivery and coverage may be prioritized while behavioral and educational functions remain under-designed. Persistent stunting alongside rising non-communicable disease risks under dietary change suggests that meals alone are unlikely to carry the full burden of health capability.

What travels from the Korean case is therefore a governance design logic that links provision to monitoring, educational reinforcement, and community-level capacity. In this respect, publicly documented cooperation in Banda Aceh illustrates a multi-actor pathway through which school-based nutrition initiatives can be sustained as an ongoing system. By centering on child growth monitoring, nutrition support, health screening, and coordination with local

government and community health centers, this example moves beyond a one-time feeding intervention to demonstrate a functional governance model.

A further implication concerns how policy evaluation should be framed. If nutrition programs are assessed only through short term health indicators or logistical metrics, the governance function is underestimated. The Korea case suggests that educational outcomes and equity outcomes should be treated as core outcomes of nutrition policy, not secondary spillovers. This directly connects to SDG 3 through improved health and prevention-oriented habits, and to SDG 4 through stronger learning conditions and reduced disadvantage linked to poor nutrition. The combined SDG framing is not rhetorical. It reflects the empirical reality that health and learning are mutually reinforcing across childhood.

At the same time, the study points to clear directions for future work. Subsequent research should examine how different configurations of space, routine, and norm-setting shape behavioral trajectories across regions and school types, and how monitoring systems can support effective feedback without creating avoidable risks for children. Comparative analysis would further clarify how governance design changes when school-based systems are integrated with community health centers and local partnerships, as in the Indonesian implementation context, and how these arrangements affect sustainability at scale.

In conclusion, the Korean case demonstrates that health education works best when it is lived through everyday governance rather than taught as isolated content. Policies that shape environments, structure routines, and reinforce norms can cultivate durable health habits while supporting educational equity. For countries implementing large scale nutrition programs such as Indonesia, the key challenge is to move from food provision alone to integrated system design that links meals to community partnerships and monitoring-based support. The key message is simple. Health education works best when it is lived in the cafeteria, not just taught in the classroom.

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Development and Validation of an APOS-Based Mathematics Mental Structure Scale

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Abstract

Action-Process-Object-Schema (APOS) theory emerges as an extension of constructivism, but it takes a more robust and targeted learner-centered approach to mathematics instruction. As a basic mathematics requirement, problem-solving skills and the development of mathematical mental structures are important. By aligning the scale's statements with the APOS theory, this study aims to bridge the gap between students' prior mathematics learning and their current educational needs. Therefore, given the critical need for a proper tool to measure the mathematical mental structure of students in the study's locale and mathematics education at large, this study provided a valuable scale. The scale development followed the process: (1) item generation, (2) item evaluation, (3) pilot-testing, (4) Exploratory Analysis, (5) final evaluation. Several studies and literature have been reviewed to generate the 62 items or statements for the scale. The items are evaluated, and only 54 of them are used for the draft scale for the pilot test. The scale was administered to 330 students for the pilot-test, and responses were screened and then subjected to Exploratory Factor Analysis (EFA). One factor was extracted. To establish internal consistency, the factor was correlated with other established constructs – motivation levels, with the scale being substantially correlated, and mathematics self-efficacy and anxiety, with the scale having predictive validity. Further tests were done, and the final scale consists of 40 items, which confirmed validity and reliability.

Keywords: mathematics proficiency, mental structure, problem-solving

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Introduction

Mathematical understanding is developed by a progressive structuring of mental structure, a hierarchical cognitive construction based on APOS Theory. Mental structures start with algorithmic, externally guided actions, which then undergo interiorization to become mentally coordinated, reversible processes; encapsulation then allows these processes to be viewed as objects that can be used for additional reasoning; and finally, a schema is created when actions, processes, and objects are logically connected into a single conceptual framework (Lande, 2021; Santos, 2021). Coordination and thematization of these systems, not just procedural execution, are essential to meaningful mathematical comprehension.

Mathematics proficiency is said to be one of the core skills an individual must have to survive in the career world. As a basic mathematics requirement, students are expected to acquire the necessary problem-solving skills and develop mathematical mental structures. Aligned with this, the APOS theory is a model of how students learn mathematical concepts in a mathematics classroom. APOS stands for "Action, Process, Object, and Schema," and it describes the stages of mental development a learner goes through when understanding a new mathematical concept. The learner eventually sees the concept as a whole "object" within a broader schema after first performing external actions and then internalizing them as mental processes (Arnon et al., 2014). According to the APOS theory, the goal of teaching and studying mathematics should be to assist students in using their existing mental models and creating new, stronger ones so they can handle more complex mathematical problems (Borji et al., 2018; Ng & Chew, 2023).

Despite this ideal, challenges persist in many higher education institutions. Feedback from international assessments in which the country participated highlights low mathematics proficiency (OECD, 2023), and scored the lowest among Trends in International Mathematics and Science Study (TIMSS) participating countries in both mathematics and science (Mullis et al., 2019). This dilemma is said to be greatly affected by students' learning foundation, specifically the mathematical foundation (Deasmin & Paglinawan, 2024; Lapinid et al., 2022; Magas, 2023). This issue has been acknowledged in institutional reviews and is consistent with findings from the Second Congressional Commission on Education (EDCOM 2), which noted persistent gaps in learning foundation across tertiary institutions. Relatively, this predicament is often worsened by the dearth of a reliable and relevant instrument for measuring mathematical competency in the country (Aguhayon et al., 2023; Igarashi & Suryadarma, 2023). Additionally, the availability of a credible and valid mathematics mental structure measurement tool remains lacking.

To address these concerns, this study adopts and modifies established measurement tools concerning the mental structure in developing an APOS-based scale for college students. The APOS theory emerges as an extension of constructivism, but it takes a more robust and targeted learner-centered approach to mathematics instruction (Oktaç et al., 2019; Tsafe, 2024). It can and has been applied to a wide range of mathematical theories, and it serves as a language for exchanging learning-related ideas (Dubinsky & McDonald, 2001). Its application in higher education has proven beneficial in supporting mathematics curriculum (Arnon et al., 2014; Dubinsky & McDonald, 2001; Tall, 1999), mathematics instruction (Afgani et al., 2017; Arnawa et al., 2007; Borji et al., 2018; Chamberlain & Vidakovic, 2021; Hanifah, 2019; Istikomah & Jana, 2019; Leng et al., 2023; Nagle et al., 2019), and learning resources (Kintoko et al., 2021; Prasetyo et al., 2021; Samosir et al., 2020).

By aligning the scale's statements with the APOS theory, this study aims to bridge the gap between students' prior mathematics learning and their current educational needs. This study aimed to contribute to the existing scales in mathematics learning that could help improve the quality of mathematics learning by focusing on students' mental structure. The development and validation of a mathematics mental structure scale suitable for evaluating the process of mental structure of students during any mathematical problem-solving tasks. Given the critical need for a proper tool to measure the mathematical mental structure of students, this study provided a valuable scale. Specifically, it sought to (1) construct items/statements that measure mathematics mental structure aligned with APOS Theory; (2) describe the validity and reliability of the developed scale in terms of i) content validity of aligning the tool to the concept of Action-Process-Object-Schema in mathematics learning, ii) construct and predictive validity using the Metacognition Scale and the Mathematics Self-Efficacy & Anxiety Scale, iii) reliability using Cronbach's alpha; and (3) explore the underlying structure in the developed APOS-Based mathematics mental structure scale through exploratory factor analysis.

In essence, the development of this APOS-based mathematics mental structure scale responds both to EDCOM 2's calls for fixing the mathematical foundation and to local classroom challenges observed at the study's locale. Integrating APOS Theory into the creation of the scale provides an opportunity to accurately measure and improve students' mathematics mental structure and enrich their learning experience in mathematics.

Methodology

This study employed a developmental research design focused on the systematic construction and validation of an APOS-based measurement scale, following the procedure emphasizing iterative item development, validation, and refinement. The participants were 330 tertiary mathematics majors during the School Year 2024–2025, a sample size considered between fair and good for scale development. Item generation was grounded in an extensive literature review, followed by expert validation, pilot testing, and administration via Google Forms and in-person. Data were collected over two consecutive weeks, with respondents oriented on the study's objectives and required to provide informed consent in compliance with the Data Privacy Act of 2012. Statistical analyses included the computation of the Content Validity Index (CVI) based on expert ratings, Cronbach's alpha for internal consistency reliability, and Exploratory Factor Analysis (EFA) to determine underlying factor structure and refine scale items. Ethical considerations were strictly observed, including approval submission to the University Research Ethics Board of Saint Mary's University, protection of confidentiality and data security, avoidance of conflicts of interest, and assurance that participants—university students and instructors—were not from vulnerable populations.

Results and Discussion

Item Generation

Several studies and literature have been reviewed to generate the items or statements for the scale. These statements are believed to specifically measure the APOS (Action-Process-Object-Schema) Mathematics Mental Structure of students. Firstly, how should the items be aligned with the structure?

Action – is the alteration of things that the person perceives as fundamentally external and that needs explicit or implicit instructions on how to carry out the operation. Students may execute rote operations at this level; in other words, they are required to act on the knowledge that has been provided to them. Process – is an internal mental structure that an individual might create when they repeat an activity and reflect on it. Instead of actually carrying out a process, students might imagine executing it; thus, they can consider reversing it and combining it with other processes. Object – When students recognize the process as a whole and understand that changes may be made to it, they have created an object from a process. The ability to assemble transformations to generate cognitive objects through the application of activities at the action and process phases is a step in mathematical concept understanding. Schema – a particular mathematical idea is a person's collection of behaviors, procedures, items, and other schemas connected by general principles to create a mental framework that may be applied to a problem scenario involving that concept. A student's ability to arrange and understand novel and unfamiliar mathematical concepts results in a collection of processes and objects.

After careful consideration of these definitions of how mental structure is achieved in each phase, the items are appropriately structured. Some of the statements of the developed scale are adopted, and some of them are modified. Statements of the "Mathematical Problems Solving Conception (MaProSC) Scale" of Catindoy (2021); the scale of Gok (2011) about problem-solving strategy steps are modified and included in the construction. Additionally, some of the items are patterned after the scale "Mathematics Collaborative Problem-Solving Skills" of Medina et al. (2019) and "Problem-Solving Skill Scale" used in Bayarcal and Tan (2023). Most of the statements are adopted from Catindoy (2021) and Medina et al. (2019); hence, approval was sought and granted.

Following the creation of items from these studies and literature, a total of 62 items were created.

Table 1
Developed Items for the APOS-Based Mathematics Mental Structure Scale

Statements	4	3	2	1
	Strongly Agree	Agree	Disagree	Strongly Disagree
ACTION				
1. I always make sure that I have the goal in mind when solving.	◯	◯	◯	◯
2. I plan what I'm going to do before I start solving the problem	◯	◯	◯	◯
3. After understanding the problem, I will identify what given quantities first and identify the unknown to solve the problem.	◯	◯	◯	◯
4. I repeatedly read the problem if it is difficult.	◯	◯	◯	◯
5. I take note of important details in the problem to guide me in solving.	◯	◯	◯	◯

6. I make sure that I know the meaning of the words in the problem.	○	○	○	○
7. I try to figure out if the problem has already been discussed in class or not.	○	○	○	○
8. I recall my past lessons that I can apply to the given problem.	○	○	○	○
9. I can identify what are given conditions.	○	○	○	○
10. I can describe a mathematical condition.	○	○	○	○
11. I can produce assumptions.	○	○	○	○
12. I can analyze relevant data in a specific problem.	○	○	○	○
13. I can apply current knowledge to solve a problem.	○	○	○	○
14. I restate the problem in my own words.	○	○	○	○
15. I try to remember existing principles, strategies, equations, and concepts related to the problem.	○	○	○	○
16. I usually search for hints in a problem.	○	○	○	○
17. I limit the given data in the problem.	○	○	○	○
18. I usually do not know how to solve a problem.	○	○	○	○

PROCESS

1. I determine what series of operations I should use.	○	○	○	○
2. I solve step-by-step so that I can look back and know what I am doing.	○	○	○	○
3. I look for patterns in the problem so I to solve it.	○	○	○	○
4. I can propose a solution immediately.	○	○	○	○
5. I can directly create a potential solution.	○	○	○	○
6. I can easily identify the appropriate formula for the problem.	○	○	○	○
7. I can mathematically think about a situation to solve a problem.	○	○	○	○
8. I can easily pinpoint point unique method to solve a mathematical problem.	○	○	○	○
9. I use my own strategies to solve the problem.	○	○	○	○
10. I try to guess how it will work before I implement the solution.	○	○	○	○

11. Before I start to solve the problem, I can make a near-correct estimate.	○	○	○	○
12. I can easily test the solutions and think about the accuracy.	○	○	○	○
13. I divide the problem into sub-problems.	○	○	○	○
14. I put the given variables in the related equations.	○	○	○	○
15. I use the trial-and-error method to find a solution.	○	○	○	○
16. I can think of at least one way to begin to work on a problem that I've never seen before.	○	○	○	○
17. I do not use any strategy while solving a problem.	○	○	○	○
OBJECT				
1. I can generate a written record of the way/s I think.	○	○	○	○
2. I can find a solution to a mathematical problem by writing an equation.	○	○	○	○
3. I can create a plan to solve the problem by drawing pictures/illustrations.	○	○	○	○
4. I can solve a problem using tabular representations.	○	○	○	○
5. I can make an answer to a mathematical problem with the use of current knowledge.	○	○	○	○
6. I try to use short shortcut to solve a problem.	○	○	○	○
7. I try to illustrate the problem so that I could understand it better.	○	○	○	○
8. I use variables to represent quantities.	○	○	○	○
9. When solving the problem, I use visual elements such as shapes and schemes	○	○	○	○
10. I spend my spare time solving problems	○	○	○	○
11. I visualize the problem.	○	○	○	○
12. I focus on the problem's solution.	○	○	○	○
13. I try to solve the problem with a similar one.	○	○	○	○
SCHEMA				
1. I use assumptions in relation to my final solution.	○	○	○	○
2. I can create new techniques to solve a problem.	○	○	○	○

3. I do not implement a pre-learned process to solve it.	○	○	○	○
4. I can evidently explain the process in the given situation.	○	○	○	○
5. I can seek multiple solutions.	○	○	○	○
6. I check the answer to see if it is reasonable.	○	○	○	○
7. I make the dimension analysis for the solution.	○	○	○	○
8. I use a problem in solving a problem I use to solve other problems	○	○	○	○
9. I can create new problems that can be used to solve the problem	○	○	○	○
10. After finding an answer using one method, I use another method to confirm my answer.	○	○	○	○
11. I associate the given problem with the real world to come up with practical ways to solve the problem.	○	○	○	○
12. I manipulate the formula after determining what variables are missing.	○	○	○	○
13. After I've solved the problem, I'll review what I've done for the solution, and I'll check the transactions before making a definitive judgment	○	○	○	○
14. By trying to find solutions to the problems in mathematics, I think I will gain experience in solving real-life problems	○	○	○	○

Content Validity

Following the item generation, four content experts validated the scale. There are two high school mathematics teachers and two mathematics instructors who serve as validators. Two of them have completed their doctoral degrees, while the other two have earned master's degrees. They are all knowledgeable in scale construction since they are involved in research and have published their own scales. They used a Survey Instrument Validation Rating Scale (Oducado, 2020) with 13 elements to validate the instrument. Findings revealed that the validity rating is 4.77, which is an acceptably high rating.

Additionally, for the relevance and alignment of the items to the concept of Action-Process-Object-Schema in mathematics learning, further validation was done. Content validity is the extent to which components of an evaluation tool are pertinent to and reflective of the intended construct for a given assessment purpose, and is calculated and decided through the CVI. Before finalization of items to be included in the tool, the calculation of CVI, the relevance rating must be recoded as 1 (relevance scale of 4 or 5) or 0 (relevance scale of 1, 2, or 3). The index is 0.88, which is an acceptable threshold for CVI. Considering the findings of the content validation, there are 54 items included for the draft of the tool for pilot testing.

Table 2

Relevance Ratings on the Item Scale by Four Experts

Statement Code	Experts 1	2	3	4	Experts in Agreement	I-CVI	UA	Experts Remarks
A1	1	1	0	0	2	0.5	0	Revise/ Remove
A2	1	1	1	1	4	1	1	Revise
A3	1	1	1	1	4	1	1	Revise
A4	1	1	1	1	4	1	1	Revise
A5	1	1	1	1	4	1	1	
A6	1	1	1	1	4	1	1	
A7	1	1	1	1	4	1	1	
A8	1	1	0	1	3	0.75	0	Move to Process
A9	1	1	1	1	4	1	1	
A10	1	1	1	1	4	1	1	
A11	1	1	0	1	3	0.75	0	Move to Process
A12	1	1	1	1	4	1	1	
A13	1	1	0	1	3	0.75	0	Move to Process
A14	1	1	1	1	4	1	1	
A15	1	1	1	1	4	1	1	
A16	1	1	1	1	4	1	1	
A17	1	0	1	0	2	0.5	0	Remove
A18	0	0	0	0	0	0	0	Remove
P1	1	1	1	1	4	1	1	
P2	1	1	1	1	4	1	1	
P3	1	1	1	1	4	1	1	Revise
P4	1	1	1	1	4	1	1	
P5	1	1	1	1	4	1	1	
P6	1	1	1	1	4	1	1	
P7	1	1	1	1	4	1	1	
P8	1	1	1	1	4	1	1	Revise
P9	1	1	0	1	3	0.75	0	Move to Schema
P10	1	1	0	1	3	0.75	0	Move to Schema
P11	1	1	1	1	4	1	1	
P12	1	1	1	1	4	1	1	
P13	1	1	1	1	4	1	1	
P14	1	1	1	1	4	1	1	
P15	1	1	1	1	4	1	1	
P16	1	1	1	1	4	1	1	
P17	0	0	0	0	0	0	1	Remove
O1	1	1	1	1	4	1	1	
O2	1	1	1	1	4	1	1	
O3	1	1	1	1	4	1	1	
O4	1	1	1	1	4	1	1	
O5	1	1	1	1	4	1	1	
O6	1	1	1	1	4	1	1	
O7	1	1	1	1	4	1	1	
O8	1	1	1	1	4	1	1	
O9	1	1	1	1	4	1	1	

O10	1	1	0	0	2	0.5	0	Remove
O11	0	1	0	0	1	0.25	0	Remove
O12	1	1	1	1	4	1	1	Revise
O13	1	1	1	1	4	1	1	
S1	1	1	1	1	4	1	1	
S2	1	1	1	1	4	1	1	
S3	1	1	1	1	4	1	1	Revise
S4	1	1	1	1	4	1	1	
S5	1	1	1	1	4	1	1	Revise
S6	1	1	1	1	4	1	1	Revise
S7	0	1	1	0	2	0.5	0	Remove
S8	1	1	1	1	1	0.25	1	Revise
S9	1	0	1	0	2	0.5	0	Remove
S10	1	1	1	1	4	1	1	
S11	1	1	1	1	4	1	1	
S12	1	1	1	1	4	1	1	
S13	1	1	1	1	4	1	1	
S14	1	1	1	1	4	1	1	
Proportion Relevance	0.94	0.94	0.84	0.87		0.88	0.81	

Construct and Predictive Validity Using the Mathematics Self-Efficacy & Anxiety Scale and Metacognition Scale

Establishing construct and predictive validity of the Mathematics Self-Efficacy & Anxiety Scale (May, 2009) and the Metacognition Scale (Fergus & Bardeen, 2019) is essential to align these measures with APOS theory and students' problem-solving outcomes. Construct validity ensures that self-efficacy, anxiety, and metacognition accurately represent affective and regulatory conditions that support or hinder students' progression from APOS levels. Predictive validity further confirms that these constructs operate as theoretically expected: higher self-efficacy and metacognitive regulation predict more advanced APOS mental structures and stronger performance, while higher mathematics anxiety predicts difficulties in coordinating and internalizing mathematical processes. Together, these justify interpreting problem-solving outcomes as meaningfully linked to the developed scale.

The findings on the correlation of mathematics self-efficacy and anxiety, and motivation levels with the developed scale indicate a substantial positive correlation ($p < 0.05$). The obtained R-value of 0.314 indicates a positive correlation between the abovementioned variables. This means that when the level of mathematics self-efficacy increases while the level of anxiety decreases, their level of mathematics mental structure improves.

According to research by Akkan et al. (2019), Fatmasari et al. (2021), and Callan et al. (2021), there is a positive correlation between mathematics self-efficacy and mathematical abilities. Also, Listiawati et al. (2025) mentioned that a low math anxiety showed a good understanding of the mathematical mental structure. In contrast to this, Hay et al. (2022) and Donolato et al. (2019) imply an inverse relationship, linking lower student mathematical abilities with better mathematical self-efficacy.

Similarly, findings also show a statistically significant positive association ($p < 0.05$) between student motivation and the developed scale. Students' mental structures and motivation are positively correlated, as indicated by the computed R-value of 0.165. This suggests that there is a connection between students' level of motivation and their mental structure in mathematics.

These results are similar to studies by Baars et al. (2017), Fatimah et al. (2019), and Saadati and Celis (2023), which found that high motivation is linked to high problem-solving abilities. This is in contrast to research by Tran and Nguyen (2021) and Liu et al. (2020), which found that students with higher motivation had lower problem-solving abilities.

Along with these findings, the results of the regression analysis, examining mathematics self-efficacy and anxiety, and motivation as predictors of the developed scale. With a p-value of 0.000, the results show that all the factors analyzed predict students' mathematical mental structures. Furthermore, 10% of the variation in mathematics mental structure among students in higher education may be explained by the model, according to the coefficient of determination (R-squared) of 0.100. Meanwhile, the 90% coefficient indicates how much of the variation in tertiary education students' mathematical mental structures may be explained by other factors.

This finding is connected to the research of Suren and Kandemir (2020), who claimed that students' mathematics anxiety predicts their achievement in mathematics. This suggests that students' aptitude for solving mathematical problems is influenced by their level of mathematics self-efficacy and anxiety. Furthermore, it is in line with the results of Živković et al. (2023), who found a strong link between students' math self-efficacy and anxiety with mathematics performance.

Reliability Using Cronbach's Alpha

In terms of reliability, the developed scale was tested, and the computed Cronbach's alpha is 0.940, which is highly reliable. The result also suggested statements 3 and 4 under Action to be deleted, and reliability after deletion is 0.941, which is not a significant difference. For that reason, the statements weren't deleted. According to Knekta et al. (2019), before ruling out an item, it's critical to take the item's alignment with the proposed construct into consideration.

Refinement of the Instrument

To explore the underlying structure in the developed scale, EFA was administered. But before that, some important requirements need to be met to administer EFA – sample, scale of measurement, normality, linearity, outliers, factorability, and adequacy (Zeynivandnezhad et al., 2019).

For the ideal number of samples, Zeynivandnezhad et al. (2019) recommended that samples should be greater than 200, which was satisfied by this study, considering that it utilized 330 samples. The second requirement was also met since the study's data is in a "ratio" scale of measurement. Meanwhile, normality, linearity, and outliers were tested and analyzed. The normality of the data was examined using the values for Kurtosis (0.331) and Skewness (0.166), which implies not much deviation from the normal curve or approximately normally

distributed. The linearity test confirmed this finding, and no noteworthy outliers were discovered.

Relevant to this study, before performing factor analysis, the “factorability” of the dataset should be evaluated first. There are two ways to determine the factorability or sampling adequacy: the Kaiser-Meyer-Olkin Test and Bartlett's Test. According to Schreiber (2021), by comparing the observed correlation matrix with the identity matrix, Bartlett's test of sphericity determines whether or not there is any intercorrelation between the observed variables. He further stated that factor analysis must not be performed if the outcome is statistically insignificant. Additionally, the adequacy of the data for factor analysis is evaluated using the Kaiser-Meyer-Olkin (KMO) test (Luong & Flake, 2023). It displays the sufficiency of every observed variable as well as the entire model. KMO took into account the percentage of variation across all observed variables, which fell between 0 and 1 (Muncer et al., 2022).

From the result, the Chi-Square for the construct was 5918.626 ($df = 1378$) ($p < 0.05$). It also displays a p-value for Bartlett's test is 0.000, which means that the test showed statistical significance. This suggests that the observed correlation matrix is not an identity matrix. Consequently, acceptable high results are shown by the study's Kaiser-Meyer-Olkin Measure of Sampling Adequacy (0.907). This value indicates that the tool can proceed with the factor analysis.

With all the indicators satisfied, EFA can be administered. The primary goal of this is to identify the fundamental structure that exists between the variables under study (Alavi et al., 2020; Huntley et al., 2022; Luong & Flake, 2023; Muncer et al., 2022; Nordahl et al., 2022; Retutas & Rubio, 2021; Schreiber, 2021).

The KMO value is 0.907 (cut-off = 0.5). Most of the loading factor was around 0.303 to 0.669 (cut-off = 0.3), establishing the suitability of the data for factor analysis. Several components have the items loaded after many rotations. Additionally, cross-loadings continue to occur in the rotated component matrices’ results. The scree plot result shows four factor loadings for the scale since there are four dots before the elbow; however, the scale has only one construct since it is developed to measure only the mathematical mental structure of students. Relatively, the highest loadings of the items are in the first construct. As a result, the scale’s last component that will characterize the APOS-Based Mathematics Mental Structure in general was determined to be the first construct.

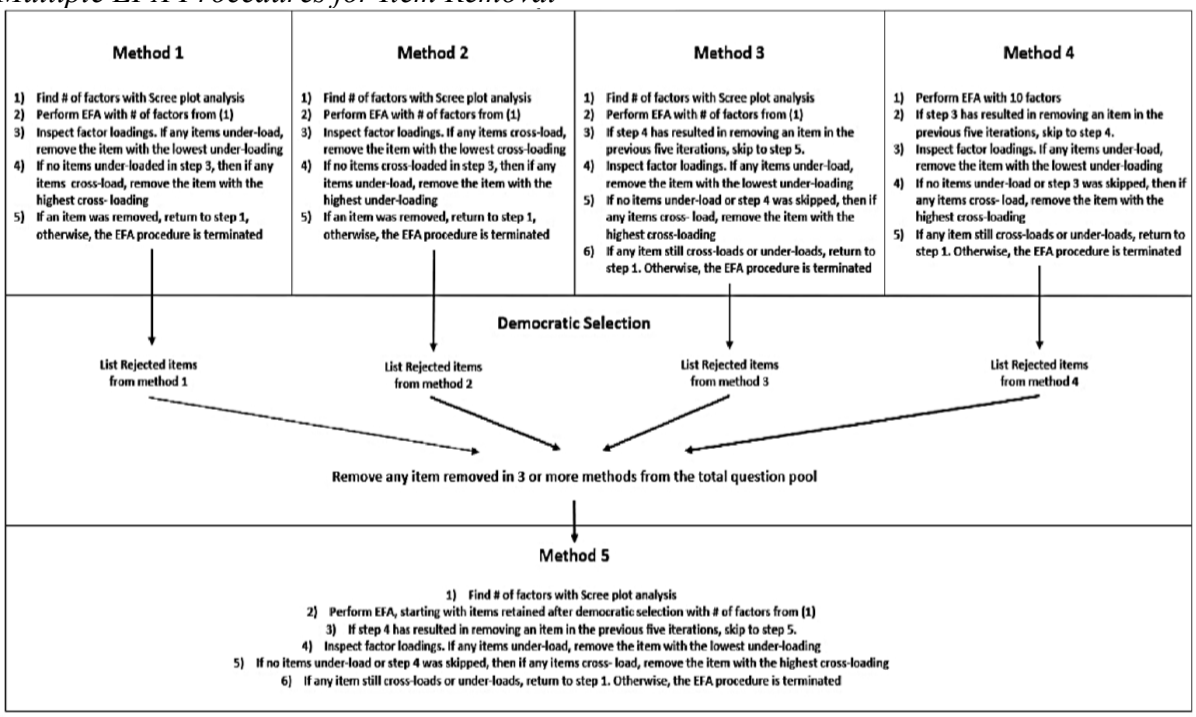
On the contrary, the study cannot overlook the items not loaded in the first construct (such as A3, A4, and O4) because of too low loading values. Also, some items cross-load to one or two other factors, most especially since they have high loadings in these factors. On this note, a thorough EFA was used to confirm that the tool will only display one construct. It is also used to further refine a produced instrument in order to guarantee its validity and reliability and to increase its overall usefulness. To investigate the dimensionality of the instrument and, eventually, improve its capacity to measure what it is intended to measure, EFA assists in locating and eliminating components that do not match the intended construct.

Generate the Final Form of the Instrument After EFA

To properly determine what items are loaded to the first construct, and further refinement of the developed tool, item removal using the results and procedures of EFA was done using the developed framework of Mirabelli et al. (2022).

Figure 1

Multiple EFA Procedures for Item Removal



Source: Mirabelli et al. (2022)

Figure 1 displays the five processes (Methods 1–5) of item removal of a developed scale. The first four methods are done as explained. After the four methods were complete, a democratically selected item deletion method was performed, where items that were not retained in at least three of the four methods were removed from the 54-item tool, and a new EFA procedure was conducted with the reduced item list and used to generate a final result. After items were removed, the fifth and final EFA method was conducted on the items that had not been removed due to the democratic selection process.

Table 3

Results of the Democratic Selection Process for Item Retention Methods

Statement Code	Democratic Selection Process					Final Remarks
	Method 1	Method 2	Method 3	Method 4	Method 5	
A1	Accept	Remove	Remove	Remove	Remove	Remove
A2	Accept	Accept	Accept	Accept	Accept	Accept
A3	Accept	Accept	Accept	Remove	Remove	Remove
A4	Accept	Accept	Accept	Remove	Remove	Remove
A5	Accept	Remove	Remove	Remove	Remove	Remove
A6	Accept	Accept	Accept	Accept	Accept	Accept
A7	Accept	Accept	Accept	Accept	Accept	Accept
A8	Accept	Accept	Accept	Accept	Accept	Accept

A9	Accept	Accept	Accept	Remove	Accept	Accept
A10	Accept	Accept	Accept	Accept	Accept	Accept
A11	Accept	Remove	Remove	Remove	Remove	Remove
A12	Accept	Accept	Accept	Accept	Accept	Accept
P1	Accept	Remove	Remove	Remove	Remove	Remove
P2	Accept	Accept	Accept	Accept	Accept	Accept
P3	Accept	Accept	Accept	Accept	Accept	Accept
P4	Accept	Accept	Accept	Accept	Accept	Accept
P5	Accept	Accept	Accept	Accept	Accept	Accept
P6	Accept	Accept	Accept	Accept	Accept	Accept
P7	Accept	Accept	Remove	Accept	Remove	Remove
P8	Accept	Accept	Accept	Accept	Accept	Accept
P9	Accept	Accept	Accept	Accept	Accept	Accept
P10	Accept	Accept	Accept	Accept	Accept	Accept
P11	Accept	Accept	Accept	Accept	Accept	Accept
P12	Accept	Accept	Accept	Accept	Accept	Accept
P13	Accept	Accept	Accept	Accept	Accept	Accept
P14	Accept	Accept	Accept	Accept	Accept	Accept
P15	Accept	Accept	Accept	Accept	Accept	Accept
P16	Accept	Accept	Accept	Accept	Accept	Accept
P17	Accept	Accept	Remove	Remove	Remove	Remove
O1	Accept	Accept	Accept	Accept	Accept	Accept
O2	Accept	Accept	Accept	Accept	Accept	Accept
O3	Accept	Accept	Accept	Accept	Accept	Accept
O4	Remove	Remove	Remove	Remove	Remove	Remove
O5	Accept	Accept	Accept	Accept	Accept	Accept
O6	Accept	Accept	Accept	Accept	Accept	Accept
O7	Accept	Accept	Accept	Accept	Accept	Accept
O8	Accept	Accept	Accept	Accept	Accept	Accept
O9	Accept	Accept	Accept	Remove	Remove	Remove
O10	Accept	Accept	Accept	Accept	Accept	Accept
O11	Accept	Remove	Remove	Remove	Remove	Remove
S1	Accept	Accept	Accept	Accept	Accept	Accept
S2	Accept	Accept	Accept	Accept	Accept	Accept
S3	Accept	Accept	Accept	Accept	Accept	Accept
S4	Accept	Accept	Accept	Accept	Accept	Accept
S5	Accept	Accept	Accept	Remove	Remove	Remove
S6	Accept	Accept	Accept	Accept	Accept	Accept
S7	Accept	Accept	Accept	Remove	Remove	Remove
S8	Accept	Accept	Accept	Accept	Accept	Accept
S9	Accept	Accept	Accept	Accept	Accept	Accept
S10	Accept	Accept	Accept	Accept	Accept	Accept
S11	Accept	Accept	Accept	Accept	Accept	Accept
S12	Accept	Accept	Accept	Accept	Accept	Accept
S13	Accept	Accept	Accept	Accept	Accept	Accept
S14	Accept	Remove	Remove	Remove	Remove	Remove

The democratic selection process omitted 7 items; thus, the fifth method began with 47 items, and iterations of that method removed another 7 items. It can be observed that for the democratic selection process, items were unanimously removed or accepted in only 40 out of 54 items. For the remaining 54 items, one or two methods demonstrated discrepancies in determining item retention.

Of note, for 8 items, one or two of the four methods rejected the item, and three or two kept the items, suggesting these items may have been more "borderline" items than other, more accepted items. For example, item number P17 had two votes to be rejected and was kept by democratic selection, but was among the four items deleted during the EFA iterations on the democratically selected items in Method 5.

After item removal, the new KMO and Bartlett's Test, and the component matrix test results are presented to show the change of values. The new KMO and Bartlett's Test revealed an increase in factorability, while the component matrix displays that all remaining 40 items are loaded to the first construct with minimal and low cross-loadings.

The result revealed a KMO value of 0.915, and most of the loading factors were around 0.502 to 0.699, establishing a greater suitability of the remaining items. Additionally, the reliability coefficient of the final scale is $\alpha = 0.948$. These findings indicate that there are 40 items in the final version of the APOS-based mathematics mental structure.

Conclusion and Recommendation

The scale APOS-based mathematics mental structure was primarily developed to support studies on mathematics achievement and performance, and to add to the scales that measure a positive construct among students' mathematics proficiency. The scale that was created was determined to be reliable and valid. Only one component was discovered using exploratory factor analysis. With the extensive exploratory factor analysis, it is further suggested to use a framework to verify whether only one classification exists or can be reconstructed to Action-Process-Object-Schema factors using confirmatory factor analysis (CFA).

Further pilot testing is also encouraged, and tool refinement with the help of other experts. One of the study's limitations is that, although the scale may be applied to both secondary and postsecondary students, secondary students were not employed in the pilot testing. Nevertheless, additional reliability tests, further content validation (especially validation of experts in test/scale construction), and CFA can still be used for additional refining of this developed instrument.

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Declaration of Generative AI and AI-Assisted Technologies in the Writing Process

The author declares that Grammarly and QuillBot were used solely for proofreading, grammar correction, and language refinement to enhance clarity and accuracy. No other AI-assisted tools were employed in generating the manuscript's content. All ideas, research design, procedures, analyses, findings, and discussions are original and derived from the author's systematic conduct of the study.

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Appendix

APOS-Based Mathematics Mental Structure Scale

**Please provide the necessary information*

Instructions: Read each statement carefully. Place a ✓ mark on the choice corresponding to the degree of your agreement with the statement. Answer all items with honesty. There are four choices for each statement, which correspond to the following:

1 – Almost Always 2 – Often 3 – Rarely 4 – Almost Never

Statements	(*Check **one** box in each **row***)			
	Almost Always	**Often**	**Rarely**	**Almost Never**
ACTION				
1. After understanding the problem, I identify what given quantities there are and the unknowns to solve the problem.				
2. I try to figure out if the problem has already been discussed in class or not.				
3. I can identify what the given conditions are.				
4. I can describe a mathematical condition.				
5. I can analyze relevant data in a specific problem.				
6. I restate the problem in my own words.				
7. I usually search for hints in a problem.				
Process After obtaining the necessary information from the problem, …				
1. I determine what series of operations I should use.				
2. I solve step-by-step so that I can look back and know what I am doing.				
3. I look for patterns in the problem so I to solve it.				
4. I can apply current knowledge to solve a problem.				
5. I can propose a solution immediately.				
6. I can directly create a potential solution.				
7. I can easily identify the appropriate formula for the problem.				
8. I can mathematically think about a situation to solve a problem.				
9. I can easily pinpoint a unique method to solve a mathematical problem.				
10. I try to guess how it will work before I implement the solution.				
11. Before I start to solve the problem, I can make a near-correct estimate.				
12. I can easily test the solutions and think about the accuracy.				
13. I divide the problem into sub-problems.				
14. I put the given variables in the related equations.				
Object				
1. I can generate a written record of the way/s I think.				

2. I can find a solution to a mathematical problem by writing an equation.				
3. I can create a plan to solve the problem by drawing pictures/illustrations.				
4. I can make an answer to a mathematical problem with the use of current knowledge.				
5. I try to use a shortcut to solve a problem.				
6. I try to illustrate the problem so that I can understand it better.				
7. I use variables to represent quantities and solve for values.				
8. I focus more on the problem's solution by spending more time on the calculation.				
Schema				
1. I use assumptions in relation to my final solution.				
2. I can think of at least one way to begin to work on a problem that I have never seen before.				
3. I use my own strategies to solve the problem.				
4. I can create new techniques to solve a problem.				
5. I can evidently explain the process in the given situation.				
6. I check the answer to see if it is correct.				
7. I can create new, simpler problems that can be useful in solving the given problem.				
8. After finding an answer using one method, I use another method to confirm my answer.				
9. I associate the given problem with the real world to come up with practical ways to solve the problem.				
10. I manipulate the formula after determining what variables are missing.				
11. After I have solved the problem, I'll review what I have done for the solution, and I'll check the transactions before making a definitive judgment				

**********END**********

Against All Odds: Deskilling and Reskilling in the Face of Artificial Intelligence Redundancy Threats in Records Management and Archival Science

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Abstract

Ever since the Industrial Revolution began, machines have been replacing humans in numerous occupations and professions. Emerging technologies such as artificial intelligence (AI) are often regarded as disruptive, especially when one looks at how they impact human employment in different sectors of the economy. While it is true that machines are displacing humans from their jobs, there is a need to devise means and ways of preparing for the inevitable labour crisis. This study proposes upskilling and reskilling in records management and archival science as a way to circumvent the impending AI-induced deskilling labour crisis. The study is very useful to serving records management and archival science practitioners who often find it difficult to cope with change, resulting in them being rendered redundant and their many years of work experience washed down the drain. The study shows the importance of education and skills upgrade in records management and archival science for personnel to remain relevant in the midst of the AI revolution. Using Lewin's change management model, the study guides records and archives management practitioners to ride with the tide lest they are pushed off the pedestal. Data in this conceptual study are obtained from a systematic literature review of the Scopus and Google Scholar databases, focusing on sources published between 2021 and 2025. The query string involved the keywords: "deskilling AND reskilling AND AI job threats OR records management and archival science".

Keywords: artificial intelligence, job losses, deskilling, reskilling, skills, skills redundancy, upskilling

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Introduction

> As the professional environment continues to evolve, upskilling, reskilling, and mega-skilling have become essential strategies for workforce development. Upskilling enhances current capabilities, reskilling prepares employees for new roles, and mega-skilling integrates knowledge across disciplines to address complex challenges. (Ayinde et al., 2024, p. 3)

Ever since the dawn of the Industrial Revolution, machines have been replacing humans in many occupations and professions. Emerging technologies such as artificial intelligence (AI) are many times regarded as disruptive, especially when one looks at how they impact human employment in different sectors of the economy. Technological change, one of the major challenges of the 21st century (Schneider & Vipond, 2023), is the most divergent driver of labour-market change in the world today (World Economic Forum, 2025). While it is true that machines are displacing humans from their jobs, there is a need to devise means and ways of preparing for the inevitable labour crisis. This study proposes upskilling and reskilling in records management and archival science as a way to circumvent the impending labour crisis, where many work processes and procedures now centre around AI. AI, which is the replication of human intelligence by machines, has been defined differently by different scholars. For purposes of this study, the term refers to the use of intelligent robotic machines and AI-powered software and applications to manage records and archives (Modiba & Shekgola, 2024).

Records management is a discipline that specialises in managing documents and information, in paper, electronic, and audio-visual form. It is defined by Mohamed and Bunawan (2022) as the effective and systematic control of the creation, receipt, maintenance, use, and disposition of records that are either received or created in the conduct of business. Organisations must pursue the professional management of records to ensure accountability, transparency, decision-making, and to uphold the rights and obligations of various parties (Agu et al., 2022). Important records of enduring value become the archives of the organisation or country. Archives, unlike records, are permanently preserved for future use and reference. Records and archives organisations have evolved from manual record systems to automated systems, including the trending AI technology. Thus, like any other current organisation, records offices, records centres, and archival centres are using various AI technologies in their work (Modiba, 2022). The rate of use and the magnitude of AI application in records and archives management are rendering traditional records and archival skills obsolete, and this is the basis on which this study is set. The study is very useful to serving records management and archival science practitioners who often find it difficult to cope with change, resulting in them being rendered redundant and their many years of work experience washed down the drain. The study highlights the importance of education and skills upgrades in records and archives management for personnel to remain relevant amid the AI revolution.

Objectives of the Study

1) To identify AI-induced deskilling threats in the records management discipline.
2) To propose upskilling and reskilling as strategies to fend off current and future employment threats in the records management discipline.

Research Problem

While a lot of literature has been published on the impact of AI on employment in many sectors of the economy (Jayes & Schneider, 2022; Rafner et al., 2021; Sun, 2024; World Economic Forum, 2025), little has been published on the impact of AI in records management, and more so, on mitigation measures to save humans from job redundancy in the field of records management. The few studies that have focused on AI and records management, such as Jaillant and Rees (2022), Modiba (2022), and Modiba and Shekgola (2024), have tended to focus on the role and application of AI in records management, and scantly touched on the impact of such technology on the workforce and possible remedies in the new era. This study seeks to fill such a gap and complements the efforts of scholars, such as Hernández and Rockembach (2025), who have begun addressing means and ways of making records management and other information professionals remain relevant in the age of technological advances such as AI, robotics, and quantum computing. The transition from the 4th to the 5th Industrial Revolution has resulted in the dawn of newer and more complicated technology that calls for both upskilling and reskilling, lest machines take over jobs that used to be the preserve of humans. Ayinde et al. (2024) aver that there has been limited exploration of the impact of the transition from the 4th to the 5th Industrial Revolution on information professionals due to technological shifts, as well as of the possible remedies to avert the impending human resources disaster.

Conceptual Framework

This study is informed by Lewin's change management model. In 947, Kurt Lewin introduced the change management model, which comprises three stages: unfreeze, change, and refreeze. Lewin came up with this model after observing change unfolding during the mid-19th century and averred that there was supposed to be a model that guides people, organisations, and countries as they transition in relation to change within their environments. In the first stage of the change process, which he referred to as the unfreeze stage, people begin to realise that there is a need for change and to let go old habits, and embrace an array of possibilities to deal with the new situation (Majka, 2024). They weigh the merits and demerits of change. Lewin referred to the exercise as the force field analysis (Connelly, 2020). If change is seen as imminent and desirable, the transition process gets to the second stage, the "change" stage. Majka (2024) states that during the change stage, people and organisations practically undertake steps that transform the organisation from its current state to the envisioned future. Action is called for at this stage, and this may include, among other things, learning, training, coaching, and mentorship (Connelly, 2020). Once new skills are acquired through some form of training, there is a need to reinforce behaviour so that people and organisations operate according to the new and desired way. Lewin calls the third transitional stage "refreezing". New skills, organisational culture, and operational frameworks are solidified, routinised and reinforced (Majka, 2024).

The model applies to this study where technological changes in records management are inevitable. As the discipline moves from the 4th Industrial Revolution's automated records management systems to the 5th Industrial Revolution AI-based records management system, there is a need for the adoption of a model to guide the change process. Lewin's change process helps people and organisations to unfreeze their skills as the industry deskills. This prepares the ground for them to be ready for change by engaging in action-oriented activities, such as acquiring improved and new skills through workshops, short courses, mentoring, online

courses, blended courses, and university courses. Such training either improves the skills of records managers (upskilling) or inculcates new skills (reskilling) in them.

Methodology

The researcher employed a qualitative, systematic literature review-driven method, utilising a change management conceptual framework to explore means and ways of mitigating AI-induced skills redundancy threats in records and archives management. A total of 25 Scopus and Google Scholar database documents were reviewed. Amongst them were journal articles, book chapters, and conference proceedings. The search query string involved the keywords: "deskilling AND reskilling AND AI job threats OR records management and archival science". The use of the Boolean operator "OR", as indicated above, yielded many documents as opposed to the use of "AND records management and archival science", which yielded very few documents. As a result, many documents from different disciplines were found. After reading the abstracts of the documents, many were discarded due to thematic misalignment, resulting in the two database searches yielding 25 papers that focused on the research problem of the study. The search was restricted to sources in the English language and published between 2021 and 2025. Scopus and Google Scholar databases' sources are renowned for their rigorous peer-review process, making them very reliable sources of information and knowledge. Issues of skills upgrades and reskilling as a panacea to deskilling with the advent of emerging technologies, such as AI, are recent phenomena, making it important to rely on more recent sources. Data were analysed thematically in line with the two objectives of the study.

Deskilling as a Cause of AI-Redundant Threats in the Records Management Discipline

One challenge that affects the field of records management today is deskilling, a phenomenon characteristic of the 4th and 5th Industrial Revolutions (Bossen & Naja, 2025; Minardi, 2022). Deskilling refers to workers' loss of professional skills due to technological or work practice changes (Rafner et al., 2021). Deskilling occurs when some skills become redundant, a phenomenon caused by, among other developments, automation, outsourcing, offshoring, and the implementation of cost-cutting measures (Adepoju & Esan, 2023). It should be noted that while earlier technology enhanced work processes conducted by humans, AI technology is replacing and displacing the very humans that it is supposed to help. In the context of this study, deskilling in records management comes as a result of automation, where several AI technologies are roped in to replace or work alongside humans in conducting business.

AI is now widely used in records management. For example, machine learning is used in records management to analyse large data sets and make predictions faster and more accurately than humans (Adepoju & Esan, 2023). Colavizza et al. (2021) define machine learning as computer programmes that learn from data. Among other things, machine learning is used for data extraction, indexing, searching, retrieval, and disposal. Omigie et al. (2023) single out machine learning as one AI technology that has caused a lot of concern about the future of work, as it is displacing humans from their jobs. Another AI technology, natural language processing, is used in processes such as text generation, transcription and translation (Hernández & Rockembach, 2025). Robots, which are also part of AI technologies, are used to share and distribute paper-based records within an organisation or in a records or archival centre. Theodotou (2023) adds to the list of AI technologies, deep learning, and robotic process automation as AI technologies that are instrumental in enhancing records and archives management activities. AI can be used to perform almost all records management activities, for example, records creation, classification, filing, storage, retrieval, and disposal (Thabakgolo

& Mosweu, 2025). This is supported by scholars such as Colavizza et al. (2021) and Jaillant and Rees (2022), who state that AI is instrumental in automating archival workflows around the "capture" and "organise" dimensions of the records continuum theory, while Modiba (2022) avers that it is applicable throughout the records life cycle. This has resulted in some records management professionals losing jobs as machines are taking over many work processes. In showing the negative effects of deskilling due to automation, some Danish physicians label the phenomenon "destructive digitalisation" (Bossen & Naja, 2025, 3).

Deskilling is unstoppable because most jobs are increasingly becoming automatable. Schneider and Vipond (2023) give the example of jobs in the United States of America, where they found that 47% of jobs are automatable. The records management and archival science discipline is not immune to such developments and eventualities, making it important for them to consider upskilling and reskilling to save themselves from the impending labour crisis. Many factors drive skills disruption in the 4th and 5th Industrial Revolutions. According to the World Economic Forum (2025), the five drivers are technological change, geoeconomic fragmentation, green transition, demographic shifts, and economic uncertainty. Adepoju and Esan (2023) hold that 4th Industrial Revolution technologies, such as AI and robotics, are the leading causes of deskilling because of their economy, efficiency, and effectiveness in accomplishing tasks. With deskilling comes reduced labour costs, increased efficiency, and improved product quality (Adepoju & Esan, 2023). Thabakgolo and Mosweu (2025) add to the list business efficacy and streamlining business operations as benefits of deskilling, where humans are gradually replaced by machines and other digital technologies. Raghunath (2021) argues that technological skills are continuously changing and, as a result, no one is safe from job redundancy in the 4th and 5th Industrial Revolutions. He firmly points out that no human is permanently tech-savvy, making it important for all humans to upgrade their skills or acquire new ones. This includes millennials (born between the 1980s and the 1990s) and Generation Z, or zoomers (born between 1997 and 2012),), the renowned technologically-savvy age group.

The World Economic Forum's Global Skills Taxonomy, published in 2025, indicates that the world average for skill disruption by 2030 stands at 39% and amongst the countries to be affected are Zimbabwe at 48%, the United Arab Emirates (41%), Canada (38%), the United States of America (35%), China (34%), France (33%) and Denmark (33%) (World Economic Forum, 2025). Amongst the new upcoming skills by 2030 are AI and big data, networks and cybersecurity, technological literacy, creative thinking, resilience, flexibility, and agility. The World Economic Forum (2025) holds that AI is likely to make 9 million redundant jobs and, at the same time, create 11 million jobs. The creation of jobs because of AI is affirmed by Omigie, Krubu, and Anthony (2023), who predicted that AI is set to create 2.8 million jobs in Nigeria by 2030. This is further supported by Schneider and Vipond (2023), who hold that during the last 200 years, despite technological changes, more new jobs have been created than lost. However, to achieve this, employees should upskill and/ or reskill to be able to fit into the new skills realm. Table 1 below shows potential new general and records management-specific job roles that are likely to be created by the AI revolution in the next few years.

Table 1
Potential New General and Specific Job Roles Created by the AI Revolution

No.	Possible new general roles created by the AI revolution	Possible new records management roles created by the AI revolution
1	Natural Language Processing (NLP) Specialist	AI Trainer or Model Specialist
2	AI Ethics Consultant / AI Ethicist	Intelligent Enterprise Content Management Analyst
3	Responsible AI & People Governance Manager	AI Metadata Manager
4	AI Policy Analyst	Predictive Records Lifecycle Analyst
5	AI Productivity Coach	AI Computational Archivist
6	Human-AI Interaction Designer	AI Metadata Architect
7	Machine Learning Engineer	Digital Archival Search Engineer
8	AI Strategy Consultant /	AI Audit and Compliance Officer
9	AI Product Manager	AI Records/Information Governance Specialist
10	AI Sustainability Analyst	AI Support & Integration Analyst

Lewin's change management model was used to inform this study. The deskilling stage in the records management industry is akin to Lewin's unfreezing stage. With deskilling, workers lose professional skills as upgraded or new technology is introduced. At this stage, workers need to ride with the tide and deskill as well, by letting go of old skills (unfreezing) to make room for the acquisition of new skills. In records management, paper records management skills, such as manual records filing, manual records classification, and manual records appraisal, should be discarded as records management professionals set the stage to embrace new AI-based skills, such as robotic process automation (for electronic filing and classification), as well as machine learning and deep learning (for electronic records appraisal). Automated processes, such as computer-based or electronic documents and records management system-based records creation, filing, classification, and disposal, should also be deskilled as AI technology becomes widely used in records management. This makes it necessary for records management professionals to let go of old, automated skills to make room for new AI records management skills. This is equivalent to Lewin's unfreezing stage. Workers' deskilling does not necessarily mean that they actually eradicate and forget the old skills, but metaphorically implies removing an unnecessary set of skills from their mind and hands to make space for new AI skills.

Upskilling as a Measure to Circumvent AI-Induced Employment Threats in Records Management and Archival Science

As new technologies are introduced in records management, employees need to acquire new skills to remain relevant in their current and future roles, chief among which are AI skills. This is supported by Sikhakhane (2025), who avers that records professionals require appropriate skills to effectively use AI to enhance the records management tasks, and this can be achieved through upskilling and reskilling in AI and other current disruptive technologies. At the same

time, Jaillant and Rees (2022) highlight that insufficient skills are a huge barrier to AI implementation in records management and archival science. In the context of this study, skills are specific technical and non-technical competencies and specialised knowledge that humans should possess to work effectively with AI technologies and systems (ARISA, 2023). Theodotou (2023) also views skills as learned abilities that enable humans to achieve predetermined results with high levels of certainty and precision. Thus, he holds that organisations should invest resources in AI upskilling and reskilling, or else humans would be gradually displaced from their jobs now and in the future.

Skills upgrades can be partly achieved through upskilling. Upskilling refers to the acquisition of broader, and higher-level skills to cope with changes in technology (Rafner et al., 2021). For example, records managers who used to classify records in Microsoft Excel need new training to pass on the job to robotic process automation, an AI technology that can be used to perform routine and repetitive processes such as records classification, filing, and inventoring. There is an upgrade of skills from being computer literate in Microsoft packages to being literate in AI technologies and packages. This implies that humans from time to time need to align themselves with technologies to remain relevant, a regrettable situation that makes them slaves of and to technology. Commenting on this scenario, Krook (2025, 1) asserts that, “The biggest threat to humanity is therefore not that machines will become more like humans, but that humans will become more like machines”. He thus labels humans in the present and future as happy slaves of technology.

Upskilling is mostly prevalent during the transition from the 4th Industrial Revolution to the 5th Industrial Revolution. According to Ayinde et al. (2024), while the 4th Industrial Revolution focuses on automation, the 5th Industrial Revolution focuses on the integration of advanced technologies with human creativity and expertise, inclusive of human-computer interaction. Thus, with upskilling, records managers do not necessarily need a set of new skills, but an upgrade and broadening of the same to be equal to the new technological demands of their day.

Reskilling as a Measure to Circumvent AI-Induced Employment Threats in Records Management and Archival Science

Reskilling is the process of training workers to acquire new skills that are required for new and different roles, in line with technological changes that make some roles obsolete (Ayinde et al., 2024). Reskilling and upskilling are sometimes used interchangeably. For example, Adepoju and Esan (2023) define reskilling as the acquisition of new skills or the upgrading of old skills to perform new roles. This study considers them as different, with upskilling referring to the enhancement of current capabilities, and reskilling referring to the acquisition of new skills for new roles in line with the technological demands of the day. Reskilling is one thing that organisations need to embrace in their strategic plans because, as previously pointed out, deskilling is the reality of life, making the acquisition of new skills mandatory. Adepoju and Esan (2023) state that reskilling is inevitable due to technological advancements, the need to cut production costs, and the need to remain competitive in the industry. Records managers need to ride with the tide so that they are not left behind. For example, records management professionals need new skills to train AI algorithms, to understand AI technologies, and to collaborate with AI technologies in conducting records management duties. This set of skills depends on the programmed level of human involvement in how machines are set to work, among which are human in the loop (HITL), human on the loop (HOTL), and human out of the loop (HOOTL).

HITL involves humans planning, executing, and evaluating the work that machines carry out, making it necessary to retain a few people to interact with machines (Rafner et al., 2021). A few records management professionals may have to be retained in order to train AI algorithms, plan, design, and evaluate the work that various AI technologies conduct. This may include prioritising which records are to be appraised first and which ones are to be transferred for permanent preservation first. The evaluation of the effectiveness of a natural language processing translator is best conducted by humans, who then make recommendations to maintain or improve how the technology works. AI technology has been accused of lacking ethical norms (Modiba, 2022; Thabakgolo & Mosweu, 2025). Humans may have to be in the loop to determine the ethical status of AI technologies and decide what to do with them in line with the ethical expectations of society. HOTL is not very different from HITL, as both scenarios involve human involvement in machine operations. However, in HOTL, humans play the role of monitoring as they only check the outcome of the process (Rafner et al., 2021). In HOOTL, humans are not involved at all in the way machines work, as machines complete transactions without human intervention (Rafner et al., 2021). The first two scenarios, HITL and HOTL, go a long way in enhancing human-machine interaction, where some humans retain their jobs, but with new skills acquired to be able to meaningfully interact with the machines. Thus, with relevant training, some humans retain their jobs as they interact with machines or as they work collaboratively with them. Added to them are newly skilled records management professionals who would be ready to take up completely new job roles brought about by AI, as explained below.

In reskilling, both technical and non-technical skills are required. AI technical skills in records management may include technical aspects such as algorithmic training and machine learning, while non-technical skills, which ARISA (2023) refers to as soft skills, may include support roles such as ethical control, regulatory control, quality control, and problem solving. The duration of training depends on the nature of the skill in question. ARISA (2023) points out that AI technical skills require longer and in-depth training than non-technical skills. Thus, AI roles such as AI training and machine learning engineering may need long college or university courses, while non-technical skills such as AI ethics, records management, and AI records management legal compliance may be done as short training courses through workshops and mentoring. The guiding principle should be an AI skills intelligence audit where a needs assessment is first conducted before the nature and duration of training can be determined. This is affirmed by Mugwambi and Mutsagondo (2024), who hold that assessing employees' training needs is a necessary condition for there to be productivity, efficiency, and effectiveness.

Adepoju and Esan (2023) opine that organisations should conduct regular skills assessments where they identify skills that have become obsolete and go on to implement training programmes that meet the new needs of the job. They hold that the training should, among other things, involve coaching and mentoring, especially as employees prepare for new organisational roles. Reskilling and upskilling can be effected by training employees in both hard and soft skills in line with the strategic direction of the organisation, as well as in response to environmental forces at play, amongst which are technology, social, and economic forces (Ayinde et al., 2024). Adepoju and Esan (2023) add that new general training is required in digital literacy, data analysis, programming, cybersecurity, human resources, software analytics, emotional intelligence, and critical thinking, where new technical skills, soft skills, and new knowledge are acquired. Reskilling is one thing that organisations need to embrace in their strategic plans because, as previously pointed out, deskilling is the reality of life, making the acquisition of new skills mandatory. Adepoju and Esan (2023) state that reskilling is

inevitable due to technological advancements, the need to cut production costs, and the need to remain competitive in the industry.

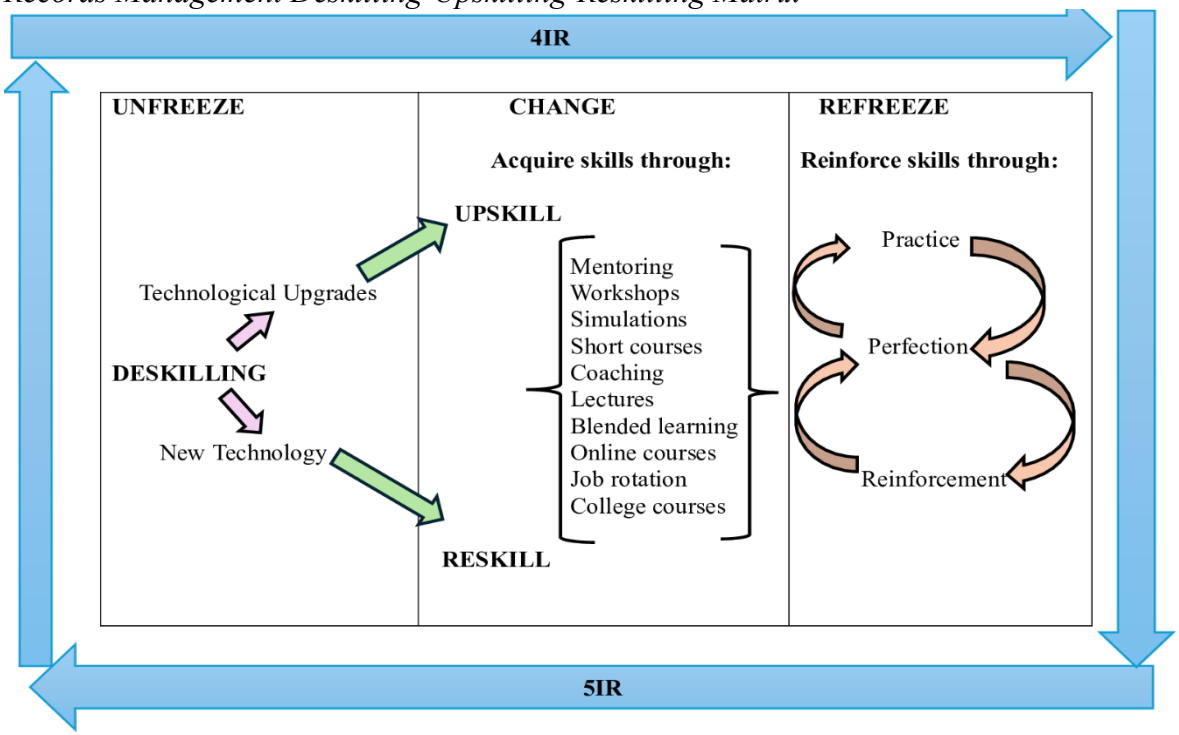
As shown in Table 1, a wide array of skills is required for records management professionals to operate at an optimal level. Ayinde et al. (2024) refer to this skill acquisition and development as mega-skilling. They define mega-skilling as a holistic approach to skill development where humans integrate knowledge and expertise from multiple fields and disciplines, including technology, ethics, and strategic management. For example, with mega-skills, records management professionals can train AI models, assess their ethical conduct, assess their regulatory frameworks, and engage in strategic management activities. This implies that while upskilling and reskilling are important, mega-skilling is even more important. As such, training for records management professionals should be broad-based, all-inclusive, and holistic as opposed to narrow-based, restricted, and fragmentary in nature. Mega skills can be acquired through workshops, seminars, online learning, hybrid learning, and even college or university courses.

Upskilling and reskilling involve a change process where records management professionals undergo training to meet the new demands of their jobs. This stage is equivalent to Lewin's change stage, where Majka (2020) states that at the change stage, people should practically transform from their current to envisioned state through different forms of training, such as learning, adaptation, training, coaching, and mentorship. Upskilling is a change that caters to technological upgrades, for example, from computerised and records management systems to AI-based records management systems. Reskilling is a change that caters to the emergence of new technology and new roles, where records management professionals need a new set of skills to effectively and efficiently apply themselves in new AI-based roles.

Once upgraded and new skills are acquired, there is a need to reinforce these skills so that they become deeply entrenched in employees. According to Lewin, in the third stage of the change management model, which he calls refreezing, new skills should be solidified and reinforced (Majka, 2024). There is a need for records management professionals to reinforce AI records management skills, such as AI model training, AI metadata analysis, and AI records management auditing, through continuous practice, perfection, and reinforcement, and through repeated practice to make the newly acquired skills deeply entrenched and embedded. In short, it should be realised that the acquisition of upgraded and new skills without their reinforcement is not enough. This makes it important to rope in Lewin's change management model in records management upskilling and reskilling. Figure 1 below is an illustrative summary of how Lewin's model can be used in enhancing upskilling, reskilling and mega-skilling to avoid AI-induced job redundancy in records and archives management within the context of the Fourth and Fifth Industrial Revolutions.

Figure 1

Records Management Deskilling-Upskilling-Reskilling Matrix



Conclusion

This study has shown that deskilling is a reality of life. It has affected records management, as the discipline has evolved from manual to automated and to AI systems. With upskilling and reskilling, skills disruption or deskilling does not necessarily result in unemployment since the acquisition of upgraded and new skills prepares employees for upgraded and new roles. As a result, in addition to working with machines or alongside machines, records management professionals are capable of assuming new roles, such as AI model training, AI ethics consulting, AI metadata architecture, and AI records governance. The failure to upskill and reskill leads to skills redundancy in records management, as the above-stated roles cannot be held by traditionally trained records management professionals. Lewin's change management model helps to reinforce the deskilling, upskilling, and reskilling matrix in records management, as his unfreeze, change, and refreeze stages speak to the deskilling, upskilling, and reskilling scenarios discussed in this study.

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A Reading Model in Positive Discourse Analysis of World Literature for Sustainable Peacebuilding

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Abstract

In a world ridden with "direct, structural and cultural violence" (Galtung & Fischer, 1973), education's role in alleviating conflict has never been more critical. Peace education offers a systemic-systematic pathway to engage in sustainable ways of transforming individuals into ethical inhabitants of a strained planet. This paper delineates the way Positive Discourse Analysis (PDA) of world literature can enable Critical Peace Education (CPE) as curricular-pedagogical praxis. Literary humanistic inquiry presents a powerful approach to peacebuilding by fostering affective, ideological and ethical engagement with the realities around us through its multidimensional representation of conflict. Strengthening critical reading and interpretive competences enables holistic evidence-based interrogation of structural and cultural conflicts. World literature, characterised by globalisation and cosmopolitanism (Damrosch, 2003), organically disrupts generalised discourses on conflict and peace, emphasising their multicultural, multiethnic and pluralistic episteme through commentaries. Reading world literature therefore builds ethico-political intercultural competence and global citizenship, with PDA offering a "counter-hegemonic" pedagogical pathway to create discerning readers of the world through the word (Freire & Slover, 1983). Situating the disciplinary focus of peacebuilding within world literature, I present a reading model with PDA as an interpretive methodology to achieve CPE in adaptive, locally sensitive ways, mapping it to Monisha Bajaj's four coordinates of CPE that build idealistic-ideological-politicisational-intellectual competencies (Haavelsrud, as cited in Bajaj, 2008). I conclude with a reading model based on PDA for CPE and comment on the normative, aesthetic and ideological pathways as three interconnected aspects that reading world literature can achieve as a pedagogy of peace.

Keywords: world literature, critical peace education, positive discourse analysis, peacebuilding

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Introduction

Peace studies as an academic discipline emerged in the wake of the second World War, with an emphasis on understanding war, disarmament and armed conflict. Subsequently, the discipline has expanded in its scope to a consideration of peace in civil society, tapping into discourses of human rights, justice and sustainability. Education is one of the tools to ensure sustainable peacebuilding. In this paper, I outline select theoretical frameworks that can shape the understanding of peace, focusing in particular on two peace theorists who laid the foundations of the discipline. I then discuss the imagination of critical peace education as a praxis that is informed by the philosophy of these theorists. This is advanced to a specific discussion in the literary humanities and Positive Discourse Analysis (PDA) as a critical reading model that can be mobilised in the (world literature) classroom for interpretation of literary works as a peacebuilding praxis. I conclude by reflecting on the value of this praxis for sustainable peacebuilding.

Understanding Peace and Peacebuilding

Peace studies as a field of inquiry has its formal origins in the work and praxis of the Norwegian, Johan Galtung, who systematically theorised on the typologies of violence and proposed models and tools for promoting peace. Galtung's formulations placed the typologies of peace and conflict under three broad categories – "direct", "structural" and "cultural" (Galtung & Fischer, 1973, pp. 35–36). For Galtung, these categories helped to construct a negative peace, which was seen as an absence of conflict. Galtung proposed, though, that a more sustainable approach was that of positive peace built on principles of dialogue that are proactive and constructive rather than preventive, in order to foster harmony.

Understanding the types of violence and conflict is important in visualising positive peace. Direct conflict, for Galtung, involves armed repression, killing, maiming and other acts of destruction that are visible and reprehensible. Structural violence, by contrast, comes with ideological control and exploitation, fragmentation, segregation and penetration, where civic bodies, socio-cultural structures of knowledge, and truth frameworks channelise and control human life. Cultural violence, for Galtung, is the most subtle and the most pervasive because it works through social and cultural systems, beliefs and worldviews. Cultural violence is hegemonic and therefore requires a continuous critical engagement for its redressal (Galtung & Fischer, 1973). Possibilities of peace, social and ecological justice are most feasible when they address cultural violence and conflict to envision sustainable solutions that transform thoughts, beliefs, identities and dispositions. Galtung developed several tools that, as a diplomat, he used to negotiate (armed) conflict between parties at diplomatic levels, the most notable being the TRANSCEND approach. He identified communication as a critical tool for ensuring long term sustainable peace, which, he claimed, is impossible to achieve in the event of a breakdown of communication. Keeping channels of dialogue open and alive, alone, can ensure sustained peace and harmony.

The emphasis on cultural conflict and communication was highlighted by Betty Reardon as well, who, like Galtung, worked towards defining, contextualising and enabling long term peace. Reardon's work evolved in the specific context of gender and human rights. Reardon emphasised ways of empowering women to deal with conflict of various kinds, the most debilitating being cultural conflict within patriarchy. For Reardon, it was imperative to view peace as the preservation of human dignity, agency and empowerment that are essential human rights. Her development of a 7R model – Reflection/Reflective Listening, Responsibility (for

and to), Risk taking (risk perceptions of how we live and perceive ourselves and the world), Reconciliation, Recovery, Reconstruction (envisioning, imaging modeling) and Reverence – was an output of this belief where each R informs human action and can lead to respect and reverence for life in all forms (Reardon & Snauwaert, 2015). This emphasis on agency and empowerment guided by ethical standpoints takes on additional significance within discourses on peacebuilding, a concept that Galtung proposed in the context of diplomatic and international relations to contain (armed) conflict. Peacekeeping, peacemaking and peacebuilding emerge as three arms along which conflict can be countered (Galtung & Fischer, 1973). Of these, peacekeeping and peacemaking carry notes of prevention and protection, while peacebuilding carries an implicit message of collaboration, positive peace and agency that is organically derived from sites of conflict. Peacebuilding as a discourse presents possibilities for imagining and mobilising action that is community-based and community-driven. Along a spectrum of strategies for peacebuilding that include armed interventions to curb direct violence at one end of the spectrum, to dialogue and mediation at the other end, the most desirable peacebuilding praxis is communication. Communication has the potential to negotiate, identify points of discord and address them continually. Peacebuilding then posits the achievement of peace as a process, rather than viewing it as a product, and emphasises communities taking ownership of peacebuilding that would be adaptable to their needs and realities (Coning, 2018).

In recent years, peace studies and peacebuilding has expanded in scope, informed by movements in academia on critical race and ethnicity, critical gender, globalisation, new aesthetics, critical media and more recently, the environmental humanities. These theories focus on systems and structures of control, regulation and oppression that eschew agency and outline the many ways in which individuals/groups are targets of oppression, violence and conflict. Identity, spatio-temporal positioning, nationalities and socio-economic cultural orientations become some ways in which structural and cultural violence manifest, which critical theories unpack systematically. Peace studies has, therefore, taken on a modification in its nomenclature, adopting “critical” peace as its new direction. The critical aspect, in its turn, focuses on interrogating construction of truths and power that play out through political discourses, and repositioning human subjectivities and standpoints. There is, then, a need for sustained “difficult dialogues” (Trifonas & Wright, 2013, xv) on the constantly evolving and morphing forms of conflict in everyday experience that become the core of effective communication for peacebuilding. It is within this context that education has a central role to play in sustainable peacebuilding.

Critical Peace Education

Scholar and peace educator Monisha Bajaj’s theorising about critical peace education offers a pertinent lens to understand and visualise the role of education for sustainable and “adaptive peacebuilding” (Coning, 2018). Critical peace education, for Bajaj, must create awareness of socio-cultural inequities and sensitise us to the many ways in which they create hierarchical structures of power and control. Bajaj cites four approaches to peace education – the idealistic, the intellectual, the ideological and the politicisational – that lend different dimensions to its praxis. The idealistic works with theories of the ought, where the emphasis of study is on universal notions to problems and solutions rather than their societal transactions. The intellectual approach looks at an academic study of peace to build knowledge among learners. The ideological approach is rooted in a neo-Marxist perspective to schooling, where educational spaces are seen as sites for reproducing dominant ideologies. The fourth politicisation approach believes that education has a role to play in transforming reality and

building peace through concrete action (Haavelsrud, as cited in Bajaj, 2008). Although the approaches signpost different pathways to peacebuilding, Bajaj indicates the way critical peace education enables a critical construction, reflection and dissemination of knowledge about societies and cultures. Critical peace education, as praxis, is an intentional act that can enable sustainable societies by knowledge building, working with learners, critiquing curricular and educational aims and goals and approaching schools as Althusserian ISAs. Critical peace education is therefore aptly positioned to interrogate structures of knowledge and control by fostering critical dispositions in learners towards their surroundings and supporting difficult dialogues around direct, structural and cultural violence. These difficult dialogues would entail honest engagement with issues of conflict to better understand systems of power and control. It is within this context that we can locate the teaching and learning of literature as a site of peacebuilding.

Literature and Critical Peace Education

As a core discipline in the humanities, literary studies address all four approaches to critical peace education articulated by Bajaj. Good literary works are aesthetic pieces and works of art that comment critically on social and cultural structures, present normative frameworks, hold mirrors up to society and offer philosophical reflections on states of being (Showalter, 2003). While late 19th and early 20th century liberal humanist traditions in literary studies held it as canons and moral lodestones in culture, the influence of critical theory on the literary humanities from the 1990s enabled interdisciplinarity, highlighting the instability of language and identities, and the fluid and political nature of reality (Barry, 2009). The turn of the century, in the meantime, re-introduced affect as an integral part of literary studies that negotiates ideological critique with empathy and critical feeling (di Leo, 2023; Reber, 2016). Literary humanities then occupy a unique position of connection with readers because of their aesthetic and ideological qualities (Showalter, 2003). As communicative discourses in multimodal forms and genres, literature captures everyday experiences through creative expression. It "defamiliari[zes]" (Shklovsky, 1917, p. 16) the ordinary by aestheticising social and cultural experiences, making us view our daily lives with a fresh eye. Good literary works are structured around conflicts that place actions and enactment within critical perspectives. Thematically, literary works address a range of issues and contexts, which include postcolonial experiences, gender and queer theory, globalisation, neo imperialism, climate change, ecology and cultural studies (di Leo, 2023). Reading and teaching literature then has a powerful impact on not merely building ideal worlds as utopias but also constructing intellectual commentary, ideological reflections and ethical standpoints that function dialogically to reflect on the imperfect realities we inhabit. Feminist and literary critic Elaine Showalter has proposed in this regard that literature bears the moral responsibility of helping us cope during dark times and navigating discourses around difficult themes like war, death, self harm, violence etc. (Showalter, 2003) Good literature is non-didactic and teaches tolerance, acceptance, respect for human and environmental rights and resilience that become values integral to fostering long term peace. Within the context of (critical) curriculum studies, these can be mobilised through the choice of content, pedagogical praxis, dialogue and self exploration within the classroom (Malewski, 2010).

The notion of representationalism is a significant element to factor in this argument. Representation works with several meanings simultaneously. One understanding of representation is to stand in, or substitute for something. This is often accompanied by political connotations, wherein a representative "speaks" for another. A consequence of this stand-in is that the resulting "representation" is both reliable and partial. As a stand-in, the representative

speaks with authority for the substitute but also presents a shadow of a perspective because it is a mirroring or reflection of the original experience. A second related meaning shows representation as a re-presentation. In this scenario, the re-presentation can be a transformed version of reality or perspective. The causes for this re-presentation could be aesthetic or ideological. It however works with the self-consciousness that it is a reflection and transformed depiction of reality and therefore makes no claims to factuality. A final perspective that representation embodies is that it shows, rather than tells, us about reality. This presentation, borrowing from visual discourse, operates as a visualising technique to help us get an image of the canvas of ideas.

These ideas find echoes in concurrent formulations of world literature that offer a robust entrypoint into the convergence of these perspectives in a literature classroom. World literature as theorised by David Damrosch in his earliest formulations lists it as a discourse and a methodology. As a discourse, world literature evokes principles of cosmopolitanism, based on syncretism, plurality and polyphony that aspire for inclusivity (Damrosch, 2003). As a methodology, world literature constructs a way of reading and meaning making that brings together translations across space, time and culture. In contexts of syncretism, polyphony and plurality, however, conflict between perspectives becomes inevitable. World literature is then a principled approach to engaging with the world, its social and cultural realities, and the conflicts that arise therein through their creative representations. World literature also creates space for connecting values and realities across cultures, recognising comparable elements alongside their divergent means of unfolding representations. Reading (about) cultures implies a critical engagement with processes, ideological and hegemonic structures, and the corresponding conflicts that emerge with diversity and heterogeneity. In its scope, reading world literature offers a potential pathway to better understand structural and cultural aspects of violence/conflict through their thematic and representational aspects that are pluralistic, discursive and contextualised in experience.

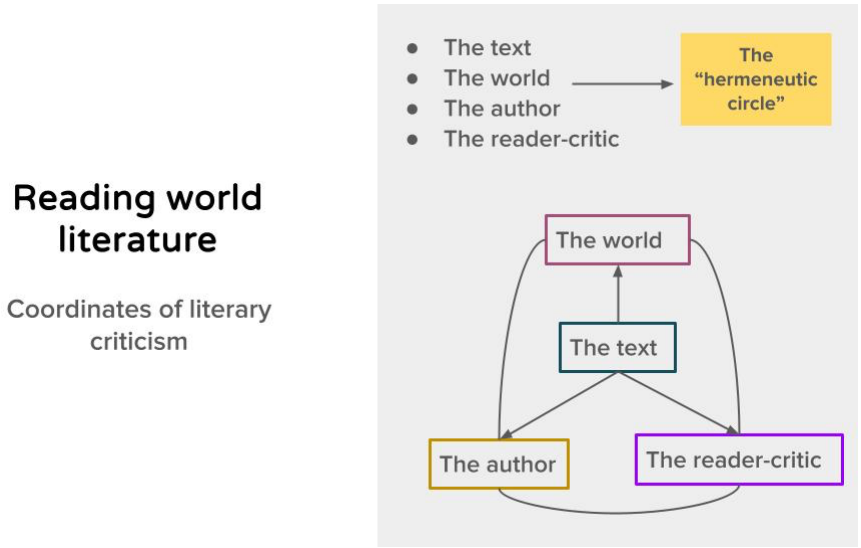
Models for Supporting Peace Education: The Hermeneutic Circle and Positive Discourse Analysis (PDA)

Several models of meaning-making exist across multidisciplinary domains that address some of the objectives of peace education in their distinct ways. In this section, I source two such models from the literary and critical humanities that talk to the needs of critical peace within educational contexts. I then present a synthesised model that captures the core elements of each practice that can promote an evidence-based reading process for peace education. This model is also refined through this author's own practice of using these reading models in her classroom over the last decade as a humanities, language and literature educator.

The Hermeneutic Circle

The figure below presents the coordinates of literary criticism proposed by M. H. Abrams in *The Mirror and the Lamp* (1953) and that remains a popular reading model in literary studies.

Figure 1
The Hermeneutic Circle – M. H. Abrams' Coordinates of Literary Criticism



The four coordinates depict one form of reading that draws from established traditions of literary criticism. The central coordinate – the text – is the heart of the reading process. Close reading of texts draws on Russian Formalist traditions of stylistic analysis as well as the New Criticism and formalist traditions of reading. These traditions proposed that meaning resides within the words on the page and they considered speculative interpretation and reading beyond the work fallacious acts of meaning making. Engaging with the prose, poetic components and structural elements of the text is sufficient to infer the meaning of the work. The latter half of the 20th century however presented other ways of reading, influenced by postmodernist philosophies, critical theories and cultural studies, thereby adding new dimensions to the idea of the text as a mirror/*mimesis* of the world as originally framed by Abrams. Contextual reading arose through a recognition of the universe or world as a source of theme as well as the material site of production, circulation, consumption and interpretation of the text. Good literary works are structured around conflicts that place actions and enactment within critical perspectives that are historically and culturally determined (Veeser, 1994). Thematically, literary works address a range of issues and contexts, which include postcolonial experiences, gender and queer theory, globalisation, neo imperialism, climate change, ecology and cultural studies (di Leo, 2023). The contextual framing highlights these aspects in the act of reading the work, adding new dimensions of understanding to the positioning of the work as commentaries, judgments, evaluations or ironic reflections of/on the universe (Anker & Felski, 2017; Chatman, 1978). The author as the third coordinate enables us to situate them as creative beings as well as ideologues who have something to communicate. Reading texts within the larger body of works by the author allows for engagement with writerly discourse, their styles, their thoughts and their positionality with respect to the themes they write about. A similar approach to the reader-audience as a critic allows us to view reading as a reflective act and the audience (which is us) also as approaching the text through pre-established presentist standpoints. In the two latter instances, there is the danger of bias, but reader-response and presentism requires us to be aware of these biases and read the text with critical awareness of our preconceived notions. Constantly revisiting the text and context to reassess authorial and audience standpoints enables a systematic self-reflexive and evidence-based mode of reading.

Reading through the hermeneutic circle is, thereby, a recursive dialogic one whereby ideas from each coordinate is synthesised to compose holistic, situated and scoped interpretations of the themes in the text.

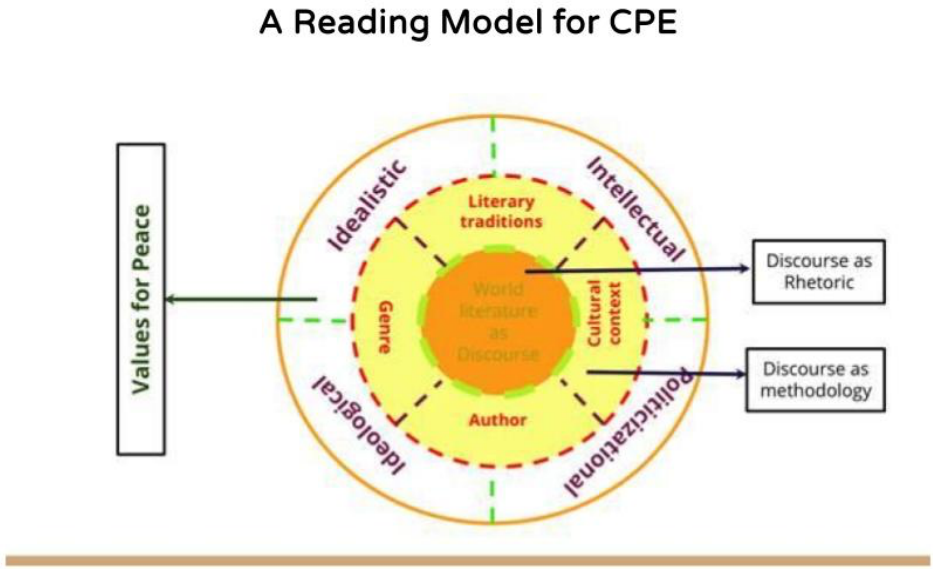
Positive Discourse Analysis (PDA)

Martin and Rose's PDA offers another model of analysis and interpretation of discourses within multimodal texts, elaborated in *Working with Discourse* (2007). This approach is rooted in functional linguistics and links discourse with social activity through grammar. PDA works through three metafunctions of language as discourse. The first is interpersonal, where we enact our social relations. The second is ideational where we represent our relationships to each other. The third is textual, which helps us organise our interactions and representations as meaningful texts (Martin & Rose, 2007). PDA provides a useful analytical foothold in the process of reading through the hermeneutic circle, where authorial discourse, the world and the reader-critic situate the discursive text within these three frames for intentional reading.

A Reading Model for Critical Peace Education

A synthesis of the hermeneutic circle and PDA with the four approaches to CPE – intellectual, idealistic, ideological and politicisational – that act as value-based frames in reading can help a world literature classroom operate as a site for sustainable peacebuilding through ESD. The reading model below presents a visualisation of this synthesis and reading praxis.

Figure 2
A Reading Model in PDA for CPE



The core of the reading model lies in the essence of world literature as not just a discipline but a Discourse that combines stylistics and linguistic expression with representations of social reality. World literature, which is a mode of reading and circulation, organically draws on the influences of international economic and cultural capital in its production. This circulation is therefore also a dynamic cosmopolitan movement of ideas, aesthetics and socio-cultural discourses on normative, ideological and political thought. Discourse in and of world literature in the context of education and peace can be approached initially through two arms of interpretation – the rhetorical and the methodological.

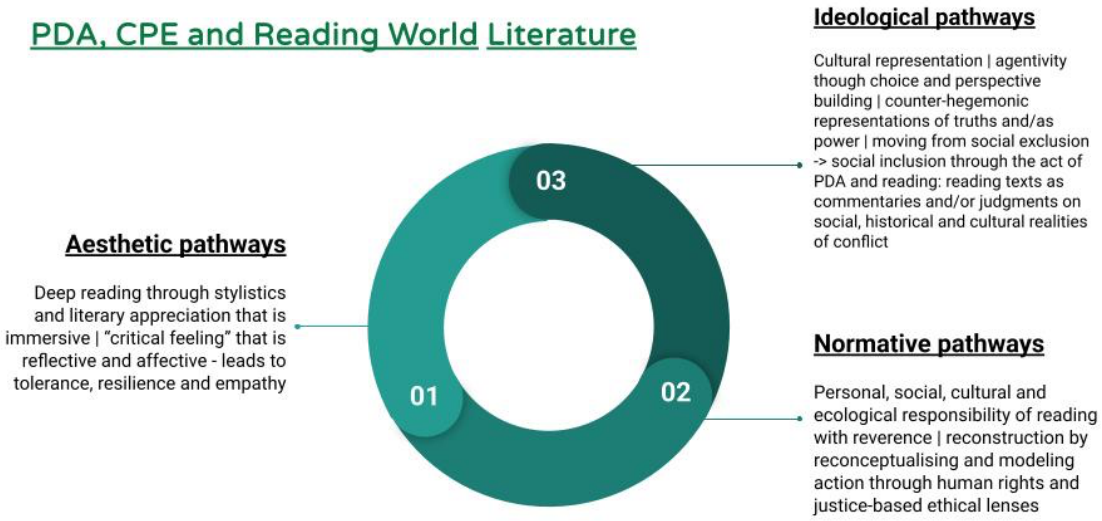
1. *Discourse as rhetoric*: This aspect comprises all the rhetorical strategies in creative and cultural expression, which include the expository, the descriptive, the narrative, the argumentative and the persuasive rhetorics, each of which brings its unique representational discourse to bear on depictions of reality in language. From depicting factual information to narrativising events for cause and effect, detailed descriptions for immersive understanding of the theme and essays that debate and take stands on issues, the rhetorical modes of representation enable diverse ways of relating to the world through the word.
2. *Discourse as methodology*: This aspect derives from Damrosch et al's debates on the poetics and politics of doing world literature. As a mode of reading, the circulation and engagement with world literature rests in methods of interpretation. Methodology as an interpretive discourse is therefore necessary for meaning making. In this regard, the "hermeneutic circle" that entails re-reading of works through different lenses that then synthesise meaning making provides pathways to concretise a CPE methodology. Four broad vectors define this hermeneutic circle as they balance the identity of the work with a contextual reading that provides perspective to literary representations of reality. The diffusive vectors of author, genre, literary traditions and cultural contexts that derive from the hermeneutic circle frame world literature as discourse, and situate narratives as creative works within socio-cultural contexts of their productions. Reading is therefore not an unintentional decontextualised act. Rather, it foregrounds the way texts need to be approached as discourses, and the act of reading as a research-based act.

Bajaj's four approaches to CPE discussed earlier operate as values that guide questions along interpersonal, ideational and intertextual lines that PDA evokes as analysis frameworks. The intellectual, ideological, idealistic and politicisational aspects of CPE support the process of PDA whereby the questions that we as readers take to the text, and by extension, the worlds we inhabit help us adopt ethical standpoints towards our reading praxis. Reading the text, for instance, by asking who speaks, whose perspectives are represented and whose are re-presented in the text, what the effects of these re/presentations, how are actions constructed, what kinds of knowledge do these constructs reveal and what does the work problematise can spotlight the "structural" and "cultural" attributes of the conflict depicted in the works. Similarly, examining what the dominant genre is and what literary traditions inform the creative representation provide schemas within which textual analysis situates itself. Recognising therefore that texts are not straightforward narratives but intentional motivated acts of production is an important first step in peacebuilding. The intentionality of creative representations helps us understand the discursive nature of human experiences, and initiates readers into the process of Trifinas and Wright's "difficult dialogues" (Trifonas & Wright, 2013, xv) as the characteristic of any communication that must lead to sustainable peacebuilding. The difficulty of engaging in these dialogues with the text, it should be noted, can arise equally from the thematic construct of texts dealing with conflicts, as well as recognising biases and our own positioning within these conflicts as sometimes internalised values and perceptions that require honest re-evaluation and reconstruction (Verma, 2017). The difficult dialogues rest, in this case, both within and without, and well written works of literature initiate us into this journey of understanding ourselves and the world around us.

PDA, CPE and Reading World Literature: Pathways to a Pedagogy of Peace

The reading model in Figure 2 signposts three pathways through which a combination of positive discourse analysis of world literature and CPE can create sustainable peacebuilding praxis. These are interconnected pathways that inform each other.

Figure 3
Pathways to CPE Through a PDA of World Literature



The scope of PDA, CPE and world literature indicate that sustainable peacebuilding can emerge through aesthetic pathways, ideological pathways and normative pathways. Creative representations are aesthetic acts. Principles of creativity, art and beauty embody an epistemic logic that is distinctly their own, and that work with critical feeling (Reber, 2016) alongside critical thinking. Philosophies of aesthetics and representation establish that the evocative nature of art embodied through rhetoric as one representational element evokes affective responses and feelings that are also sites of knowledge formation that derive from long and rich literary-cultural traditions. Literary appreciation as an aesthetic act provides one path to peacebuilding when it requires humility, empathy building, tolerance, acceptance and resilience in the act of evidence-based meaning making.

Ideological pathways become a second avenue to approach peacebuilding through CPE when PDA of world literature delineates the cultural and ideological nature of representations of social reality and conflict. Recognising the constructed nature of truths through and within language and its hegemonic nature is an important flagging point in reflective reading and composing critical commentaries on themes. This aligns organically with the prevalence of structural and cultural violence conceptualised by Galtung as core challenges to sustainable peacebuilding. They also comprise the first step to positive peace.

Normative pathways are, in this respect, the most urgent approach to positive peace. The identity of literary discourse as philosophy that is often rooted in moral and ethical dilemmas that plots and characters delineate, mirror corresponding choices in life. Literature acts as a space for contemplation and reflection on values, norms and principles of a just life in society and on the planet. As normative pathways, literary discourse and its analysis evoke Reardon's

7Rs and Galtung's requirements of positive peace that is guided by reverence, responsibility towards and respectful listening to voices around us. Difficult dialogues that fold these into the reading model for CPE through the hermeneutic circle can thereby create spaces for reflection and, by extension, positive action towards sustainable peacebuilding.

Some Concluding Reflections

If peace is located within ethical decisions, standpoints and actions that are sustained and continuous, then normativity that is informed by social and ecological justice, respect and reverence for human and planetary rights, and acceptance are necessary lenses to achieve CPE. Literature that delineates these through its thematic, non-didactic and discursive concerns are aptly positioned to construct normative, ideological positions through aesthetic representations. These may draw equally and dialogically on liberal humanist and critical theoretical perspectives to project a crisis critique (Barry, 2009) through imaginations of ideal societies and cultures, and of positive peace through education.

Education has the power to transform thoughts and, by extension, human actions. The aesthetic, ideological and normative pathways that the reading model provides show three trajectories through which affective and aesthetic sensibilities, critical insights into structural and epistemic constructions of conflict, and ethical paradigms that inform individual and social decision making as we read about our world can structure educational praxis as systematic processes of evidence-based inquiry. Reading as a formalised, intentional, cultivated act driven by the analysis of rhetorical discourses presents one pathway to achieve this transformation for sustainable peace.

Declaration of Generative AI and AI-Assisted Technologies in the Writing Process

The author declares that no AI or AI-assisted technologies have been used to generate, refine, or correct the content in the manuscript. The ideas, design, procedures, findings, analyses, and discussion are originally written and derived from careful and systematic conduct of the research.

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Faculty Attitudes Toward the Use of Artificial Intelligence in Higher Education

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Official Conference Proceedings

Abstract

This mixed-methods study investigated faculty perceptions of AI use in a mid-sized, teaching-focused, public university in the Mid-Atlantic region of the United States. Data instruments consisted of a quantitative survey consisting of opposing attitude statements and qualitative focus group interviews. Findings demonstrated that many faculty were interested in learning how AI applications could improve their teaching and that artificial intelligence (AI) would have an impact on the teaching process by changing their content and methods of instruction and assessment. Faculty members also recognized the need for a change in the role of the professor that prioritized AI literacy, critical and analytical thinking, and educating students on the value of struggle. There were both positive and negative perceptions about the use of AI to grade student work and assess student progress, and of their ability to recognize AI-produced content. Finally, most faculty would not use AI to assist in research writing. There was recognition of the need for skills-based, policy-related, and resource-focused faculty professional development.

Keywords: faculty attitudes, artificial intelligence, higher education

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Introduction

With the recent development of ChatGPT, much attention has begun to be paid to artificial intelligence (AI) and its applications. However, the concept and use of artificial intelligence is nothing new. Research into applications of artificial intelligence in education (AIEd) has been occurring for over 30 years. However, it is only now that educators are starting to explore AI applications as learning tools more broadly (Zawacki-Richter et al., 2019). With the increased investment in AIEd by companies such as Google and Apple, artificial intelligence applications have begun to play a significant role in higher education (Contact North, 2018; Popenici & Kerr, 2017).

Literature Review

What is Artificial Intelligence?

A broad definition of artificial intelligence was provided by Baker and Smith (2019), namely that AI refers to "computers which perform cognitive tasks, usually associated with human minds, particularly learning and problem-solving" (p. 10). Artificial intelligence, however, is not one specific technology, but encompasses a variety of technologies, including machine learning, natural language processing, data mining, and neural networks or algorithms (Baker & Smith, 2019). Machine learning is "a subfield of artificial intelligence that includes software able to recognize patterns, make predictions, and apply newly discovered patterns to situations that were not included or covered by their initial design" (Popenici & Kerr, 2017, p. 2). Natural Language Processing (NLP) has to do with using computers to "understand and manipulate natural language text or speech to do useful things (Chowdhury, 2003, p. 1). Data mining attempts to identify patterns in large data sets (Romero et al., 2010) while neural networks are machines that mimic the human brain to recognize patterns among data (Picton & Picton, 1994). All these technologies can impact how students are taught.

Applications of AI in Higher Education

How can these artificial intelligence technologies be applied to the higher education classroom? The three types of classroom-related artificial intelligence applications include intelligent tutor systems (ITS), intelligent support for collaborative learning, and intelligent virtual reality (Luckin et al., 2016).

As the name implies, intelligent tutor systems simulate a private tutor. "[B]ased on learner models, algorithms and neural networks, they can make decisions about the learning path of an individual student and the content to select, provide cognitive scaffolding and help to engage the student in dialogue" (Zawacki-Richter et al., 2019, p. 4). ITSs are excellent for large-scale distance education situations. Artificial intelligence can provide support for collaborative learning by "supporting adaptive group formation based on learner models, by facilitating online group interaction or by summarizing discussions that can be used by a human tutor to guide students towards the aims and objectives of a course" (Zawacki-Richter et al., 2019, p. 4). Artificial intelligence can also use intelligent virtual reality to engage students and to teach students in a game-based environment.

Another way that artificial intelligence can be used in education is in revolutionizing the way teachers assess, allowing teachers to provide just-in-time feedback. Instead of traditional tests, assessment can be integrated into instructional activities as formative assessment of what

students have learned. In addition, artificial intelligence applications are capable of predicting future achievement or whether students will drop out (Zawacki-Richter et al., 2019). Artificial intelligence applications can also automate administration tasks and identify areas of need for students so teachers can provide support and guidance. Artificial intelligence also allows college administrators to monitor educational processes and provide corrections as needed (Zawacki-Richter et al., 2019).

Potential Problems With AI

However, despite the enormous potential of artificial intelligence to improve education, AI introduces significant ethical issues within the educational process. "For example, in times of budget cuts, it might be tempting for administrators to replace teaching by profitable automated AI solutions" (Zawacki-Richter et al., 2019, p. 2). As a result, faculty members and administrators may be concerned that artificial intelligence applications may cause them to lose their jobs (Zawacki-Richter et al., 2019).

Another concern has to do with the amount of data that has to be collected from students and faculty for some AI applications. This raises ethical issues regarding the confidentiality of the information collected. For example, administrators may be making employment and tenure and promotion decisions about faculty based on information collected by artificial intelligence applications. This poses a major concern about the appropriateness of such uses (Zawacki-Richter et al., 2019).

One of the most significant ethical concerns among faculty members about the use of artificial intelligence is its ability to create documents for submission as assessment requirements. Applications such as ChatGPT can produce written documents, such as essays, when provided with parameters for the assignment. While there are ways of identifying such documents, as such applications become more sophisticated, they become more difficult to identify (Malinka et al., 2023).

Methodology

In view of both the affordances of and challenges with AI as expressed and experienced by faculty members, this study investigates faculty attitudes towards the use of AIEd at a university in the United States.

Having obtained IRB approval and informed consent, faculty attitudes were investigated using both a written, fixed-response survey, as well as focus groups. In the written survey part of the study, participants responded initially to demographic questions. They were then presented with two opposing attitude statements and were asked to indicate the extent to which they leaned toward one side or the other of the issue.

Participants were faculty members at a mid-sized, teaching-focused public university in the Mid-Atlantic region of the United States. An invitation to complete the survey administered through Qualtrics was sent in Spring 2024 to all professors teaching at the university. These included adjunct, assistant, associate, and full professors at both the undergraduate and graduate levels. Two weeks after the initial survey invitation was distributed, a follow-up email reminder was sent to all faculty. The responses were entered into a spreadsheet, uploaded to SPSS, and analyzed. Demographic statistics about the sample were calculated, as well as faculty members' responses to attitude statements about artificial intelligence.

At the end of the survey, respondents were asked if they would be willing to participate in a focus group interview to follow up on questions asked in the written survey and to further discuss their attitudes toward using artificial intelligence to teach. Those who indicated they were willing to participate were subsequently contacted via email with possible focus group interview dates. Those who responded were assigned to a focus group based on their desired time slots. Of those contacted, 44 accepted the invitation to participate, with 13 faculty members actually participating in three focus group interviews (the first two conducted in September 2024 and the third in February 2025), as follows:

Table 1

Pseudonym and Department of Focus Group Interviewees

Interviews	Pseudonym	Department
Interview 1	Max	Biology
	Riley	Communication Sciences and Disorders
	Nora	Biomedical Engineering
	Fernando	Languages and Cultures
Interview 2	Kate	Math
	Ava	English
	Melanie	English
	Tessa	Graduate Social Work
	Cole	Languages and Cultures
Interview 3	Vera	English
	Eliana	History
	Blake	Secondary Education and K-12, Health and Physical Education
	Mia	Languages and Cultures

At the beginning of each focus group interview session, participants were asked to sign a consent form. The following questions were then asked of the participants.

1. Faculty members: In what subject area(s) do you teach?
2. Have you had experience with students attempting to use apps such as ChatGPT to submit assignments? Explain what happened.
3. What do you see as the potential upside of students using artificial intelligence apps, such as ChatGPT?
4. What do you see as the potential downside of students using artificial intelligence apps, such as ChatGPT?
5. What do you see as a way of preventing potential problems associated with using AI apps?
6. In general, how can such apps be better integrated into teaching?
7. What would you tell students about the use of AI Apps?
8. If you had a university administrator here right now, what advice would you give him or her to deal with artificial intelligence?
9. Are there any other comments you would like to make about artificial intelligence apps?

The responses were collected using two recorders, which were then transcribed. Using NVivo 2020, the transcriptions were coded and analyzed to look for themes across all three focus group interviews.

Results

Survey Demographic Information

Tables 2 through 8 show demographic information about the respondents to the written survey.

Table 2
Quantitative Survey Response Rates

	Faculty	Percent
Total number invited	963	
Total number responded	168	17.4%
Usable data obtained	143	14.8%

Overall, 17.4% of faculty members responded. However, once responses with less than 50% were culled from the sample, the final response rate was 14.8%.

Table 3
Years Taught at the University

Years	Frequency	Percent	Cumulative Percent	Percent of Years Taught at the University	Cumulative Percentage - University
0–5	38	26.6	26.6	39	39
6–10	48	33.6	60.1	23	62
11–15	22	15.4	75.5	13	75
16–20	14	9.8	85.3	13	88
21–25	9	6.3	91.6	6	94
26–30	6	4.2	95.8	2	96
31–35	5	3.5	99.3	3	99
36+	1	0.7	100.0	1	100
Total	143	100.0		100	

Of those who responded, 85.3% had taught for 20 years or less and 60.1% had taught ten years or fewer. Compared with the number of faculty members at the university in general, the percentages within the sample were similar. The only differences were with faculty who had been teaching at the university the shortest amount of time. The lower responses among those who had been at the university 0–5 years was probably due to fewer adjunct faculty responding to the survey. Those who had been at the university for 6–10 years was more highly represented in the sample. At the university, this group consisted of many of those who were recently tenured.

Table 4
Rank of Respondents

Rank	Frequency	Percent	Cumulative Percent	Percent - University
Adjunct	32	22.4	22.4	34
Assistant	28	19.6	42.0	15
Associate	48	33.6	75.5	24
Full	35	24.5	100.0	27
Total	143	100.0		

Most of the respondents, 58.1%, were associate professors or full professors. Less than a quarter, 22.4%, were adjunct professors. Compared with the percentages at the university, the adjunct professors were underrepresented in the sample. Associate professors, on the other hand, were more highly represented in the sample than in the population. This is reflected in Table 3 in the higher number of faculty who had taught at the university between 6 and 10 years.

Table 5
Age of Respondents in Years

Age in Years	Frequency	Percent	Cumulative Percent
20–29	4	2.8	2.8
30–39	25	17.5	20.3
40–49	44	30.8	51.0
50–59	38	26.6	77.6
60–69	25	17.5	95.1
70–79	6	4.2	99.3
Missing	1	0.7	100.0
Total	143	100.0	

The majority, 30.8%, of the respondents were in the 40–49 years age group while the next highest percentage was for the 50–59 age group. The percentages increase and decrease with age, with very few at the lowest and highest age groups.

Table 6
Gender of Respondents

Gender	Frequency	Percent	Cumulative Percent	Percentages in Population
Male	49	34.3	34.3	43%
Female	90	62.9	97.2	56%
Non-binary	1	0.7	97.9	0%
Prefer Not to Say	1	0.7	98.6	1%
Missing	2	1.4	100.0	0%
Total	143	100.0		100%

The majority of the respondents, 62.9%, were female. Compared with the population of the university, females were more highly represented.

Table 7
Race/Ethnicity of the Respondents

Race/Ethnicity	Frequency	Percent	Percent - University	Difference - Percent
White, non-Hispanic	117	81.8	80.7%	+1.1%
White, Hispanic	7	4.9	3.7%	+1.2%
Black or African American	4	2.8	6.1%	−3.3%
Asian	7	4.9	8.8%	−3.9%
American Indian or Alaskan Native	0	0.0	0.2%	−0.2%
Two or more races	5	3.5	0.3%	+3.2%
Missing	3	2.1	0.1%	+2.0%
Total	143	100.0		

The vast majority of the respondents, 81.8%, were white, non-Hispanic. This is to be expected since the large majority of the faculty members at the university were white, non-Hispanic. However, there were fewer responses from some minority professors, most notably Black or African American and Asian professors. However, there were a higher percentage of professors of two or more races. So, it is not clear what the minority representation of the sample is.

Table 8
College of the Respondents

College	Frequency	Percent	Percent - University	Difference
Sciences and Mathematics	18	12.6	20%	−7.4%
Arts and Humanities	36	25.2	23%	+2.2%
Education and Social Work	20	14.0	16%	−2.0%
Health Sciences	19	13.3	14%	−0.7%
Business and Public Management	11	7.7	15%	−7.3%
Honors	1	0.7	1%	−0.3%
Other	3	2.1	5%	−2.9%
Music	0	0	6%	−6.0%
Missing	35	24.5		
Total	143	100.0		

Almost a quarter of the respondents, 24.5%, did not respond to this question. This is not surprising since the survey made this question optional. The highest percentage of respondents, by far, 25.2%, were from the College of Arts and Humanities. Again, this is not surprising since this college has the highest percentage of faculty members in the university. Differences in percentages between population and sample indicate that two colleges, Sciences and Mathematics as well as the College of Business and Public Management, were not as highly represented in the sample. This suggests that faculty members in those disciplines might not have as much interest in or concerns about artificial intelligence and its impact on teaching.

Table 9
Comfort Level With Digital Technology in General

	Frequency	Percent	Cumulative Percent
Very comfortable	92	64.3	64.3
Comfortable	42	29.4	93.7
Neutral	6	4.2	97.9
Very uncomfortable	3	2.1	100.0
Total	143	100.0	

A large majority (93.7%) of the respondents were comfortable (29.4%) or very comfortable (64.3%) with digital technology.

Table 10
Degree of Familiarity With Generative AI

	Frequency	Percent	Cumulative Percent
Very familiar	32	22.4	22.4
Somewhat familiar	63	44.1	66.4
A little familiar	33	23.1	89.5
Not familiar at all	15	10.5	100.0
Total	143	100.0	

Less than a quarter of the respondents, 22.4%, were very familiar with generative AI. The largest percentage, 44.1%, were somewhat familiar with it. This contrasts with Abdelaal and Al Sawi (2024)'s finding where the majority of participants, 30.8%, were neutral with regards to familiarity with AI.

Table 11
Extent To Which Respondents Use AI to Teach

	Frequency	Percent	Cumulative Percent
Not at all	71	49.7	49.7
A little	50	35.0	84.6
A moderate amount	20	14.0	98.6
A great deal	2	1.4	100.0
Total	143	100.0	

Approximately half of the respondents, 49.7%, did not use AI to teach at all. A large majority, 84.6%, use AI a little or not at all to teach.

Table 12
Faculty Comfort With Technology

Majority of participants	**Response**
Comfort with digital technology	Very comfortable (64.3%)
Familiarity with Generative AI	Somewhat familiar (44.1%)
Extent of using AI to teach	Not at all (49.7%)

Table 12 above summarizes Tables 9–11, which demonstrates that while the majority of participants were very comfortable with digital technology and somewhat familiar with Generative AI, they still were not using AI to teach.

Faculty Attitude and Usage Statements

Faculty ratings for the pairs of attitude and usage statements about artificial intelligence have been divided into the following four tables based on faculty perceptions: (1) positive, (2) both positive and negative, (3) neutral, and (4) negative. It should be noted that within tables, the columns are ranked from most positive to most negative, and that the following have been combined in the column rankings:

- negative and slightly negative, and
- slightly positive and positive.

Table 13

Faculty Ratings for the Pairs of Attitude and Usage Statements About Artificial Intelligence – Positive

Category	Interest in Using AI Applications to Improve Teaching	AI's Impact on the Content or Methods of Instruction	Interest in using AI apps to teach	Impact of AI on the professor's role	Using AI to Advise	Assessing Students Using AI
Negative Statement	I have no interest in learning how AI applications can improve my teaching.	AI applications will have no impact on the content or methods of instruction.	Interest in using AI apps to teach	AI is going to take over jobs as professors so that some will no longer be needed.	Using AI to help advise students should be avoided since it makes it too impersonal.	AI will not significantly change the way I assess my students.
Negative	11.9	1.4	20.3	2.8	12.6	11.9
Slightly Negative	6.3	13.3	10.5	7.7	15.4	20.3
Neutral	11.2	25.2	16.8	37.1	28.0	24.5
Slightly Positive	**23.1**	**35.0**	**18.9**	**30.8**	**30.8**	**27.3**
Positive	**46.9**	**24.5**	**33.6**	**19.6**	**13.3**	**15.4**
Positive Statement	I am very interested in learning how AI applications can improve my teaching.	Because of AI's impact on my profession, I will need to change the content or methods of instruction.	I would be interested in using AI applications to design the lessons I teach.	AI is a tool that will help professors to do their job better.	AI applications have the potential to make advising students easier and more effective.	AI will significantly impact the way I assess my students.

Positive perceptions, namely being very interested or interested, appeared to center around faculty interest in learning how AI applications could improve their teaching (70.0%), realizing that this would include a need to change their content or methods of instruction (59.5%) and an interest in using AI applications to design lessons (52.5%). Faculty believed that AI would

help them to do their job better (50.4%) including making advising students easier and more effective (44.1%). Faculty also believed that AI would significantly impact the way they assessed their students (42.7%). These results confirm Abdelaal and Al Sawi's (2024) findings that "AI enhances teaching" (p. 15).

Table 14

Faculty Ratings for the Pairs of Attitude and Usage Statements About Artificial Intelligence – Positive and Negative

Category	Using AI to Grade Students' Work	Using AI to Assess Student Progress
Negative Statement	I would not consider using AI applications to grade assignments.	I would not use AI applications to assess student progress.
Negative	**23.1**	**21.7**
Slightly Negative	**16.8**	**15.4**
Neutral	21.7	25.2
Slightly Positive	**21.0**	**24.5**
Positive	**17.5**	**13.3**
Positive Statement	I would be very interested in using AI applications to grade students' work.	I would feel comfortable using AI applications to assess student progress.

While faculty believed that AI would significantly impact the way they assessed their students, they appeared to be evenly split about how they would do so. 38.5% would and 39.9% would not use AI applications to grade student work and 37.8% would and 37.1% would not feel comfortable using AI applications to assess student progress.

Table 15

Faculty Ratings for the Pairs of Attitude and Usage Statements About Artificial Intelligence – Neutral

Category	AI's impact on the use of writing assignments	Impact of AI on Enrollment in My Program
Negative Statement	I am less likely to assess students using writing assignments because of AI.	Artificial intelligence will not have a significant impact on the number of students who enroll in my program.
Negative	8.4	25.9
Slightly Negative	18.9	13.3
Neutral	**60.1**	**42.0**
Slightly Positive	7.0	11.9
Positive	4.9	6.3
Positive Statement	I am more likely to ask students to write as part of their assessment because of AI applications.	Artificial intelligence will have a significant impact on the number of students who enroll in my program

Faculty appeared to be neutral about their likelihood of asking students to write as part of their assessments because of AI application (60.1%), nor did they think that AI would be relevant to student enrollment in their programs (42.0%).

Table 16
Faculty Ratings for the Pairs of Attitude and Usage Statements About Artificial Intelligence – Negative

Category	Recognizing AI-produced content	Using AI to write articles	Impact of AI on homework and writing assignments
Negative Statement	I (will) have difficulty recognizing AI-produced content.	I would never use AI applications to assist me in writing articles based on my data and research	Because students can use AI applications to create homework assignments, AI applications are going to make our jobs harder.
Negative	**16.1**	**32.2**	24.5
Slightly Negative	**26.6**	**16.1**	25.9
Neutral	21.0	15.4	34.3
Slightly Positive	29.4	20.3	9.8
Positive	6.3	15.4	3.5
Positive Statement	It is/will be easy to recognize AI-produced content.	I would use AI applications to assist me in writing articles based on my data and research.	Because AI applications can be used to help students to write, AI applications are going to make our jobs easier.

Faculty believed that they would have difficulty recognizing AI-produced content (42.7%) and that students being able to use AI applications to create homework assignments would make their jobs harder (50.4%). Finally, faculty would never use AI applications to assist them in research writing (48.3%).

Discussion

Research Question 1: What are faculty members' perceptions of artificial intelligence to fulfill the assessment requirement of their classes?

Students Cheating

In view of the fact that cheating is not new (Max, Nora, Ava), faculty were unsurprised to have suspicions of students cheating using AI although they had no proof of such wrongdoing (Nora, Fernando, Max). These suspicions arose because of a mismatch between previous and current work (Nora, Fernando) and the fact that the submitted work did not answer the assessment questions or was irrelevant (Kate, Eliana). Melanie also described the double-cheating that occurred in the Writing Center, where students submitted AI-written or partially AI-written papers as their own, raising the question, "are we the police of using AI?" This experience of having suspicions of students cheating appear to counter the survey statement of 42.7% of faculty that "[they would] have difficulty recognizing AI-produced content." A possible reason for the disparity may be the self-selected nature of the focus group interviewees.

Further, Kate and Ava opined that students were terrified of writing, both because of the high stakes involved and the time required (Ava), particularly since many students worked multiple jobs (Melanie). Vera reiterated:

> maybe one of the problems, though, is that we don't communicate to students that there's space for them to be clumsy. … So I'm afraid that we're creating fear in them … I don't know how to do this right, and it's safer for me then if I let AI do it, because it'll do a cleaner job of it, than I will.

To combat such academic dishonesty, Max and Fernando explained that creative assessments are needed, for example AI as a conversation partner (Fernando). Other suggestions included scaffolding the assessment process (Nora), grading using a rubric (Kate), and eliminating discussion boards that appeared to be prone to dishonest use of AI: "my assignments now being structured in a way in which I'm being strategic that they can't use AI" (Tessa). Meanwhile, Eliana and Mia were insistent on not policing AI use while Max and Fernando mentioned not using anti-cheating software. The suggestions of creative assessments are in line with the opinion of 59.5% of faculty who believed that "[b]ecause of AI's impact on [their] profession, [they would] need to change the content or methods of instruction."

Rationale for AI Integration and Role of Professor

In spite of such academic dishonesty, there is still a place for AI integration, and the role of the professor in such integration. Max and Mia stressed that students need to learn how to live in the AI world, hence the importance of AI literacy (Fernando), for example, as found in employers using AI to review resumes and conduct background checks. The role of the professor (Gârdan et al., 2025; Kurtz et al., 2024) is suggested in the following excerpts:

- "AI works best with a smart human. And you want to be that smart human."
- "AI will never do better than an expert at something. At least now, maybe for a while." (Max)

This professor role comes on where the AI role leaves off. AI is good at efficiency, as an avenue where busywork is offloaded, for example in the writing of reports (Riley). It is also "a way for the people who are already left behind to catch up a little bit" (Max). Furthermore, AI is good for proofreading, for example, through Grammarly (Ava) and in summarizing text, thereby helping with the comprehension of struggling students (Mia, Vera). As Vera suggested "if we were offloading some of the lower order kind of thinking on the AI, that would then free up the students to do … the more analytic work that you want them to do."

Nora stressed that it's in this "more analytic work" that the professor's role comes in:

> if ChatGPT … can accurately sort of feed students information, then that sort of emphasizes that that shouldn't really be our role as faculty. … what can we take on as a role of helping them sort of synthesize and see the, the bigger picture? (Nora)

The fact that faculty were asking "what can we take on as a role" aligns with the survey statements of:

- 70.0% of faculty who were "very interested in learning how AI applications [could] improve [their] teaching."
- 59.5% of faculty who stated that "[b]ecause of AI's impact on [their] profession, [they would] need to change the content or methods of instruction."

- 52.5% of faculty who "would be interested in using AI applications to design the lessons [they taught]."
- 50.4% of faculty who believed that "AI [was] a tool that [would] help professors to do their job better."

Research Question 2: What are faculty members most concerned about with regards to AI? What do faculty members perceive as barriers to faculty learning about AI?

Besides privacy issues (Ismail, 2025; Zeide & Nissenbaum, 2018) such as FERPA (Riley) or HIPAA (Riley, Tessa), faculty also raised intellectual property concerns such as data submitted being used to train AI (Nora, Ava). As such, Nora mentioned that students needed to be aware that some companies require the use of in-house secure AI. Other issues included the ethics of energy expenditure of AI use (Blake), and the hallucination (Schardt, 2023) of AI (Cole, Vera).

One of the most prominent issues raised by faculty was students' aversion to struggle, as indicated below:

> I think my biggest problem with AI is its major design principle is to remove friction. … And learning requires the right amount of friction. And I think like our goal is to provide them the push just outside of their limits. And they can never get there if they're never if they're, if there's always a tool that they can use to avoid that in the first place, which they will if it's available. (Max)

It can be said that the value of struggle (Nora), namely the learning that results from friction, is critical thinking:

> We're writing to think, um, and emphasizing that to your students. Like the reason that I'm having you do this writing assignment is so that you can put your thoughts on paper and find a new way to organize them. It's not to get an A. Um, and I think increasingly that is something that we have to teach students. We, you know, we have to explain in detail why we're doing the things that we're doing and that it's okay for them to be uncomfortable or to struggle. (Riley)

Riley's reference to written assignments seems to align with the 60.1% neutral faculty stance that suggests that faculty are still using written assignments even though students may misuse AI in such assignments. This is particularly true since students appear to be struggling with reading and writing post-pandemic (Melanie, Ava, Tessa, Kate). Furthermore, there are AI tools being developed that attempts to cultivate critical thinking, for example in Deepseek's self-talk (Blake), which "thinks," "contemplates," or "processes" (Mia), because "self-talk … [is] a critical aspect of how we develop metacognitive skills and being able to think through problems and understand processes" (Blake).

Vera added "We're sort of overwhelmed with information, but starving for knowledge. And … the future is going to belong to people, to the people who can synthesize information."

Ava concluded:

> I'm reassured that there are still students who really want to engage, who want to think about what they're doing. And I'm trying not to worry as much about the ones who don't, even as I want to show them. Okay, use this tool, but use it in ways that are critical.

Research Question 3: How are faculty members currently using artificial intelligence in their classrooms?

Instances of AI Integration by Students

Some faculty had not incorporated AI integration into their courses because:

- They did not know enough about AI to integrate it (Riley);
- They did not know how to teach students to effectively and ethically use AI (Nora);
- AI was evolving faster than faculty could keep up with (Fernando), so that faculty were playing catch up (Tessa, Cole).

In other words, the AI continuum ranged from anti to wary to pro-AI (Nora). Some faculty had incorporated AI into their teaching in the forms of:

- The use of Grammarly to fix narrative review or writing, with prompts and AI responses appended (Riley);
- The use of literature review tools such as Research Rabbit, and the use of AI to brainstorm ideas and topics (Nora);
- Discuss the similarities and differences between student-generated and AI-generated ideas (Riley);
- Discuss students' feelings about using AI to create resumes, provide feedback, or align resumes with job advertisements, and employers' use of AI to review resumes (Ava);
- Dual-track research, with- and without-AI, with source review for AI-aided research (Vera);
- Planning and brainstorming with citation (Eliana).

While some students were reticent or averse to AI integration (Vera, Eliana, Mia), others thought differently:

> They came to appreciate AI, as you know, like an assistant, as opposed to, you know, a primary author through this process of generating a text where they could have 15% of it be sourced through, you know, AI's writing, and some of them likened it to, you know, like talking with a friend. (Vera)

These examples of AI Integration by students confirms the survey statement by 42.7% of faculty that "AI [would] significantly impact the way [they] assess[ed their] students."

Instances of AI Integration by Faculty

Besides the planning of AI integration as implemented by students, faculty also

- modeled AI integration by annotating lecture transcripts, summarizing, identifying confusing points, and then having students replicate this process in an assignment (Max);
- used AI with letters of recommendation (Nora);
- used AI to produce grammar documents for class (Mia).

The use of AI with research articles, however, received mixed feedback from faculty. Like the survey statement by 48.3% of faculty who shared that "[they] would never use AI applications to assist [them] in writing articles based on [their] data and research", some reported not using AI with research articles because:

- they already knew how to do what AI was being used for, and that it was harder to learn how to do it using AI (Eliana);
- the ethics of using submitted data for AI training (Vera, Ava).

Others asked AI to:

- provide feedback on professional writing as a hypothetical colleague (Max);
- Cole advised that it was better to ask AI for a list of suggestions without having it touch the text;
- provide the main points of an author in a text: "the thing guides me, and then I go and do the work myself" (Cole).

However, Ava acknowledged that there was variable effectiveness to AI rewriting depending on prompts used. The mixed feedback by the focus group interviewees may again be the result of the self-selected nature of these participants.

Research Question 4: In what ways can the university support faculty members in using AI to teach?

The integration of AI or not by faculty and students suggests the need for faculty professional development (Sperling et al., 2024). There have been events already implemented such as:

- AI Teaching Circle (Riley);
- A module on Generative AI (Nora);
- Critical Thinking and Writing Workshop (Riley).

However, faculty also requested professional development topics such as:

- How to use AI as a tutor? As a conversation partner? (Nora);
- Tools to help with grading (Nora);
- Fernando requested conversations about where the department stood in regard to AI, as also suggested in Farazouli, Cerratto-Pargman, Laksov, & McGrath (2024). However, Riley shared that it was not possible to create a blanket AI statement because of the diversity of teaching needs at the institution.
- A tech course as part of the General Education requirements (Riley);
- Time and effort to help faculty and students understand how to use AI effectively (Nora, Fernando);
- Practical courses, e.g. prompt engineering (Riley).

Besides topics, faculty also expressed the following needs:

- Meetings with instructional designers, and instructional designers being available to faculty (Tessa);
- Not to use AI to surveil students, e.g. through Navigate (Tessa);
- More funding/resources for instructional designers (Kate);
- Incentives (Tessa);
- Reducing writing class sizes, which are currently capped at 25 students when 18 is recommended (Ava);
- To know what others are doing (Vera);
- Freedom to do what we need to do (Mia);
- Should AI integration be one-offs or integrated throughout the semester? (Eliana);
- To know what AI apps students are using (Mia) so that equitable access can be provided (Eliana) and so that faculty can gain expertise in one app (Vera).

Conclusion

This study discovered that faculty were interested in learning how AI applications could improve their teaching and lesson design, through changing their content and methods of instruction and assessment, and through more effective student advising. The change in methods of instruction and assessment could include the use of creative assessments, for example, using AI as a conversation partner. This change and the integration of AI in classrooms further suggest a change in the role of the professor, "transitioning from knowledge transmitters to facilitators of learning" (Buele, 2025), particularly in view of the fact that students will graduate into a world where AI is being used, hence the need to prioritize AI literacy, critical and analytical thinking, and educating students on the value of struggle, especially with reading and writing.

There were both positive and negative perceptions about the use of AI to grade student work and assess student progress, as suggested by privacy issues and intellectual property concerns. There were also mixed results about faculty's perception of their ability to recognize AI-produced content. Finally, most faculty would not use AI to assist in research writing.

There was recognition that the use of AI in higher education was inevitable, which suggests the need for faculty professional development, both skills-based, policy-related (Ullah et al., 2024), and centered on the deployment of resources.

Declaration of Generative AI and AI-Assisted Technologies in the Writing Process

The author declares that no AI or AI-assisted technologies have been used to generate, refine, or correct the content in the manuscript. The ideas, design, procedures, findings, analyses, and discussion are originally written and derived from careful and systematic conduct of the research.

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