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Modular Learning Design: A Modern Curriculum Structure, Including a Teacher Training Plan, Suitable for K-12 Schools, Based on Theoretical and Practical Teaching and Assessment of 21 st-Century Skills

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The European Conference on Technology in the Classroom 2016
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Abstract

Modular Learning Design is a structure for K-12 schools Curriculums. The designing must happen depends on learning. Instead of making curriculum, unite-lesson plans for learning objectives, transferring information; Modular Learning Design allows and suggests making curriculum for skills. This article explains and examines practical usage by different concepts such as: Goal, Method, Center, Key point, Assessment, Unit Plan, Technology Usage, Flexibility-Modularity, 21.Century Skills and the theoretical foundations of modular learning design, particularly constructivism and constructionism, and notes the similarities and differences among implementations, including project-based science (Blumenfeld, 1991), Understanding by Design (Wiggins, 1996), Learning by doing (Piaget, 1960), Proof upon practice (Skinner, 1945), Assessment and teaching 21st Century skills (Griffin,2011), Zone of Proximal Development (Vygotsky,1962) , Discovery learning (Bruner, 1961), Criterion-Referenced Measurement (Glaser, 1963), disciplined inquiry (Levstik & Barton, 2001). Finally, practical advice and recommendations for modular learning design are discussed, including beginning slowly with the implementation, teaching students to negotiate cooperative/collaborative groups and establishing multiple forms of performance assessments.

MLD proposes a new paradigm for schools to ensure holistic learning of individuals to address 21st century needs of human. This will be an introduction and demonstration of a new curriculum framework designed for students aged 3 to 12 with evaluating 21.Century Skills especially for assessment of 21st century skills with the interactive sample of "Collaborative problem solving"

Keywords: technology, 21 st-century skills, curriculum, teacher training, learning

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Introduction

Modular Learning Design is a flexible framework for curriculums in K-12 Education. Purpose of this Design ensure the realisation of lifelong, whole and meaningful learning fits 21 st Century. It accepts the speed of Change, the increasing importance of personal differences and support all modern learning methods as much as traditional, such as: Social Learning (Bandura,1963), Learning by doing (Piaget, 1960), Montessori (1912/1964), Zone of proximal development (Vygotsky, 1962), Bloom Taxonomy (Bloom, 1956) Assessment and teaching 21.Century Skills (Griffin,2011), Understanding by design (Wiggins, 1996). MLD(Modular Learning Design) which use Inquiry-based (Levstik & Barton, 2001) and Discovery-based (Bruner, 1961) consider the speed and immensity of reaching and sharing information and individual learning (lifelong- at the school & outside of the school).

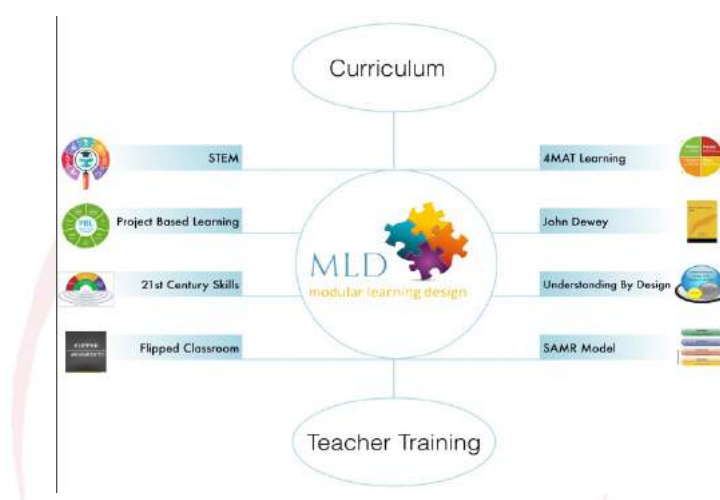


Figure 1: Schema of Modular Learning Design.

MLD aims a learning continuum in a flexible and modular construction according to student group potential and skills, infrastructure of school, timing of the learning, abilities of teacher and technological opportunities. For this MLD accepts learning is a change that have occurred in the life of individuals and offers learning objectives on the curriculum should be real-world engaged. MLD provide this with construction on skills progress. MLD points to kind of skills: Social and Cognitive: Collaboration, Problem Solving, Analysing, Synthesis, digital Literacy, Learning (to learning), researching, memory, Organising, Emotional Intelligence, innovation, creativity, adaptation, changing, learning also include skills referred to as 21. century skills. MLD accepts Learners and teaches are people who have active and variable roles during learning progress and keeps realisation of learning at the whole process.

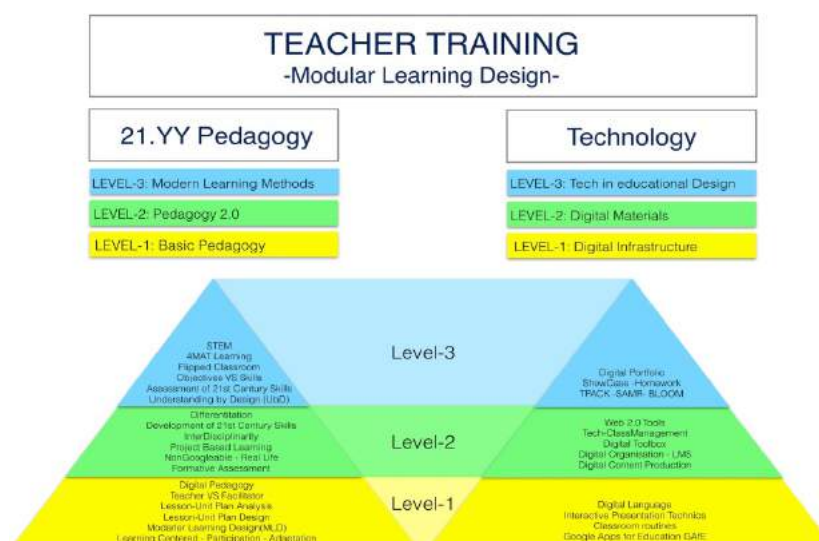


Figure 2: Teacher Training Schema of Modular Learning Design.

When design a program there is an order for instructor: Identify real life production that student will create, Connecting the real life production and learning objectives, Identify tools and skills will be developed, Assessment of the learning process. MLD accepts assessment is a part of learning process by summative and formative styles and for student awareness of learning progress, for the teachers it is a tool for analysis of learning and development of the plan. Technology is a tool in this whole process such as traditional ones for MLD. MLD suggest use of technology when it is necessary within possibilities at the all learning steps in this instruction.

Infrastructures

Goal

To realise a deeper and meaningful learning at 21. Century. To raise young people who can solve the problems that actually humanity have never faced before. To give them skills that they will need when they are in the workforce.

Method

“Tools for Learning Objectives” paradigm is traditional learning aim for the time between 20th and 21st Century. MLD says learning design should start with the point “Learning Objectives for Tools”. Learning objectives (common core, ministry of educations expect from curriculum makers) was the main aim of schools. While we are teaching these objectives we can use some tools such as, researching, debating, discussion, group work, flipped classroom, presenting...

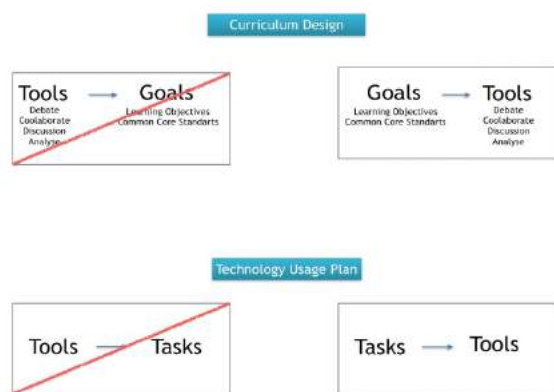


Figure 3: Tools and objectives order.

MLD believes more important one is Tools & Skills, Not the Learning objectives. In the meantime MLD believes Learning is subjective, individualised not objective. About education and cognitive development: the discovery versus instruction principle is a basis of Montessori's (1912/1964) educational methods. Using these methods, a teacher gives no formal instructions but equips the classroom with materials selected to encourage exploratory actions by the children that lead them to discover the principles that the teacher wanted them to learn. Soviet psychologists also endorsed the discovery versus instruction principle. For example, Pavel Blonsky recommended it as a method for school instruction (Kozulin, 1984, p. 131). Discovery has also been a basic developmental principle, perhaps especially in dialectical theories. Examples are Piaget's cognitive psychology (e.g., Piaget, 1970) and Soviet psychology (e.g., Lisina, 1985, pp. 8-9).

Discovery Learning is a student centered method that allows students learning by their observations and activities. (Sözer, 2000, p. 101; Özdemir and Sönmez, 2000 2, p. 63). Senemoğlu (1997, ss. 65- 66) points some practical advices of Bruner's method: Students must learn with their own discoveries. Discovery activity could be in just a lesson or in a whole unit Children must have enough background information which allows to learn new thing connected to that. Students must have a learning environment allows them progress self-paced.

Center

At the center of MLD there is just Learning. Student centeredness or teacher centeredness is not the balance point. MLD say Learning should be at the center of curriculum design. and define roles and responsibilities of teachers and students.

On the each design these can change. Teacher can be a coach on a project then at the next one can be presenter. next one Debate Judge. etc... Also for student, inquirer, researcher, presenter, listener, doer etc. Metacognition, or "thinking about thinking" refers to the mental processes that control and regulate how people think. Metacognition is especially important in project work, because students must make decisions about what strategies to use and how to use them. Marzano's (1998) research of 4000 different instructional interventions found that those that were most effective in improving student learning were those that focused on how students think about their thinking processes and on how students feel about themselves as learners. Constructivist classrooms do more at promoting the children's social, cognitive, and moral development than teacher-centered programs. (Devise & Kohlberg)

Key Points

21st Century Skills are the core of the Design, Social and Cognitive skills: Collaboration, Problem Solving, Analysing, Synthesis, digital Literacy, Learning (to learning), researching, memory, Organising, Emotional Intelligence, innovation, creativity, adaptation, changing, learning.



Figure 4: 21 st Century Essential Cognitive Skills for MLD.

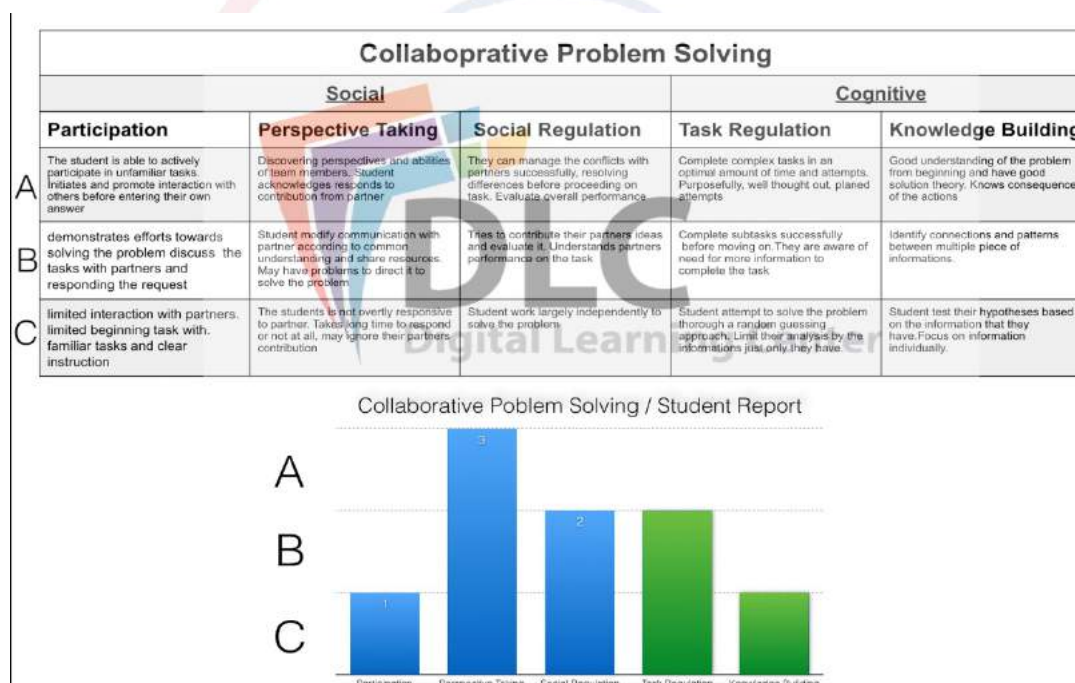


Figure 5: Assessment for Collaborative Problem Solving.

The literature shows that classrooms promoting self-directed learning develop students who are curious and willing to try new things (Garrison, 1997), view problems as challenges, desire change, and enjoy learning (Taylor, 1995). Taylor also found students in these environments to be motivated and persistent, independent, self-disciplined, self-confident and goal-oriented. All of these characteristics support the 21st century skills that students must acquire to be successful in their future endeavours.

Collaborative Problem Solving

MEFİS Wikiedia Page

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123 Arial

A B C D E

Find The red area!

ABCD bir dikdörtgen ve BEC daire dilimidir. Kırmızı renkli alanı bulunuz. (Gerekli bilgiler mail olarak iletilecektir.)

Lütfen çözümü için konuşmanızı alttaki kutulara yazınız.

Öğrenci 1 ertuğrul	Öğrenci 2 efehan
A-B kenarı 12	başka bir şey daha lazım bi eşitlik olayı fin
D-E 8 ise E-C 4	bence EC ve BC eşit bu yüzden BC 4 AD 4
E-C 4 ise ve eferin varsayımını ele alarak	DC 12 AB 12 EC 4 BC 4 AD 4
dikdörtgenin alanından dairenin alanını çıkartmamız lazım	12.4= 48 olur ABCD dikdörtgeninin alanı 48
12.4=48 ise dairenin alanı bulamamız gerek	daireyi bulamaz o zmn EC zaten yapıp
dairenin alanı pi.kare	tam olarak düşünürsek daireyi tamının alanını bulup 4 e bölelim
16.3= 48 dairenin alanı	4ün karesi 16 oğlum benim tarafıma geçme yav .D
48/4=12	güzelmiş kardığım .D 48 i 4 e böl insan oğlu
48-12=36	12 oluyo dikdörtgenin alanı 48 ise
E-C ile E-C eşit olmaz çünkü bu bir dikdörtgen	48 - 12= 36 bu kadar easy .D sen ne düşünüyorsun ertu

KUTLUHAN			
İşbirlikli Problem Çözme			
Beynel		Bilimsel	
Katılımcılık	Bilgiye ulaşma	Görev Yöneticilik	Bilgi İmkanı
Öğrenci atışık olmalı, öğrenme süreci aktif olarak katılmalıdır. Kararı vermede diğerleri ile eşitliği takip eder, kapalıdır.	Aktarılmış olan bilgiyi öğrenme süreci aktif olarak katılmalıdır. Kararı vermede diğerleri ile eşitliği takip eder, kapalıdır.	Öğrenci öğrenme süreci aktif olarak katılmalıdır. Kararı vermede diğerleri ile eşitliği takip eder, kapalıdır.	Öğrenci öğrenme süreci aktif olarak katılmalıdır. Kararı vermede diğerleri ile eşitliği takip eder, kapalıdır.
Sorumlu öğrenme süreci diğerleri ile eşitliği takip eder, kapalıdır.	Aktarılmış olan bilgiyi öğrenme süreci aktif olarak katılmalıdır. Kararı vermede diğerleri ile eşitliği takip eder, kapalıdır.	Karar vermede diğerleri ile eşitliği takip eder, kapalıdır.	Mevcut bilgiler bir araya getirilerek, öğrenme süreci aktif olarak katılmalıdır. Kararı vermede diğerleri ile eşitliği takip eder, kapalıdır.
Diğerleri ile eşitliği takip eder, kapalıdır.	Aktarılmış olan bilgiyi öğrenme süreci aktif olarak katılmalıdır. Kararı vermede diğerleri ile eşitliği takip eder, kapalıdır.	Karar vermede diğerleri ile eşitliği takip eder, kapalıdır.	Mevcut bilgiler bir araya getirilerek, öğrenme süreci aktif olarak katılmalıdır. Kararı vermede diğerleri ile eşitliği takip eder, kapalıdır.

Figure 6: Online Collaborative Problem Solving Example.

Technology

Technology is a major tool for support to realise self learning, researching, organising, archiving, creativity. Today's K-12 students are very different from even their recently graduated peers. These students are digital natives, a term attributed to futurist Marc Prensky to distinguish between those who have grown up with technology and those who have adapted to it [Prensky, 2001] Platform-free or device-free is the ideal way to support. But technologic developments will affect that strongly. In that case Institutes must decide that according to their case. To choose BYOD or 1-1Tablet or just a Computer Lab etc... SAMR Model is an important rubric for integrating technology into learning tasks.

TPACK is an n important tool for defining teachers role during the learning process. Technology implementation should be according to Classroom and learning routines. It must support learning circle: Background information, introduction, delivery-lecture-learning, student reflection - sharing learning outcomes, assessment, feedback, revision.

Flexibility-Modularity

Learning process must let student progress self pace and support them individually. Curriculum makers provide options for different needs. According to Students groups, learning objectives, time of the year, location geography, culture, technological infrastructure, economic realities, common core standards, school and family

expectations and Local-national-international exams; Learning design should allow changes and flexibilities about parts, assessments, timing and progress.

Unit Planing

Backward Planning is also the important part of the designing. Students must involve and shape the project parts; Goals, aims, targets, rubrics, success criteria, skills they will develop.

Learning Objectives: Graphs of quadratic equations, understanding of the symmetry axes of parabola, find the equation of the graph given, extreme points

Lesson:	Mathematics	Product	Learning Activities	Background Info	Intro	Reflection
Class:	Grade 10 (50 Students)	Students create catapult that works based on instructed (Test, improve, evaluate, create)	1) Video analysis of basketball shots 2) Investigating real life parabolas 3) Statistics of catapult shot trails, 4) Mathematical explanations of parabolic movements	Factorizing, simple equations, Linear equations	Basketball shot guess with slowmotion video activity	Video Journal of the production Catapult working capacity
Subject:	Quadratic Equations					
Duration:	4 weeks					
Technology		Vernier for testing catapults	Desmos, FreeGrCalc, Google research, analysis, Nearpod presenting	Nearpod for self reflection of students	Video analysis with Vernier Physics, Graph with Desmos	Movie
Modern Learning Theories	Collaborative problem solving		Pencil, eraser, ruler			
	Flipped Classroom	Create scaffold at home			Watch videos	
	Project based Learning	PBL	PBL	PBL	PBL	PBL
	Challenged based Learning	best basketball shot?				
SAMR Integration	STEM					
	Understanding by design	UBD	UBD		UBD	
	• Substitution		Google - Encyclopedia	Book - nearpod		
	• Augmentation		FreeGrCalc - TI calculator			
4MAT Learning (Student)	• Modification				desmos-analysis video	
	• Redefinition	Vernier - Throw movement	vernier - movement analysis			
	• Engage (WHY?)	Why we test?		What we need?		
	• Share (WHAT?)	How we produce?	How we design?			How we can show?
21st Skills	• Practice (HOW?)				what if we throw different?	
	• Perform (IF?)					
	• Interdisciplinary	Geometry - Vectors	Physics - Throws, dynamics		History - Armies - Weapons	
Individualised	• Advanced Students	find the lowest basket shot			Angry birds and rockets research	
	• Support needs	Make a catapult just throw something	degree of the equations		repeat secondary equations, factorizing	
Assessment	• Formative	quiz for basket shot equations	quiz for background info		(homework) parabola at home	slow motion movement analysis
	• Summative	Catapults test results	describe movement with equations			
21st Skills	• Creativity	production	design		connections - real life	description
	• Critical Thinking	evaluation of product				
	• Communication		designs and decisions			
	• Collaboration	Production jobs				Production movie jobs
	• Problem Solving	test and improve			real life connection	

Figure 7: Unite Plan Example / Mathematics / Grade10.

Learning Objectives: Digital citizenship, cyberbullying, cybersafety, digital laws, copyrights, citation, digital profile

Lesson:	ICT	Product	Learning Activities	Background Info	Intro	Reflection
Class:	Grade 5 (40 Students)	Students will create schools Wikipedia Page	1) Create online platform to create a webdesign. 2) Get the efficient informations, 3) get the resources, 4) Become a wiki-writer 5) Publish it.	Wikipedia, MIT Wikipedia, Edit a page, digital share and collaborate	Students check schools current (old) Wikipedia page, and let them see somebody hacked it. How did it happen?	They will choose a way to show how they did it to other schools
Subject:	Digital Citizenship					
Duration:	6 Weeks					
Technology		Grammarly for citation	Google sheets for pre-web design	Google Chrome and Drive	web: digital citizenship, wikipedia	Movie, Explain everything, bookcreator
Modern Learning Theories	Collaborative problem solving		How to edit wikipedia			
	Flipped Classroom				Research who did?	
	Project based Learning	ProjectBL	ProjectBL	ProjectBL	ProjectBL	ProjectBL
	Challenged based Learning					
SAMR Integration	STEM		How do you secure a web?			
	Understanding by design					
	• Substitution	Grammarly-teacher				
	• Augmentation		GoogleSheets - collaboration			
4MAT Learning (Student)	• Modification		Manage the school page		Create the schoolpage	
	• Redefinition					
	• Engage (WHY?)		What we put as content?			
	• Share (WHAT?)		How to edit?			
21st Skills	• Practice (HOW?)				What if somebody hack again?	
	• Perform (IF?)					
	• Interdisciplinary	Interview - Literacy	Create your own Language version - NFL			
Individualised	• Advanced Students	Adding picture and video?	How many people visit school wikipedia?			Prepare a presentation for other grades
	• Support needs			Drive Share rules	Become Wiki-Writer	
Assessment	• Formative	Working collaboratively in digital rules	Grammar check			
	• Summative	Website is proven by Admin	Grammar check			peer assessment - job completion
21st Skills	• Creativity				webdesign	
	• Critical Thinking					
	• Communication					presentation
	• Collaboration		research		webdesign	
	• Problem Solving					

Figure 8: Unite Plan Example / ICT / Grade5.

Before process start, students must know what they will learn, which skills they will try to develop, what are the success criteria and what are the assessments. Real life production that student will create: First start find a product that student will create for the Unit. This product should be anything related subject and observable on the real life of student.

Connecting the real life production and learning objectives: Design learning process according to learning objectives and production process together.

Identify tools and skills: Identify which skills and tools will need and develop.

Assessment of the learning process: Adjust formative and summative assessments on the progress steps.

Assessment

Assessments should give feedback to people who responsible for learning. teachers should evaluate their role and Plans for unit and lessons for complete the learning and fixing the rest of the plan also redesigning for future.

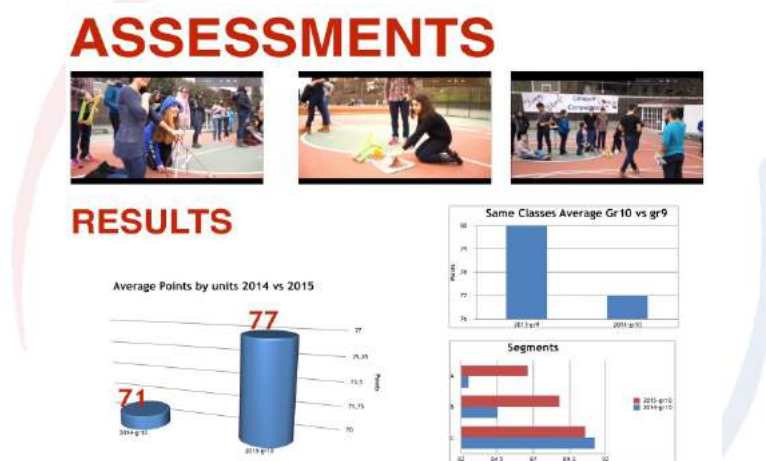


Figure 9: Assessment examples and results.

And students evaluate their learning according to targets and move on for self pace, get what they need and self organise. Assessment should be a part of learning process. And motto about it “What do you assess is actually what you teach” What type of knowledge is being assessed: reasoning, memory, or process? (Stiggins, 1994)

Self assessment - reflection: After finishing the project, students need to reflect on the strengths and weaknesses of their work, make plans for improvement, and integrate the assignment with previous learning (Paris & Ayres, 1994; Stiggins, 1997; Wiggins, 1998). Students’ self-assessments are an essential part of guiding instruction because they provide further evidence of student efforts and achievements. Self-assessments improve communication because students become aware of areas in which they are having difficulties and are better able to articulate their needs (Kulm, 1994). Interviews are better than traditional assessment methods for determining students’ reasoning and level of understanding, Interviews allow for the direct response to students’ misconceptions and errors (Moon and Schulman, 1995; Stiggins, 1997).

Students Collaboration

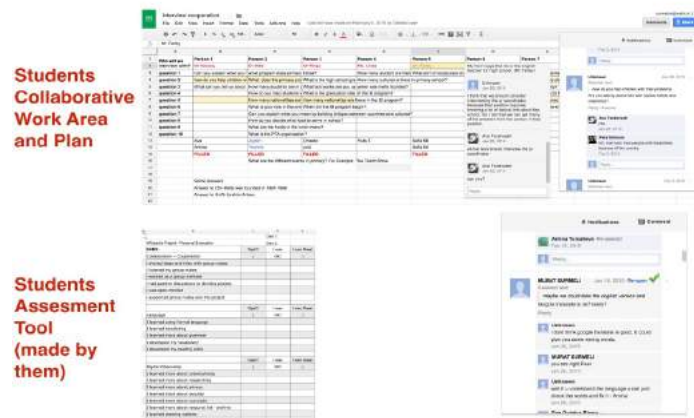


Figure 10: Online Collaboration sheet and self assessment tool from students.

Here some practical examples and essential questions about self-learning for elementary and middle school students: With this project I learned... I was good at (students must create a concept map here as a variation) I was good at How well did i work with others in my group? I can't figure out..., It was really hard to.... What do I want to know more about? I still have questions about.... I am curious about If i do the same activity next time i change....

Positions and responsibilities of student and teacher

Teacher is not just a resource of information. And learning process is not an information transfer process. Teacher positions mostly: facilitator, coach, judge, presenter, supporter, guide etc. depends on the unit and learning approaches. Student roles: doer, researcher, project manager or presenter etc. depends on the unit and learning approaches.

CLASSWORK



Figure 11: Classwork examples about real life learning.

MLD use 4MAT Learning style for defining roles of student and teacher. It has essential questions by student. The 4MAT Model, that humans learn and develop through continuous, personal adaptations as they construct meaning in their lives, is

derived from the work of John Dewey, Carl Jung and David Kolb. And the essential connectedness of knowledge and experience can never be omitted without consequence to the development and individuality of the learner.

Fundamentals

Constructivism (Perkins, 1991; Piaget, 1969; Vygotsky, 1978) explains that individuals construct knowledge through interactions with their environment, and each individual's knowledge construction is different. So, through conducting investigations, conversations or activities, an individual is learning by constructing new knowledge by building on their current knowledge. Constructionism takes the notion of individuals constructing knowledge one step further. Constructionism (Harel & Papert, 1991; Kafai & Resnick, 1996) posits that individuals learn best when they are constructing an artefact that can be shared with others and reflected upon, such as plays, poems, pie charts or toothpick bridges. Another important element to constructionism is that the artefacts must be personally meaningful, where individuals are most likely to become engaged in learning. Also Project-based learning allows in-depth investigation of a topic worth learning more about (Harris & Katz, 2001) such

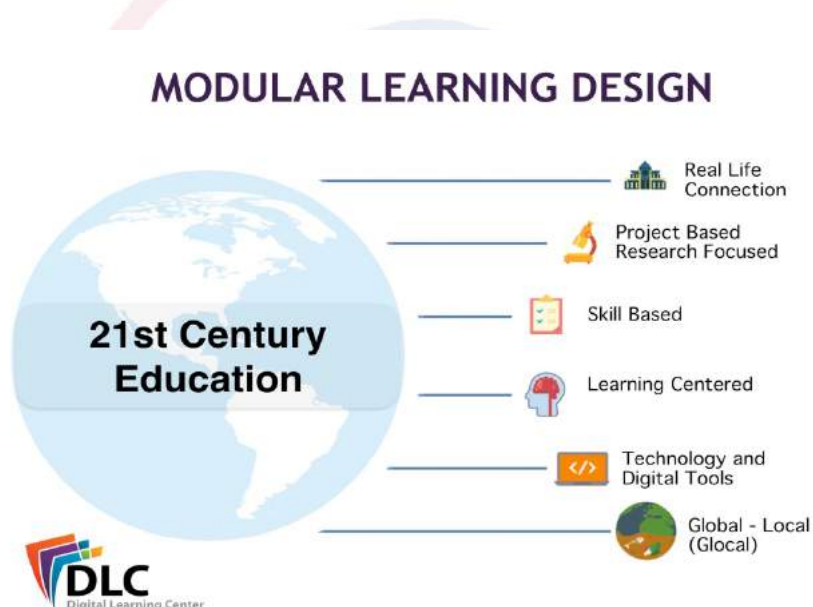


Figure 12: 21 st Century Education Concept for MLD.

as problem based learning. Through the construction of a personally-meaningful artefact, which may be a play, a multimedia presentation or a poem, learners represent what they've learned (Harel & Papert, 1991; Kafai & Resnick, 1996). In addition, unit, project, problem or product based learners typically have more autonomy over what they learn, maintaining interest and motivating learners to take more responsibility for their learning (Tassinari, 1996; Wolk, 1994; Worthy, 2000). For example at project based learning, with more autonomy, learners "shape their projects to fit their own interests and abilities" (Moursund, 1998, p.4)

Lave and Wenger (1991) argue that learning should not be viewed as simply the transmission of abstract and decontextualised knowledge from one individual to another, but a social process whereby knowledge is co-constructed; they suggest that

such learning is situated in a specific context and embedded within a particular social and physical environment

Differences

MLD define “learning, understanding, perceive, realise” different. Learning should give a reflection on real life of a person. High-Fidelity of assessment, tasks, reflections. Students must work on the tasks actually based on real life conditions. results should affect life. MLD doesn’t suggest make educational approaches to create a learner profile. MLD support individual development of students as who they are with their all differences. A presentation, play or poster is not enough to understand real learning realised.

What is new

(Teaching-Learning-evaluating Skills): MLD believes we can observe all the behaviours if we have the skills and sub-skills and define them, then develop and assess. Schools should give report at the end of the semesters, Academic and skills on a developmental continuum bases.

Conclusion

Current technology integration process in education substitutes tools in the classroom and changed the way pupils reflections about learning, however woefully lacks the aspects which technology can be useful in the whole learning progression, especially, analyse, deciding, applying, collaborative working, peer learning; shortly, when learning is happening. This presentation proposes a new paradigm for schools to ensure holistic learning of individuals to address 21st century needs of human. This will be an introduction and demonstration of a new curriculum framework designed for students aged 3 to 12: Modular Learning Design (MLD). With collective rich experience of several years and teachers have experienced Modular Learning Design personally. This new education will achieve: -Pupils ready with values, perception and skills for using their aptitude to effectively use technological advances meaningfully. -Differentiated and productive education -Learning-centered education -High-fidelity in education -Skill based development on individuals -Readying Gen-X to be able to lead and mentor Gen-Y for realising their full potential. -Evaluating 21.Century Skills With this presentation participants, will get the examples of unit-lesson plans, digital materials and students works designed by Modular Learning Design. Participants can join the activity for assessment of 21st century skills with the interactive sample of "Collaborative problem solving"

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The Night of Science: Optics and Photonics for All

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The European Conference on Technology in the Classroom 2016
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Abstract

Today, optics and photonics are widely regarded as among the key technologies for this century. Many experts even anticipate that the 21st century will be the century of the photon – much as the 20th century was the century of the electron. Optics and photonics technologies have impact on nearly all areas of our life and cover a wide range of applications in science and industry, e.g. in information and communication technology, in production, medicine, life science engineering as well as in energy and environmental technology. However, even if so attractive, photonics is not well known by the majority of people. In order to motivate especially the young generation for optics and photonics we took part already two times in the “Night of science” event with a lecture about optical data transmission. We prepared many practical activities and experiments to explain how modern communication through the optical network works. Combining hands-on teaching with having fun while learning about the basic optics concepts we aroused interest of not only the children but also the parents, with a very positive feedback. The “Night of science” is the only nation-wide research event in Austria where the institutions make science accessible to a wide population. Its objective is to present science and research in an innovative, understandable and entertaining way. In the frame of interactive presentations, lectures, guided tours and interactive stations, people of any age can discuss with researchers their latest research results and can perform their own experiments.

Keywords: (the night of science, FHV, Austria)

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Introduction

“The night of science” is the only nation-wide research event in Austria, taking place every two years, where domestic institutions, going from basic research up to industry, make science accessible to a wide population (Fig. 1). This biggest event for science communication has the objective to present the science and research in an innovative, understandable and entertaining way with a free admission. An extensive program offers insights into the world of research: from school projects to cutting-edge research. In the frame of interactive presentations, lectures, guided tours and interactive stations, interested persons can discuss with researchers the latest research results and experiment on their own. The spectrum of exhibitors ranges from scientific institutions such as the Austrian Academy of Sciences, universities, colleges of education through the polytechnics and non-university research institutions to the big industrial companies [1].



Figure 1: Different activities offered to the wide population at “The night of science” event.

Optics and Photonics for All

Today, optics and photonics is widely regarded as one of the key technologies for this century. Many experts even anticipate that the 21st century will be the century of the photon, much as the 20th century was the century of the electron. Optics and photonics technologies have an impact on nearly all areas of our life and cover a wide range of applications in science and industry, e.g. in information and communication technology, production, medicine, medical technology and life science engineering as well as in energy and environmental technology.

However, even though attractive, photonics is not well known by majority of the people. In order to motivate especially the young generation for optics and photonics we prepared already four times the “children’s university” with the lecture about “optical data transmission” with a very positive feedback [2].

Since 2010 “The night of science” event takes place in Austria every two years. Our Research Centre for Microtechnology [3] at Vorarlberg University of Applied Sciences (FHV) participated in this event each time with an interactive optic and photonic stations related to:

1. **2010: Laser and its applications** (Fig. 2a): On May 16, 1960 the first LASER was produced on earth by Theodore Maiman assisted by Irnee D’Haenens and C. K. Asawa. A beam of red coherent light generated in a ruby crystal by Light Amplification by Stimulated Emission of Radiation (**LASER**) shined a bright light spot onto the wall of Maiman’s laboratory at Hughes Research Labs in Malibu California. It is strange, the first person able to see this red light spot was D’Haenens because he was somewhat red color blind and could see red only very faint. The laser crystal at that time was not perfect and produced also plenty of red stray light causing Maiman and Asawa to be dazzled by the bright light flash. D’Haenens eyes suppressed the stray light and only the laser spot in the middle was sufficient brilliant to be seen by him. In 2010 was the 50th anniversary of the invention of the laser and we built a model of this laser with a real ruby crystal for demonstration in “The night of science” event (Fig. 2a). Children and adults have been curious to see and learn how this first laser worked. A laser can be focused to a very small intense light spot and children were fascinated watching a CO₂ – Laser cutting give-away samples out of a fluorescent polymer. To emulate Maiman’s flash light we used a blue LED to stimulate the ruby in our laser model for red fluorescence light emission.

2. **2012: Plants and flowers** (Fig. 2b, c): The same blue LED’s are used in lamps to facilitate plants and flowers to grow better. David Schmidmayr, then a student at Vorarlberg University of Applied Sciences, explained that plants need blue and red light for growth (Fig. 2b). That is the reason plant leaves are green, out of the sun light plants “eat” blue and red light and reflect back the green light which we people can see best of all colors. The student developed a lamp to help plants grow better. For this purpose he did research on light conversion material capable to change just the right amount of blue LED light into red light. The result is a pink color lamp and plants like pink (Fig. 2c). He did this experiment in a mixing chamber, a so called Ulbrichtsche Kugel, to find the best pink for plants. David was very successful in his scientific work and now he could establish his own company together with a friend producing special lamps for plants. I hope the bonsai trees in Fig. 2b will not grow too well with the pink lamps and become finally mammoth trees.

3. **2014, 2016: Optical data transmission**, this is the main topic of this paper and therefore we will discuss it in detail.

We prepared many practical activities and experiments to explain how the laser and the modern communication through the optical network work. Combining the hands-on teaching with having fun while learning about the basic optic concepts we aroused interest of a wide audience.



Figure 2: LASER (a), plant lamps (b) and fluorescence light (c), interesting and useful in our daily life.

Introduction into Optical Data Transmission

Today we can no longer imagine our lives without computers. We write messages to friends, surf the Internet, download music and videos or just play games online, all this belongs to our daily life. But do we also know what's behind that all?

The Internet Connects People as the Roads

The Internet is a huge network connecting millions of people. One can imagine it as the road network. Houses where we live are the computers in the network and the roads connecting the houses are just like the cables connecting all computers together. Cars that drive on the roads, is information that we send or download (Fig. 3).

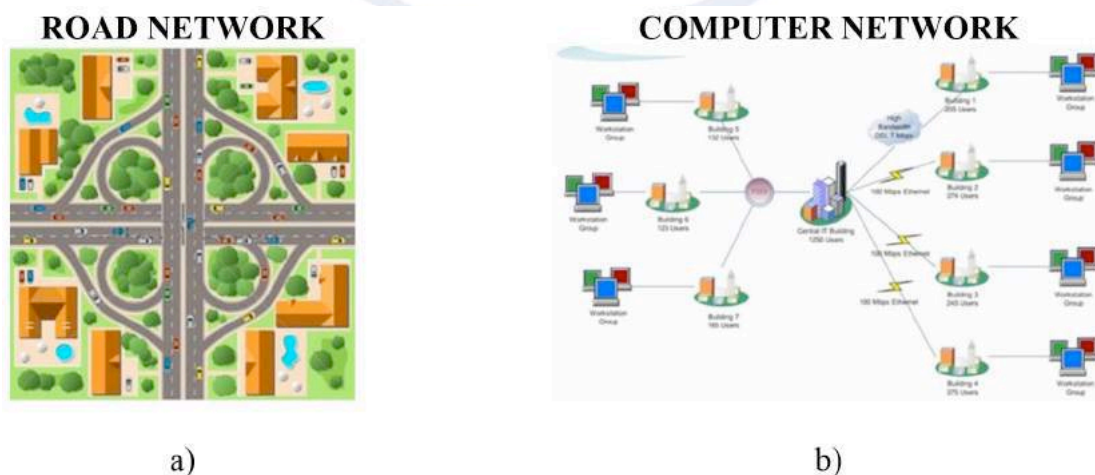


Figure 3: Road network (a) versus computer network (b).

The simplest network consists of two computers that are connected via an electric cable (Fig. 4, so called "point-to-point" network). All information (data) will then be transmitted in the form of electrical signals between computers. Whether an email, a song or a photo, all are first encoded in bits in the computer (translated into computer language), i.e. consist of many 0's and 1's (so called "binary code"). Each bit is then assigned to an electric signal (logical 1) or no signal (logical 0) and sent over the cable. The first computer is also called "transmitter" because it sends (transmits) the data. The second computer is called "receiver" since it receives the data. The received data is then decoded back into a text, a song or a photo.

As long as only two computers are connected via cable, the data transfer is very fast. But when multiple computers have to share a communication cable (Fig. 4, "point-to-multipoint" or even "multipoint-to-multipoint" network), the transmission is getting always slower. The biggest challenge lies in the communication cables that connect cities, countries and even continents. To solve this problem not only a "one-way street" (one electrical cable), but a "highway with many lanes" must be built to serve so many cars (huge amount of data) that simultaneously drive (are simultaneously transferred).

Well, the question is how to do it?

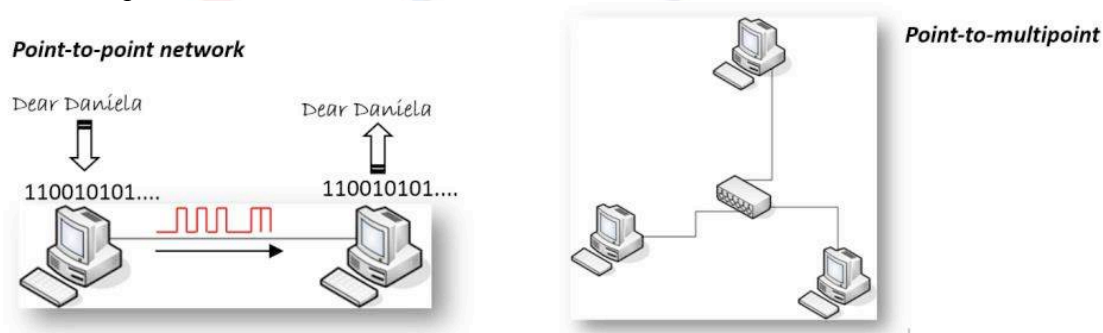


Figure 4: Point-to-point and point-to-multipoint network.

Light Signals are the Solution

The solution to this problem lies in the application of a new technology that uses optical signals rather than electrical signals for the data transmission. To achieve this, our point-to-point communication system from Fig. 4 must be extended (see Fig. 5). In this new system, as a first step the electrical signals (coming from an electrical part of the network) need to be converted into optical signals. To this purpose, the transmitter is used, consisting of light sources such as a light emitting diode (LED) or a laser. This source is modulated, that is turned on or off to represent the binary digits (1's and 0's) from the electrical part of the network. The output are the optical signals. A glass fiber in a fiber optic cable then transmits these signals (light pulses) over long distances. Of course, since the computers can only work with electrical signals, the received optical pulses are converted back into electrical signals again. Photodetectors are usually required on the receiving side. The last part of our optical communication system is the regenerator. When the light signal has to be transmitted in an optical fiber over long distances, it is attenuated and begins to lose its shape. The result is that the signal cannot be recognized at the receiving end. Here so-called regenerators are used.

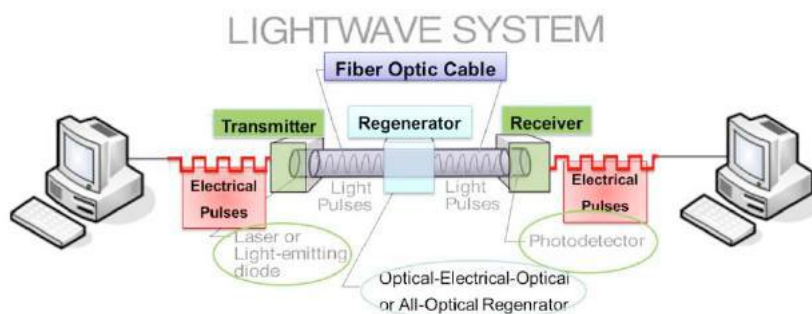


Figure 5: Point-to-point optical system.

Fiber Optics: a New Technology Revolution on the Internet

This new technology is called "Fiber Optics": "Optics" - because the light signals are used as an information medium and "Fiber", because glass fibers are used as the transmission medium. In the model image of our streets the light signals are passing cars and the glass fibers are like a "virtual highway", in which you can increase the number of lines without having to rebuild it, thereby taking advantage of the fact that the light is coloured. Each colour is as a line on the highway (a separate transmission channel). The more colours we use, the more data we can send through a single fiber at the same time without interfering with each other. Already using two different light signals, we can double the transmission capacity. That is one of many benefits of this technology. This new technique is called Wavelength Division Multiplexing (WDM) (Fig. 6).

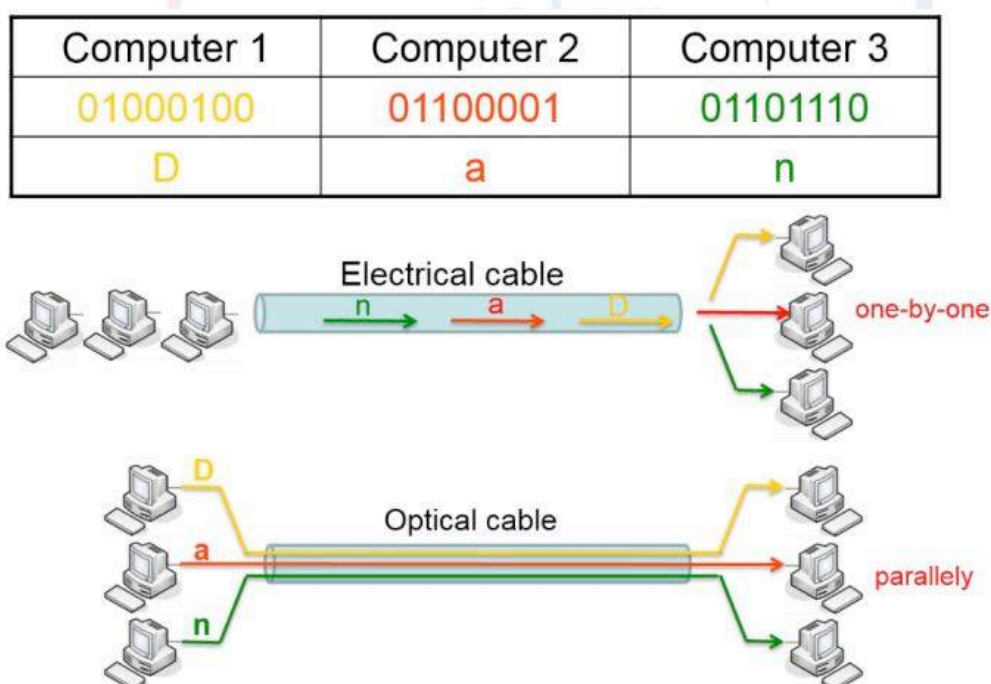


Figure 6: Wavelength Division Multiplexing technique.

The next important advantage of this technology is that the optical signals can be sent over hundreds of kilometres. Nevertheless, how is it possible that the light remains trapped in the fiber and does not get lost?

How does the Fiber Work?

The fact that the light can be guided in a fiber almost without losses over hundreds of kilometres, is based on two physical phenomena: reflection and refraction of light at the boundary between two optically different media. Considering these two phenomena, under particular conditions, the so-called total internal reflection takes place (Fig. 7a). In other words, the light will not enter the other optical medium but stays inside the fibre (Fig. 7b).

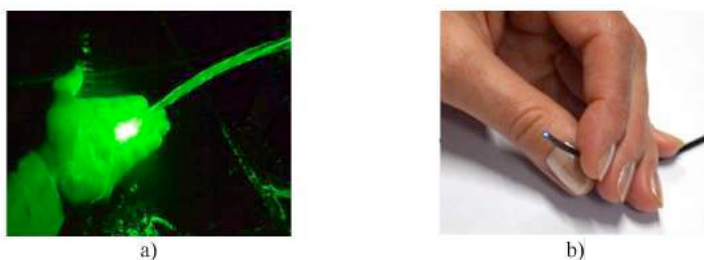


Figure 7: Total internal reflection (a) and optical fiber (b).

Optical Data Transmission for All

The activities at our station were split into three parts:

1. Optical data transmission and optical fibers,
2. Jelly optical waveguides,
3. Photonics explorer.

Optical Data Transmission and Optical Fibers

This activity was split into two parts:

1. **Theory:** To show that we use the optical data transmission everywhere, we started the presentation with an advertising spot from the TV about A1, an Austrian telecom provider, which shows very clearly the use of the optical data transmission in our everyday life (Fig. 8a). This spot also shows the laying of the optical cables in Austria to connect the people (Fig.8b).



Figure 8: a), b) An advertising spot in the TV about A1 (Austrian telecom provider); c) an explanation of bits and bytes.

To explain how any information can be sent through the optical cables (“internet”) we discussed in the next step what is the computer and where it can be used. To this topic we prepared a couple of questions like “What do you usually do with the computer at home?”, “What is an E-mail?” or “Which parts consists computer of?”. This was the simplest part of the presentation since people are very familiar with using computers. With these questions we moved onto the more challenging part, namely “What language do computers really use?”. We were talking about that the people speak different languages, they use different symbols and numbers and this overall is too complicated for computers. Therefore, a brand new language was developed for the computers to understand and communicate with each other. We discussed the bits, Bytes and binary code and their representation in the computer (Fig. 8c). The translation from our language to the computer language and back was also discussed. Finally, we explained how can data be transferred physically through the network: The original way was to send them in the form of electrical signals. However, such data transfer strongly limits the network capacity since the data can be sent through communication links only on one-by-one basis (Fig. 6). If the electrical signals are replaced by the optical signals, they can be easily recognized, e.g. they can be sent simultaneously in one fiber without interfering with each other. This technology, known as Wavelength Division Multiplexing (WDM), is of considerable importance and has one major advantage, namely that even without new infrastructure and using as few as two colours, the transmission capacity of the glass fiber cable can be doubled. The more wavelengths used therefore means the more data can be transferred (Fig. 6).

We discussed also how the optical fibers work and explained total internal reflection (Fig. 9a). At the end of the presentation we showed an experiment (Fig. 9b (left), 9b (middle)) of Daniel Colladon, young professor of physics at the University of Geneva in the 19th century, so called “Daniel Colladon's Light fountain or Light Pipe”. He was the first person, who demonstrated the total internal reflection in the water beam (Fig. 9b (right)) [4].



Figure 9: Demonstration of the total internal reflection in optical fibres [3].

2. Application of the theory: Understanding the theory, in the second part of the presentation the visitors of any age could play the computers where they used real fibers to send the information (one letter) to the others. Some of them played the computers sending the data (transmitters, Fig. 10a) and the others were receiving the optical signals and decoding them into useful information again (receivers, Fig. 10b,c). This was the most interesting and amusing part of the presentation about the optical data transmission.



Figure 10: Sending the optical signals through the fiber: a) transmitters, b), c) receivers.

Jelly optical waveguides

This demonstration was included to give an overview of the physical phenomena that lead to waveguiding, using as waveguides pieces of edible transparent jelly cut out in suitable shapes. It allows, too, to look at the waveguiding of light in a large, easy to see system.

The inspiration for this demonstration comes from conversations, which took place about ten years ago, of one of the authors with Prof. Matthew Anderson (then a postdoc at the University of Rochester, now at San Diego State University). The idea is cutting optical waveguides out of edible jelly. In this way large, fairly transparent waveguides can be obtained and the demonstration has a “house-made” flavour which – hopefully – makes it more attractive. The path of a light beam inside the jelly can be easily followed with the eyes and several basic effects can be shown.

We found one important detail for the preparation of the jelly in an online document of the U.S. organization NNIN (National Nanotechnology Infrastructure Network) [5]: it is better to prepare the jelly in a more concentrated form as in the recipe found on the package; in this way the jelly is firmer and easy to handle. We used a

concentration twice higher than the recipe and we kept the jelly in a refrigerator overnight. Another practical tip is the following: cut the jelly with a hot knife to obtain smooth edges [6] (heating the knife in hot water was sufficient for us). With this preparation it is possible to follow the path of the beam of a laser pointer, sent into the jelly, for four or five bounces before scattering destroys it – scattering takes place mostly at the walls but some scattering centers inside the jelly can be found as well (see Fig. 11). Playing a bit with the position and direction of the laser beam one finds quickly a path along which the beam propagates fairly undisturbed for a distance of 15 to 20 cm. We used a green class 2 laser, which is eye-safe except for prolonged direct radiation - which is usually impeded by the natural aversion response to bright light [7]. The beam path inside the jelly for this laser is easily visible in a room with moderate lighting.

The visitors, like for the other demonstrations, came in little groups of about five to twenty persons throughout the evening. Our initial demonstration was quite essential: show the beam bouncing inside an approximately 15 cm long waveguide, explain that light cannot go through the jelly-air interface (and show that no light comes through the wall using small pieces of paper), bend the jelly showing that light can be guided into different directions.

The demonstration became a bit richer in the course of the evening thanks to questions and stimulating proposals by the audiences. One of the participants expressed his wonder at how can light escape through the wall if a disturbance is present on the other side, close enough to the interface (he was referring to the phenomenon of frustrated total internal reflection [8]). We were – of course – not able to reproduce the phenomenon in this demonstration, as it requires sub-micrometer precision in the placement of the external disturbance; we were though able to demonstrate that an external disturbance that touches the wall disrupts the reflection – we placed a small piece of jelly next to the waveguide wall, at a location where the beam hits it, and the reflected beam (with an almost “magical” effect) disappeared. In retrospect, it would be nice to test the same thing with different materials and see the effect on the beam; we noticed only that water droplets roll quickly off the jelly surface, so that one cannot follow with the eyes their effect on the beam. We took anyway the occasion to talk about an application of waveguiding as a rain sensor (the rain is the external disturbance) or more in general as a surface sensor.

This demonstration led to a next step, in which we cut a waveguide with a slanted entrance edge and we placed its slanted edge in contact with the side of the first waveguide; the slanted edge makes the direction of the second waveguide different from the direction of the first. By pressing the waveguides one against the other or pulling them slightly apart light can be sent into one or the other channel (one can show it with a piece of paper held at the end of either waveguide), which makes for a rough but fun demonstration of optical switching. A couple of children asked then to join more waveguides, and, despite the quite large scattering losses, it was still possible to see light coming out of the far end – just by looking at the paper, they were quite convinced that it was possible to lead light through a couple of “jelly joints”, without any need for words from the demonstrator.

A final step was the demonstration that waveguiding can be achieved only inside the densest medium. In order to do this, we placed two waveguides parallel to each other, with a gap in the middle of approximately the width of each waveguide. We then sent the laser beam inside the gap, trying to get it to bounce at the walls – one could immediately see the path of the light that escaped through the walls of the side-waveguides. The descriptions were different for different groups of people, following the interests of the participants and the intuition the demonstrator had about these interests. We talked about the low absorption of optical fibers and gave a rough comparison with household glass (we stated that 10 km of optical fiber is very roughly as transparent as a few meters of household glass); we explained the preparation of the jelly in detail; someone wanted to know more about the laws of refraction; some people with technical backgrounds asked a few deeper questions. All of this was possible because of the relaxed pace of the evening, the fact that some groups were quite small and that there was usually a gap of a few minutes between one group and the next.

This informal demonstration is easy for the experimenter and – we hope – interesting for the audiences. The immediate impression was that the demonstration is able to raise interest. The jelly waveguides can be turned, in a different setting, into a hands-on demonstration where the participants cut their own waveguides and experiment with them. Since the shape of the waveguides that can be cut is rather arbitrary, experimenting should be rich and fun ([5] suggests the following question: we can cut a waveguide that makes the light direction change by 180 degrees – how small can we make this waveguide?). Of course adequate precautions for eye safety need to be taken when distributing laser pointers to participants.



Figure 11: Sending the laser beam through the waveguide.

Photonics explorer

The experiments used at our station were taken from Photonics Explorer; an educational kit (Fig. 12b), developed by the photonics research team B - PHOT at VUB (Vrije Universiteit Brussel), for students of secondary schools to experiment with the different properties of light and photons (Fig. 12a). The concept is a 'lab-in-a-box' that enables students of the 2nd and 3rd grade to do photonics experiments themselves at school with lasers, LEDs, lenses, optical fibers, and other high-tech components.

The kit fits the learning objectives for sciences and pursues two main objectives of STEM (Science Technology Engineering Mathematics). In the first instance Photonics Explorer links applications to real-world situations and to the life of young

people. They discover for example how the polarization of light is crucial for LCD screens of smartphones and tablets, or how light can speed up the time to download movies from the Internet. Furthermore, the kit is also built entirely around inquiry-based learning in which all students are involved, observing and reasoning actively. This hands-on approach gives students more confidence and stimulates their curiosity and problem-solving skills.

Since November 2011, EYESTvzw is responsible for the assembly and mass distribution, and for supporting teachers in our endeavour to convey the fascination of science and engineering to pupils (Fig. 12c). To organise the distribution all over Europe, EYESTvzw works together with very motivated partners in several European countries. Local Associated Partners are responsible for the teacher trainings and the distribution of the Photonics Explorer in a particular country or region. For more information visit [9].



Figure 12: Photonics Explorer: a) the students of secondary schools experimenting with the different properties of light and photons; b) an educational kit; c) workshops for the teachers.

Conclusion

In this paper we have shown that science can be made attractive for people of any age if it is explained and presented in an appropriate way. One of the examples is the Austrian event “The night of science”, that makes science accessible to a wide population. Here we described the activities we proposed visitors at the Research Centre for Microtechnology (FHV) in this occasion. Combining hands-on teaching with having fun while learning about the basic physical concepts was amusing not only for the visitors but also for the demonstrators.

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Planning and Building Wooden Houses with, And for, Refugees and Residents

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Abstract

In this paper we present the project “Building as Integration” conducted by the students at the higher level secondary technical and vocational college in Rankweil (HTL Rankweil). The project was initiated to help the integration of young refugees and immigrants in the most western part of Austria called Vorarlberg. Throughout the course of this project, a construction engineering class with 30 students wants to put their theoretical knowledge to a practical use and pass it on the refugees. These 30 students are divided into ten teams, each offering mentoring one refugee.

Keywords: building wooden houses, refugees, integration, HTL Rankweil

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Introduction

In the Austrian province of Vorarlberg there are 96 municipalities. Approximately 4 000 people are looking for accommodation. The asylum seekers increase this number every day. The concept of the three local architect that has developed in cooperation with the Vorarlberg timber architecture at the HTL Rankweil, is very impressive. Higher-level secondary technical and vocational colleges in Rankweil train the students in the industries, trade practice and the arts. The main subject's areas are information technology and construction engineering. The project deals with the essential issues of the integration process of young immigrants and refugees.

The aim of the project is the construction of the residential timber houses for the refugees as well as the residents. Under current conditions, planning processes for affordable social housing are going to be implemented. Consequently, the completion of the first house for unaccompanied, underage refugees is planned for next year. Experts on construction engineering, timber construction, carpentry, electrical engineering and installation technology alongside with the linguists, translators, communication and cultural experts work at the HTL Rankweil. Their common effort will be of crucial importance. The neighboring schools will contribute knowledge in the field of kitchen gardening, domestic management and cooking. The first wooden house is scheduled for in-school-construction in 2016. Completing the project requires a team work and a good communication as well between the students and the refugees in order to come up with the final solutions. The project is supported by teachers as well as various local institutions such as the diocese, the parishes, the State of Vorarlberg, the municipalities as well as building societies in cooperation with Vorarlberg timber craftsmen.

Planning and project work

This project commenced as the task during the workshops (GBK) in and the lessons Building Construction and Technology (BKT) at the HTL Rankweil. Without knowing what the wooden houses can be used for, the students began to draw. They started with the first sketch plans for the construction of floor (see Figure 1), sections and elevations. After completing the first sketch, the BKT teachers explained that the houses may be especially suitable for both, the refugees and the locals. The students became very interested and exciting about it. They made small changes to the current designs of the first models with scale 1:200 (see Figure 2) [1]. Simultaneously, the students discussed the process of the completion and re-using the wall and ceiling structures in various wooden designs.

Ecological aspects

Wood is a sustainable building material. It has excellent CO₂ and energy indicators. It is a renewable-and energy-efficient building materials with the best CO₂ balance. A wooden house for adolescents should be a zero-energy house (under 30 kWh/m²). This house has to be built close to the town centre so that the refugees have good access to public transport. The extra surfaces are to be used for planting the gardens. This house is very ecological by using an energy balance at the construction, including its mobility possibilities.

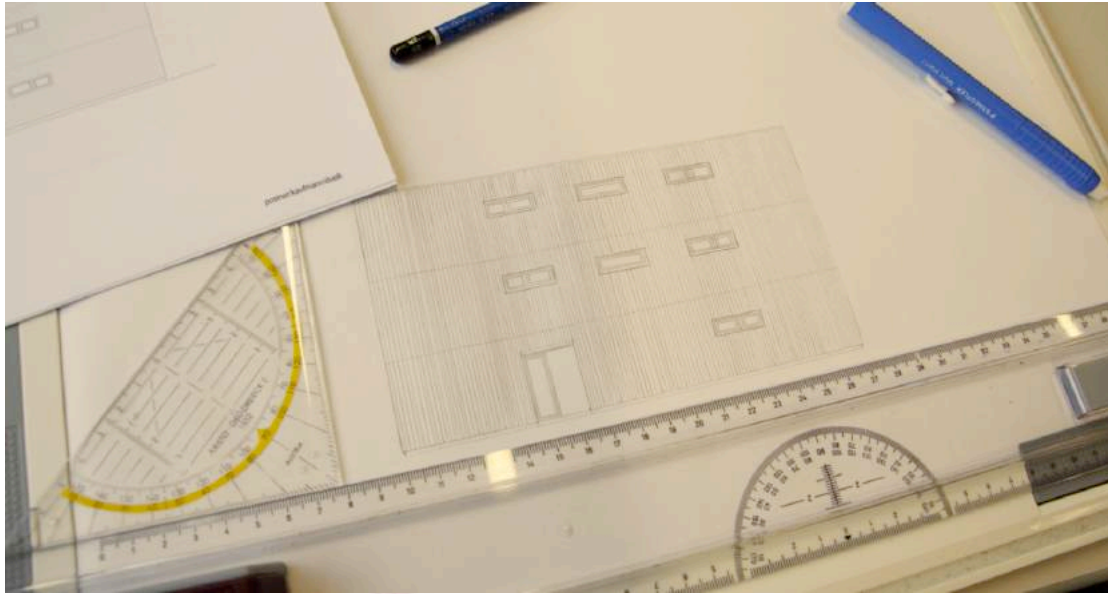


Figure 1: The first sketch for building the floor.

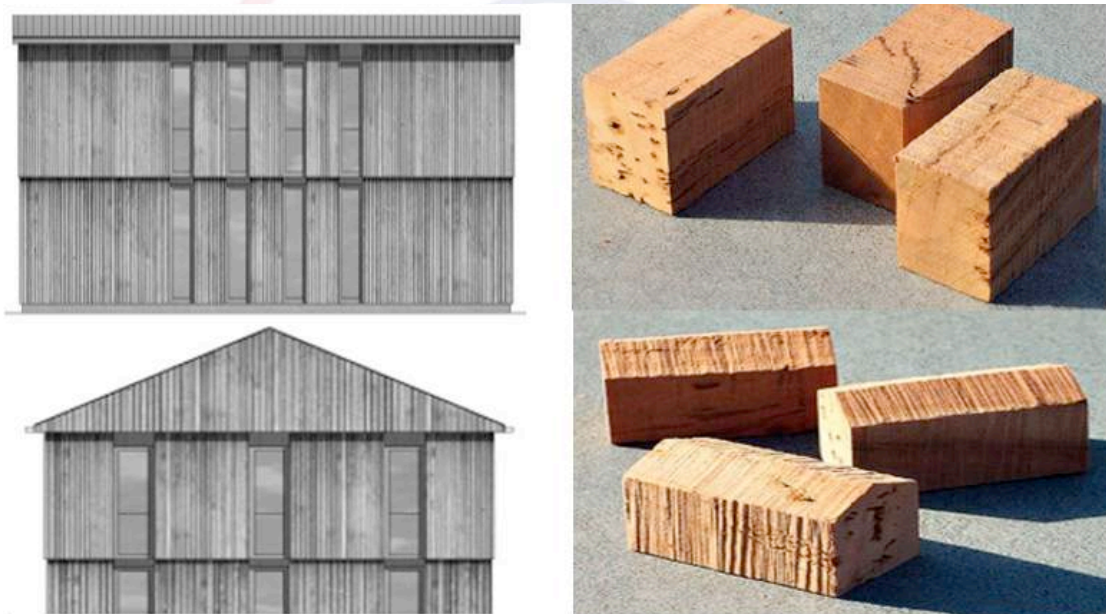


Figure 2: Housing patterns in wooden constructions (left) and the first models with the scale 1:200 (right).

Social aspects

The whole school project has also a social aspect. The refugees did not have any opportunity to learn something about the Austrian culture or language. And the other way round, the same was true for Austrian youngsters. In this project, the teamwork, self-organization and organizational skills were very important (see Figure 3) [2]. It gave the students a chance to get to know the refugees personally. This was the best way to become familiar with the purpose of the designs (see Figure 4) [3].



Figure 3: Social contact between students.



Figure 4: Students working on the project objectives in wooden constructions.

Economic aspects

The designed houses are very cost-effective, built by our employees in a very efficient way at the same time. The main concept concerning the residents of those houses, whether they are the refugees or the locals, is to help with the expansion. It refers to the interior design, possibly the facades, furniture - especially through recycling- and also to the gardens and surrounding areas. Those houses, once they are no longer accommodated by the refugees, can be immediately used as a guest house or apartment. This also involves the cooperation with the municipalities that come to term in a win-win situation.

Economic feasibility

Financially, the houses are entirely feasible. There will be three floors and it will officially cost about 540 000 Euro net, which is extremely cost-effective. It was estimated that the extra 10% could be saved due to the team own work and funding.

Objectives and Project Results

The first objective was to prepare the plans for the pre-fabrication of the wooden house in the timber workshop of the HTL Rankweil (see Figure 5). In order to achieve it, in the interim, a new goal was to make such progress in the designs with the scale 1:50 so that it could be built with the scale of 1:10 as a model plan in the summer 2016.



Figure 5: Wall and ceiling structures in wooden constructions.

The second objective was to give the young people from Afghanistan, Iraq, Iran and Syria, refugees at the same age (15 to 19 years) the chance to participate in the planning process (see Figure 6). Additionally, three students from the College in Bludenz came to the HTL Rankweil every day to teach them German language. There were more than 40 people in the classroom every day.

The third objective was to document the project work in order to present its results at the competition “Youth innovation” (see Figure 7 and 8).

The fourth objective was to come up with a vocabulary list in four different languages (see Figure 9, 10 and 11).



Figure 6: Making progress by participating in the project.

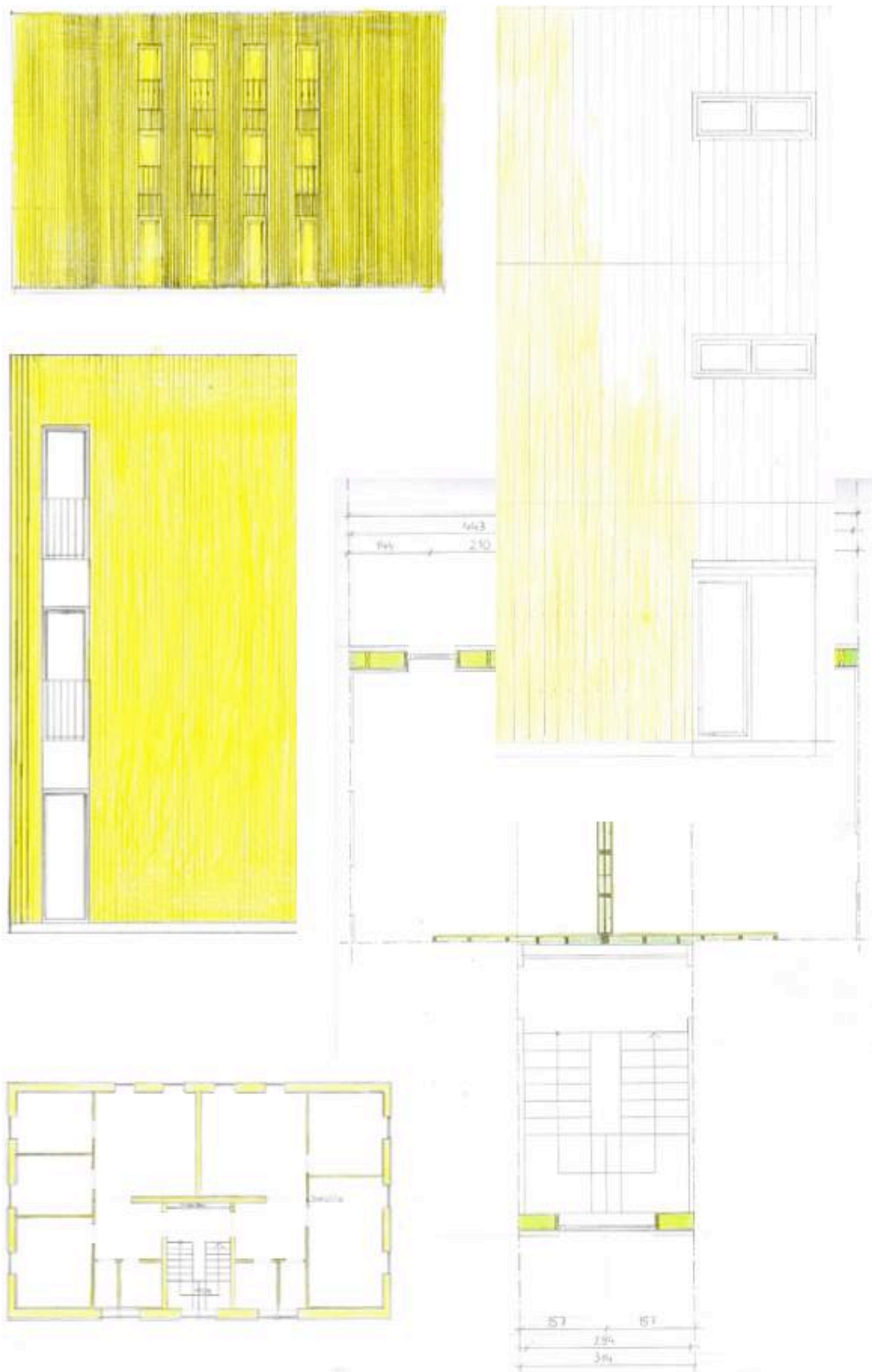


Figure 7: Examples of students 'sketches.

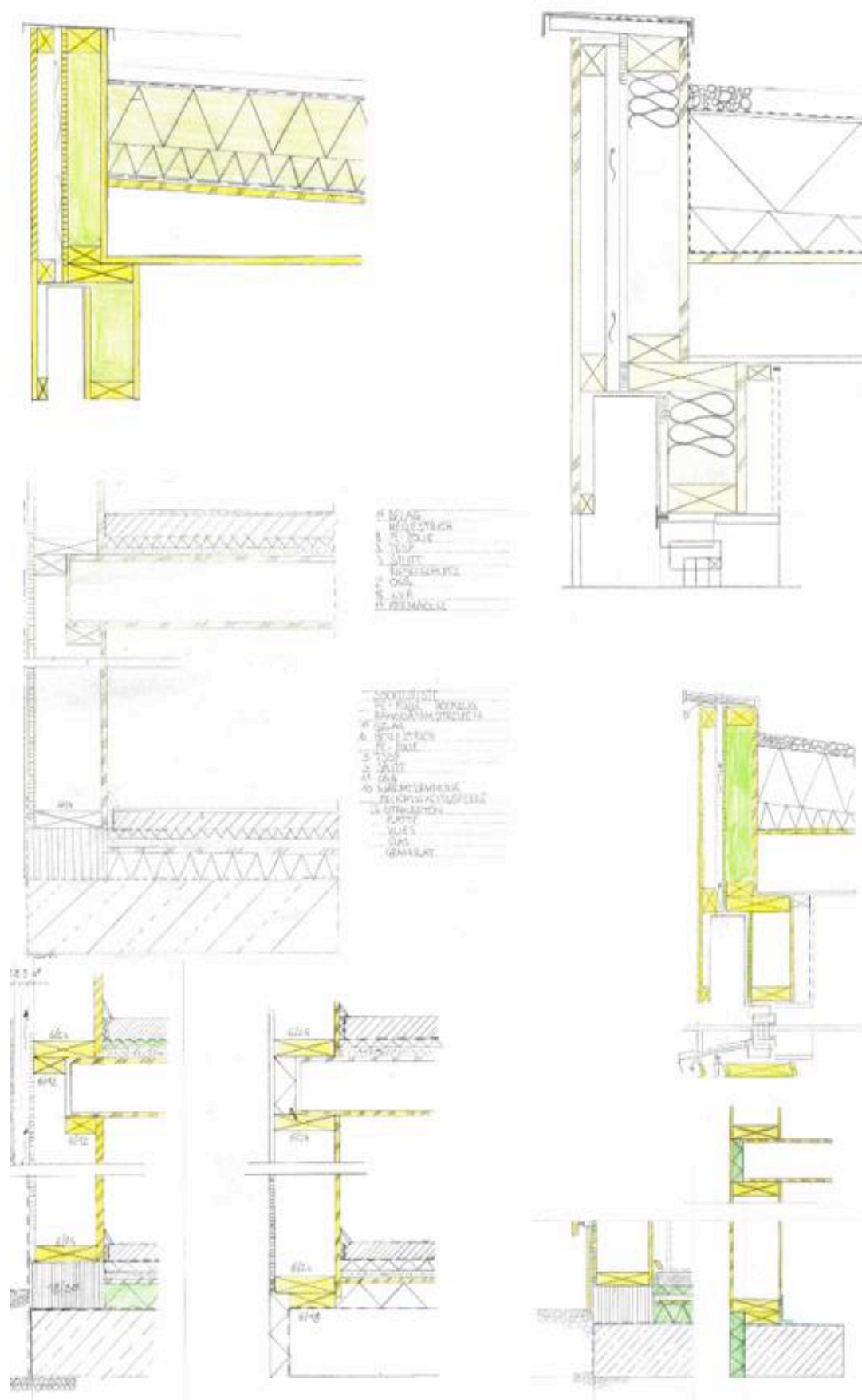


Figure 8: Examples of students' sketches.

Deutsch	Englisch	Persisch	Arabisch
Grundbegriffe fürs Bauen			
Grundstück	property	طرح	موقع السناد
Maßstab	scale	مقیاس	مقیاس
Grundriss	floor plan	نقشه ساختمان	مخطط البناء
planen	to plan	برنامه ریزی	مخطط
Winkel	angle	زاویه	زاوية
Fassade	facade	نمای خارجی	واجهة
Wand	wall	دیوار	جدار
Straße	street	خیابان	شارع
Erdgeschoss	first floor	طبقه اول	طابق اول
Obergeschoss	upstairs	طبقه بالا	طابق علوی
Schnitt	section	مقطع. کس	مقطع
Baustelle	building site	محل ساختمان	موقع البناء
Decke	ceiling	قسمت داخلی سقف	بدراسة السقف
Boden	floor	طبقه. زمین	أرضها
Ziegel	brick	آجر. ضلع	بلوكة / لينة
Beton	concrete	کافکونیت	بتون
Holz	wood	چوب	خشب
Stiege	stairs	پله	اوداج
Dämmung	insulation	عایق	عزل
Dach	roof	سقف	سقف
Fenster	window	پنجره. ککلیک	نافذة
Türe	door	در دراز	باب

Figure 9: A list with technical terms in four languages.

Deutsch	Englisch	Persisch	Arabisch
Grundbegriffe für die Kommunikation			
Hallo	Hello	سلام	مرحباً
Tschüss	Bye	خدا حافظ	راك اللقاء
Wie heißt du?	What is your name?	نام شما چیست؟	ما اسمك؟
Ich heiße...	My name is...	نام من چیست...	أنا ادعى...
Wie alt bist du?	How old are you?	شما چقدر ساله هستید؟	ما هو عمرك؟
Ich bin ... Jahre alt.	I am ... years old?	من ... ساله هستم!	أنا ... سنة
Wie geht es dir?	How are you?	من و شما چگونه هستید؟	كيف حالك؟
Mir geht es gut.	I am well.	من خوب هستم!	أنا بخير جيدة
Mir geht es schlecht.	I feel bad.	من خوب نیستم!	أنا أشعر بالسوء..
Woher kommst du?	Where are you from?	شما از کجا هستید؟	من أين أنت؟
Ich komme aus...	I came from...	من از ... هستم!	أنا أتيت من...
Was möchtest du essen?	What would you like to eat?	دوست دارید چه چیزی بخورید؟	ماذا أريد أن تأكل؟
Ich hätte gerne...	I would like to have...	من می خواهم داشته باشم...	أنا أريد أن أأخذ...
Was machst du gerne?	What do you like to do?	چه کاری را دوست دارید انجام دهید؟	بماذا أتعجب أن تفعل؟
Ich mache gerne...	I like to do...	من دوست دارم ... را انجام دهم!	أنا أحب أن...
Danke	Thank you	شکریه ممنون	شكراً لك
Bitte	please	لطفاً. خواهش می کنم.	من فضلك
Entschuldigung	Sorry	معذرت می خواهم. ببخشید	مناسبت

Figure 10: A list of useful words and expressions in four languages.

DEUTSCH	ENGLISCH	PERSISCH	ARABISCH
Räume / Zimmer			غرف
Wohnzimmer	living room	الطاق نشین	غرفة المعيشة
Treppenhaus	staircase	راه پله	بيت الدرج
Badezimmer	bathroom	حمام	حمام
Schlafzimmer	bed room	طاق خواب	غرفة النوم
Küche	kitchen	آشپزخانه	مطبخ
Garage	garage	گاراژ	س.ا.ع
Garderobe	wardrobe	جارفتی. جالوسی	خزانة
Esszimmer	dining room	الطاق غذاخوری	غرفة الطعام
Toilette	toilet	توالیت. بمسند	توالیت
Abstellraum	storeroom	انبار	مستودع
Keller	cellar	زیرزمین	قبو
Dachboden	attic	طاق زیرسقف	عليه سقفة
Hobbyraum	hobby room	الطاق بازی. الهوايات	غرفة الهوايات (العب)

Figure 11: Vocabulary list in four languages.

The collaboration between the students and refugees

Everybody was very pleased with the communication between the students and the refugees. The pupils didn't know them at all before the Project Week. Nobody knew what would happen. Of course, the youngsters had some good experience from the workshop during the "Open Day" at the HTL [1]. One big advantage was that most refugees were at the similar age. The older people assimilated quickly and completely, had a lot of fun and helped with the translation. It also gave the Austrian teenagers a big chance to get in touch with the young people from Syria, Iraq, Iran and Afghanistan without any complications. It was a great opportunity to work together and have common goals. Of course, the students learnt as well that not all of the refugees were interested in the construction work. In spite of it, they were convinced that this was an interesting week for all. Besides, they laughed a lot while working. They visited some of the refugees during the holiday time. It was very interesting for them as well and they learnt a lot. Working together was very successful in spite of language and technical problems, because several colleagues helped a lot with translation: Professor Heidi Shah is an architect and works in the HTL Rankweil. She used to live and work in London for several years. When some of the complicated matters were discussed in German language, she could easily translate them into English. Zainab Murtazawi, a medical doctor and a computer science specialist from Afghanistan and Issa Almaaz, an architect from Syria could perfectly translate from English into Farsi and Arabic language.

Learning process in teams

Advantages: The key to the success during that week was good management of the project. The youngsters worked in small groups consisting of four people: the three locals and one guest per team. Sharing the responsibilities was crucial as well: drawing, transferring, documenting helped a lot while working together with the guests. Another big advantage was the possibility to continue working as long as it was necessary without any interruptions. The breaks and meals were well-timed. The students were very happy to have a day off on the “Carnival-Tuesday”. The discussions with the experts were very informative. The pupils were pleased with the static calculations and the progress of particular solutions. The time spent with media, namely the ORF TV was exciting and they had a lot of fun together.

Drawbacks: The group had much more work than other HTL students. They also had to remain in school and work after the lessons. It really was an intensive period of time. But they all spoke with one voice and decided to continue working on this project. All in all, the project enabled the students to gain some unforgettable and practical experience of the world of work. In the future, they will be certainly using their computers more often. This was not possible at that time, because the pupils were not experienced enough and had too little training then.

The collaboration with the partners

The cooperation with the partners (companies, research institutes, authorities, media) was of primary importance as well. Several interviews were conducted with some authorities: University Professor Hermann Kaufmann, TU Muenchen, Herbert Brunner, Holzbaukunst Vorarlberg, Both of them invested a lot of time in order to explain essential details concerning the wooden constructions. They spent several hours with the group, way too few. However, the students hoped to be able to invite them again. Herbert Brunner explained thoroughly a great potential of ‘wood construction’ in Vorarlberg and gave the exact reasons why he was so fond of the project. His interview can be watched and heard on video. He expressed himself that he could imagine himself being involved in the making of the project [4]. Christian Breuss, the Department of Housing and Urban Development, Municipality in Rankweil, Wilfried Blum, priest in Rankweil were appointed to represent the president of Rankweil. They explained in detail all of the development projects nearby the HTL Rankweil, including the one chosen for the team to make their dreams come true. His statement let the group realise that above all a building with educational purposes for the teenagers was necessary. Wilfried Blum talked about his point of view as a priest. He encouraged the young people to pursue their goal. Obviously, a good atmosphere while working together in the group of the teenagers from different cultures, impressed him a great deal.

It was a very special event for the students to welcome the representatives of the local government in Vorarlberg during the Project Week. It was interesting to hear them both talking about their job, which correlates significantly and closely with the project. Both of them were impressed by it and considered the work completed by that time to be the first step in the whole process. They were also amazed how uncomplicated the teamwork (locals and refugees) was.

The visit paid by the journalists was an interesting experience to the students. Parizia Begle from the diocesan communication centre in Feldkirch and Stefan Krobath from the ORF Vorarlberg interviewed the students, most of them for the first time in their life. Making short videos with the ORF Vorarlberg was especially fascinating. The youngsters realised how much time and energy it required in order to present the project clearly to the TV-viewers [5]. Some shots had to be taken twice because of some minor problems. The second attempt worked out fine most of the time.

Conclusion

In this paper, the integration project “Building as Integration” was presented. The project was initiated by the refugees and the students at the higher level of secondary technical and vocational college in the HTL Rankweil. It was supported by their teachers as well as various local institutions like the parishes, the State of Vorarlberg and the municipalities. The project required a good cooperation of many building societies with the Vorarlberg timber craftsmen.

Hereby, the activities taken up by the HTL Rankweil students and the refugees, were described. Their work, step by step, including the planning, their project work, the ecological-social-economic aspects and eventually the results of the project were presented.

The whole process combined some hands-on experience of the job and approach to teaching with a continuous improvement process, which included learning about construction engineering and information technology.

Forward planning for constructing the wooden houses was very successful because of the good time management, being efficient and working in a team. There was plenty of fun for all the students, refugees and the collaborators. Shared knowledge, effort and joy was a contributing factor in order to achieve a common goal.

Acknowledgements

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The Situation of Media Literacy of Physicians in Iran

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Abstract

Media literacy is a set of views that addresser use it actively when confronting to Medias messages to interpret and analyze the meaning of received massages.

In this research situation of media literacy of physicians in Kerman, especially general physicians and also the relation between media literacy of physicians in Kerman, their personal features, the amount of using different Medias, the amount of access to different medias, special kind of using different medias, the reason of using different medias, the amount of knowledge about medias contents, the amount of knowledge about medias consequences and their views about modern communicational technologies has studied.

Studying the first hypothesis of this research showed that there is a meaningful relation between personal features of physicians in Kerman and their media literacy.

Studying the second hypothesis of the research showed that there is a relation between the amount of using Medias with physicians in Kerman and their media literacy. It means that in case of increasing the amount of using different Media by physicians in Kerman their media literacy will increase.

This research showed that there is a relation between the amount of access to different Medias with physicians in Kerman and their media literacy. It means that in case of increasing the amount of accesses to different Medias by physicians in Kerman their media literacy will increase. So there is a relation between the kind of using different Medias and their media literacy.

This research also showed that there is a straight relation between the reason of using different Medias by physicians in Kerman, the amount of their knowledge about Media's contents, the amount of physicians in Kerman's knowledge about Media's consequences and their media literacy.

The last hypothesis of this research showed that when increasing in the physicians in Kerman's views about modern communicational technologies their media literacy will increase.

Keywords: Media, literacy, media literacy, physician, general physician in Kerman

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Introduction:

In the past, the more educated the ability to read, write and count knew, but in the present era of information and communication technology development, production and distribution of diverse information, the emergence of networks, databases and multimedia and need more people to information, the concept of literacy has changed.

The concept of literacy in today's information society which is subject to technological change as well as numerous information sources, with other concepts like library literacy, computer literacy, network literacy, media literacy and information literacy is linked. Living in the information society on information literacy as a set of abilities and skills to search, evaluate and use information effectively needs.

Literacy is the foundation of human thought and consciousness. Some traditional literacy required capabilities to communicate with others through reading, writing and arithmetic the shed. It aims to improve the daily life, collaborative, problem solving human and social development and individual capacities society. Many experts believe that media literacy is primarily targeted to deal with the media will be discussed.

Therefore, media literacy, skills training necessary to communicate thought fully and deliberately to the media and had to get a detailed look at critical and analytical media messages (written, visual and auditory) is important.

The medical community has a constant dialogue there stating whether the information in social media are a reliable and valuable.

In fact, any media, and politics has its own guidelines and its own method of compiling the facts. This means that different media may be a single event to provide different forms.

Statement of problem:

The key role of media and communication technologies play in society. How to deal with this technology and its interaction with all segments of society, including doctors, basic and important debate.

Media literacy determines right and wrong today the availability of information with multiple large media, the audience what to do and what to take?

The main objectives of media literacy awareness and try to minimize the negative effects of the media. People need to understand that every day by the media to purchase goods and various messages are permanently invaded.

They must realize that the media goals are and how they are clever without being in your thoughts, actions and behavior is shaped by the media contacts unconscious, with a view to the coordinated actions and words.

In today's social media messages are seen in abundance on the health of people to comment on. Custom messages in the field of health, especially by foreign media to spread in the community. In addition to the general public, someone in the audience of the media, the medical community.

The importance and role of doctors in a community is no secret. Because doctors are dealing with the health of a society and the media also are the largest and most extensive notification Tool. Therefore, physicians' use of media in spreading health messages and carrying out activities related to the promotion of public health, it seems imperative.

Unfortunately, some doctors have no understanding of the influence on society and the media may cause this problem, the importance of spreading health messages through the media are realized.

With increasing media communication between doctor and increase their level of media literacy can be solved this problem. Also a physician for the use of new scientific content requires the use of media . And its association with factors such as the type of expertise, personal characteristics, the use of media.

The present research status of media literacy Kerman Kerman on media literacy and the use of communication technologies and media focusedss to various media, how to use different media, motivated by the media, awareness of media content, familiar with the consequences of the use of physician's attitude toward the media and new technologies, review.

The main research question is: What is the status of media literacy Kerman. The assumption is that physicians' use of information and communication technologies and varied media.

Research purposes:

The overall objective of this investigation was to identify the status of media literacy and media literacy is Kerman. So the main aim of this investigation was to identify the differences Kerman media literacy and how differences in skills or abilities in the use of the media there.

Detailed

objectives:

1. Recognize the individual characteristics of Kerman and the relationship between individual characteristics with their media literacy.
2. Recognition of Kerman medical specialty physicians' specialty media literacy and the relationship between them.
3. Diagnosis of Kerman access to different media and different media access and media literacy relationship between them.
4. Understand the use of different media practitioners and media literate about how to use them.
5. Understand motivation physicians' use of the media and respect their motives and media literacy.
6. Demonstrate the knowledge of doctors of media content between their knowledge of the content and media literacy.
7. Trading in Kerman understanding the consequences of using the media and the relationship between the familiarity and their media literacy.
8. The views of doctors about the new communication technologies and their perspective on the relationship between new technologies and their media literacy.

The main question:

What is the status of media literacy of physician in Kerman city?

Minor points:

1. What are the characteristics of individual in Kerman and whether the individual characteristics of physician in Kerman and media literacy there is a significant relationship?
2. What is the specialty of Kerman and is a significant relationship between medical expertise and media literacy is there?
3. What is the physicians' use of media types and the relationship between media use and media literacy doctors there?
4. What is the availability of Kerman in various media and any significant relations between the different media access and media literacy are there?
5. How to use different media practitioners. How the media use and literacy there do is a significant relationship?
6. What is the motivation motivate physicians' use of media and media literacy There is a significant relationship?
7. What is the knowledge of physicians of media content and the relationship between knowledge of the content and media literacy doctors there?
8. Trading in Kerman medical outcomes what is the use of media and the difference between the familiarity and media literacy doctors there?

How is the physician to new communication technologies and the relationship between media literacy and their perspective on the new communication technologies are there.

Hypotheses:

1. There is a significant relationship between media literacy and among individuals in Kerman city.
2. There is a significant relationship between expertise and media literacy in Kerman.
3. There is a significant relationship between the use of media and media literacy in Kerman city.
4. There is a significant relationship between the access to the different media and media literacy in Kerman city.
5. There is a significant relationship between the use of different media and media literacy.

The theoretical framework of media literacy:

Media literacy is a set of views that exposure to media messages for the audience to actively use it. Media literacy experts 5 basic principle for a critical analysis of media messages that are mentioned include:

Make media messages and media professionals.
Media messages are just a part of reality is expressed.
The media inquiry is to produce a set of unique rules.
Media messages to their audience sense

Methods:

In this study, in order to collect the required data, a questionnaire was designed.

According to the study, statistical population consists of all doctors working in Kerman formed in 1393 that the number of 1564 persons. This is self-made questionnaire items media literacy, motivating media usage, media usage, media consumption, attitudes towards the media, and awareness of media content, media and awareness of the consequences of demographic characteristics and job measures will.

Descriptive findings:

Frequency distribution of subjects by gender

Of the 172 patient's evaluated 8 patients did not specify their gender. From 164 respondent 64 (0/39%) women and 100 (0.61%) were male. The table and chart below shows the frequency distribution by gender.

Table 1. Distribution of subjects by gender

Sex	frequency	percent
Female	64	0/39
Man	100	0.61
Total respondents	164	100
No answer	8	
Total	172	

Distribution of subjects based on age

Of the 172 patients evaluated 10 patients did not specify their age. Out of 162 respondents, 28 (17.3%) between 20 and 30 years, 58 patients (7/35 percent) between 31 and 40 years, 61 patients (7/37 percent) between 41 and 50 years and 15 (3 / 9%) had more than 51 years of age. The table and chart below shows the distribution by age.

Distribution of those surveyed according to the level of language proficiency and computer 5 out of 172 people studied had not specified the language skills and your computer. 167 respondent of 11 patients (6.6%) and 7 patients (2.4%) less, 77 patients (1.46%) and 82 patients (1/49 percent) average, 44 patients (3.26 percent) and 48 (28.7%) high, 18 patients (8.10%) and 18 (8.10 percent) high and 17 patients (2.10%) and 12 patients (2.7 percent) quite thus had mastered the English language and computers. The following chart shows the frequency distribution table in terms of proficiency and computer are given.

Qualitative descriptions variable media access

Of the 172 people studied five patients (9.2 percent) are very low, only 6 (5.3%) less, 20 patients (11.6%) in average, 24 patients (0.14%) high and 117 (0 / 68%) had access to the media too much. The results of the tables and graphs are presented below.

Describing the qualitative aspects of media use variable incentive most doctors examined to get scientific information and then receive political and cultural, economic and social use of the media.

A small percentage of doctors to use recreation of the media.

Qualitative descriptions variable media literacy

Of the 172 patients evaluated in 4 patients (3.2%) is very low, 10 patients (8.5%) or less, 45 patients (26.2%) in average, 95 cases (2/55%) high and 18 (5 / 10%) had too much media literacy.

Qualitative descriptions ranging knowledge of the content Of the 172 patients evaluated, 16 patients (3.9 percent) are very low, 41 patients (23.8 percent) or less, 55 patients (0.32%) of average, 50 patients (29.1%) high and 10 (8 / 5%) were aware a lot of media content

Analytical results

Hypothesis 1: between individual characteristics of physician in Kerman and to examine the relationship between individual characteristics of Kerman and analysis of variance (ANOVA) and correlation coefficient ETA (a variable nominal qualitative and a quantitative variable of normal) were used. Results are shown in the table below. Results indicate that between individual characteristics of physician in Kerman and media literacy. There is no significant relationship (05/0 <p).

Hypothesis 2: Between the use of media by physician and media literacy exists. To study the relationship between the use of media and media literacy of Kerman Pearson correlation coefficient was used (a normal two variables).

Hypothesis 3: between the physicians in Kerman access to a variety of media and media literacy exists.

To study the relationship between the Kerman access to a variety of media and media literacy they have access Pearson's correlation coefficient (normal quantitative variables) Pearson correlation coefficient between the two variables Kerman access to a variety of media and media literacy was equal to 536/0 that illustrates the relationship between these two variables (05/0 > P). This relationship is in place. That is logical and constructive with increased access to the media, media literacy will also increase.

Conclusion:

The study "Kerman media literacy" was performed. Media literacy is a set of perspectives that the audience actively for exposure to media messages it used to mean the message has been received, as well as the interpretation and analysis. .

In theory, people who are media literacy, the information it less vulnerable because messages designed to influence them and sent at different levels to better recognize.

Even children are aware of how the media can generate information in the world of children, are less effective in the face of mass media messages. Also, teachers and professors that media literacy skills, can effectively and efficiently disseminate know.

In this study, the first hypothesis test showed that the relationship between individual characteristics of Kerman and media literacy is meaningful. Edge denial media and the gap between educational and social programs to eliminate. Cooper and colleagues studied the results of this study contradict.

Based on the results Cooper and his colleagues demographic characteristics associated with the experience and activities over features, factors that are continually physicians' use of online social technologies had an impact at different levels. The reason for this discrepancy difference in the community and those elections.

In this study, the second hypothesis test showed that Kerman between the use of media and media literacy exists.

With increasing use of media types by physician, media literacy also will increase.

In this study, the third hypothesis test showed that the amount of Kerman access to a variety of media and media literacy exists.

By increasing access to a variety of media Kerman, media literacy will increase them. As a result, media literacy enables the message is received, the challenges faced and the audience from passive to active status, interviewer and show your reach.

In this study, the fourth hypothesis test showed that the use of different media and media literacy Kerman exists.

In this study, the fifth hypothesis testing showed that the motivation of Kerman medical use of different media and media literacy exists.

"Media literacy" as most relevant to "get motivated for media use scientific information", "motivated the use of media for political information," "motivation to get information from media and cultural-economic-social" and " motivation media use for recreation "is.

By increasing scientific, political, cultural, social, and economic and media literacy will also increase. Also, by reducing the use of leisure and entertainment, media literacy will increase.

In this study, the sixth hypothesis testing showed that the relationship between the knowledge Kerman media content and media literacy exists. . Namely to increase the knowledge of Kerman media content, media literacy will also increase.

In this research, hypothesis testing showed that between the seventh Kerman awareness of the consequences of media and media literacy exists.

This means that with increased awareness of the consequences of Kerman media, media literacy will increase their.

The final hypothesis testing showed that between Kerman physicians and used of new communication technologies and media literacy there were coloration.

With positive attitudes toward Kerman new communication technologies, media literacy will also increase.

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CALL to Arms: Generations Clash Over Digital Technology in the Foreign Language Classroom

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Abstract

Is a smart phone a toy or a tool? Students can't get enough of it – after all, social media notifications and viral videos do take time to reflect on - while teachers, quite understandably, are dismayed to see an excellent educational tool used purely for entertainment. This paper posits that these two concepts and attitudes are not mutually exclusive. It proposes a possible common ground, 'edutainment,' the integration of interactive mobile technology with the classroom for new opportunities to effectively achieve learning objectives in a light-hearted spirit. The research study described below examines the attitudes and intentions of 120 Thai EFL university students towards learning with a playful, competitive smart phone application, hoping to find out if there is any resistance to adoption, and if so, how to overcome these obstacles. Results indicate general acceptance, widespread use, and an altogether positive attitude to the software. The paper concludes by highlighting student impressions of its relevance to their studies and offering recommendations for further integration of digital technology into foreign language classrooms.

Keywords: CALL, mobile technology, foreign language learning

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1. Introduction

Students send texts, watch videos and update social media. A lecturer facilitates understanding of content through relevant activities. As long as these do not happen at the same time, there is peace in the classroom. However, when these conflicting interests collide, a desperate tug-of-war begins. Teachers resent the recreational use of mobile devices, saying it is detrimental to learning, while learners complain when their instructors prevent them from posting pictures of last night's dinner. Today's students spend their days hooked up to one screen after another: a flat-screen TV at home, GPS navigation in the car, a tablet/iPad for fun, a laptop computer for homework, and of course, a smart phone as often as possible. In school, however, they get in trouble when any of these screens leave their school bags. If they break the rules and have separate from these devices, even if only till the end of the day, the emotional pain they feel amounts to that of losing a limb – which is essentially what a mobile phone has become for most of them.

This paper argues that there exists a common ground, a learning-centred intersection where a digital mobile device is an asset, not a liability. It examines student behaviour and perceptions about an interactive multimedia software application in the specific context of an international university in Thailand. The concept of digital technology integration *per se* is not new at this institution; every classroom is equipped with a projector and a computer with Internet connectivity. This study documents an educational initiative where both parties, teachers and students alike, step out of their comfort zone: instructors have to accept that they are not the sole educators in the classroom, while students need to take responsibility for their own learning and realise that a smart phone can be much more than pure entertainment.

This *something old, something new* approach to education is often called blended learning. One of its many pedagogical advantages is that it moves learning beyond the classroom. Students have instant access to authentic material, allowing them to make use of “dead time” (time spent waiting for a bus, their friends, or to be seated at a restaurant) which would otherwise be lost for studying. Another benefit is that a computer never gets distracted, bored or tired of being asked the same questions, of having to repeat the same explanations over and over again (Nunan & Lamb, 1996). In addition, this indefatigable virtual tutor may provide personalized training, or offer much-needed remedial practice to struggling learners.

Yet another important aspect of blended learning concerns information flow. In a traditional classroom, subject-related information flows in only one direction, from teacher to students (T2S). In a blended environment, learners are encouraged to interact with each other (student-to-student (S2S)) and/or with the computer (S2C). Another common scenario involves instructors who are less familiar with computer technology and need to rely on their students' tech-support advice (S2T). Blended learning is a novel approach not only in the sense that it incorporates digital technology, but also because it reshapes and redefines conventional roles of the teaching/learning process.

2. Objectives

This study attempts to find positive relationships between students' beliefs and actual use of a target software called Quizlet. It investigates how this particular mobile application supports educational goals, especially in the context of undergraduate foreign language learners from the millennial generation. Although examining the attitudes of all stakeholders (i.e. learners, teachers and school administrators) may provide a clearer picture, the focus of this paper is restricted to analyzing the students' perspective, their expectations, opinions and decisions. Instructors and their beliefs concerning the impact of adopting mobile technology, as well as curriculum design decisions and policy recommendations by school administrators are hoped to be explored in a follow-up study.

The paper addresses the following research objectives:

1. To identify the relative significance of factors that lead to Quizlet use;
2. To explore how beliefs, attitudes and intentions predict actual usage;
3. To consider whether access to the software drives actual usage, and
4. To actively involve participants in content creation.

3. Literature review

This paper uses Davis' (1989) *Technology Acceptance Model* (TAM) as its conceptual framework. Although this model is widely used in social psychology and business management, the author believes it is suitable for computer-related educational research purposes as well. Designed to explain how new technology is received and used, it identifies two specific beliefs, perceived usefulness and perceived ease of use, a combination of which first affects attitudes and behavioural intentions, then leads to actual use (see Figure 1).

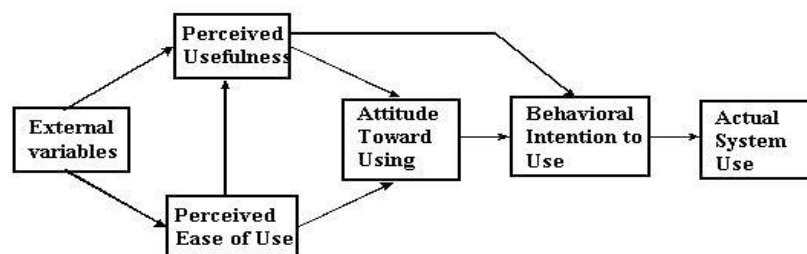


Figure 1. Technology Acceptance Model. Source: Davis et al., 1989

Davis et al. (1989) defined perceived ease of use as the degree to which a person “expects [that using a particular] system [would] be free of effort” (p. 985). He also described perceived usefulness as “the degree to which a person believes that using a specific application system will increase his or her job performance” (ibid). External variables include system design, task and

user characteristics. These factors were further refined by Venkatesh et al. (2003) who proposed a *Unified Theory of Acceptance and Use of Technology* (UTAUT). This model extends the scope of intention to use by three major factors: performance expectancy, effort expectancy and social influence. In the current paper, performance expectancy refers to students hoping that Quizlet will help them pass exams; effort expectancy means that it does so without an unreasonable amount of time and effort; and finally, social influence is interpreted as peer pressure; whether or not others view Quizlet use as beneficial or unnecessary.

Perceived benefits are a powerful factor in technology use. As Dörnyei (2007) points out, “it is highly unlikely that every student will do his/her best for a project in which they have little interest and which has no direct bearing on their school grades” (page 189). In an immediate, often unconscious cost/benefit analysis, an assignment is evaluated “within an economic framework of how much attention a student must invest in completing it” (Lankshear & Knobel 2002, cited in Purushotma, 2005:94). Consequently, if a student is not convinced about the ease and usefulness of an activity, they will be less inclined to take part in it.

Sharma & Barrett (2007) describe blended learning as a combination of face-to-face teaching and appropriate use of technology. A blended model can also be defined as “a thoughtful integration of classroom face-to-face learning experiences with online learning experiences” (Garrison & Kanuka, 2004:96), with a [potential] “outcome [of] increased efficiency and convenience for students and professor” (ibid). Hubbard (2009) posits that the online aspect improves learning efficiency (“learners pick up knowledge or skills faster and with less effort”), learning effectiveness (“learners retain knowledge or skills longer, [...] and/or learn more”), and convenience, because “learners can study and practise [...] across a wider range of times and places” (page 2).

The “digital divide,” according to the Merriam-Webster dictionary, encompasses “economic, educational, and social inequalities between those who have computers and online access and those who do not.” Warschauer (2002) extended the original scope of the concept, including factors and resources that allow people to use technology well, i.e., those of content, language, education and literacy. By this definition, all students who participated in this survey were digitally literate. The overwhelming majority had access to both a mobile phone and the Internet; they were encouraged to learn with the digital version of a part of their textbook; all were reasonably fluent speakers of English, and finally, they could reasonably be expected to be familiar with touch-sensitive smart phone screens, with swipe / tap navigation within software applications. However, what Warschauer failed to take into account was the importance of generations. Today’s young learners are sometimes referred to as “the Millennials.” They have access, they have the know-how, and their skills and preferred channels of communication are mostly technology-based. Not accommodating their learning styles could lead to “a failure to build a bridge between the technological world Millennials live in and the classrooms we expect them to learn in” (Considine et.al., 2009:473). The amount of smart phone use in classrooms has reached a critical mass, a level where restricting it is not just a Herculean effort, but is also counter-productive. This techno-savvy generation expects a learning experience that is

fundamentally different than that of their parents, and when they are refused, they resist and rebel.

Technological innovations are especially susceptible to fads, of getting popular very quickly, then disappearing just as fast. Gartner's (www.gartner.com) *Hype Cycle* (Figure 2) graphically describes the expected lifespan and popularity of fresh initiatives. This model is typically used in the business world, but this author proposes adopting it for educational research as well, in order to highlight and predict potential obstacles to classroom technology integration.

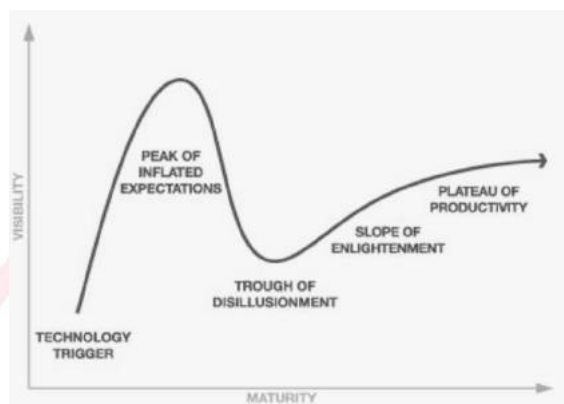


Figure 2. Gartner's Hype Cycle. Source: www.gartner.com

The graph begins with a “technology trigger,” the introduction of a new product/program/process, often accompanied by bold promises. People are inspired, and form “inflated expectations” of what it is rumoured to be capable of. When the product cannot live up to these high hopes, people get discouraged and many of them abandon it altogether. Later on, with reasonable expectations and more time spent exploring the program’s capabilities, comes “enlightenment,” and finally, “productivity,” where “mainstream adoption starts to take off” (Gartner). Learners in digitally enhanced language courses go through the same stages; therefore, they need to be informed about the strengths and limitations of computer technology in the classroom so they can look at it as a tool that can improve their foreign language skills, rather than a substitute to class attendance.

4. Context

Decontextualized coursework (Egbert, Paulus and Nakamichi, 2002, cited in McMurry et al., 2016) poses a major threat to both motivation and achievement. Awareness of reasons behind course content decisions tends to increase student involvement. In order to avoid student sentiments that the word lists in each unit of their English II textbook are *ad-hoc* selections of unrelated lexis, it is important they realize that in the context of tertiary studies, success requires knowledge of academic vocabulary.

Academic vocabulary is defined as “non-high-frequency vocabulary common across academic disciplines” (Schmidt, 2010:78). Assumption University (AU) has an international, multi-cultural

faculty and student body; therefore, apart from foreign language courses, the medium of instruction is English. Consequently, familiarity with interdisciplinary phraseology is expected of students who need to interpret, analyze and critically reflect on subject-matter areas in faculties as diverse as Communication Arts, Business Management, Law or Nursing.

In English for Academic Purposes (EAP) courses of increasing difficulty, AU students acquire the skills necessary to successfully meet course requirements. A fundamental criterion for the selection of course content, including vocabulary, is to improve comprehension of scholarly texts, and to increase the quality of students' written work and interpersonal communication skills. The majority of these word families come from the Academic Word List (AWL) developed by Coxhead (2000). During mid-term and final exams, a selection from each set of words is checked as part of students' progressive assessment. When they are able to confidently form meaningful, grammatically correct sentences, they have mastered the lists, helping them "produce coherently structured written assignments." (Coxhead, n.d., page 1)

This research study used Quizlet, a multi-platform mobile application, to investigate student attitudes towards EFL-related technology. In a separate but related survey three months earlier, students' self-reported mobile technology use had been found to be restricted to electronic dictionaries and occasional Google ® searches for course-related information. By offering a multimedia tool that they could access any time and anywhere, it was believed that this new approach would provide a significant enough departure from teacher-fronted vocabulary activities, as well as from students' habitual purposes of smart phone use, i.e., entertainment.

Quizlet was chosen for reasons of convenience, relevance and interactivity. Although many other similar apps are available, the author had been introduced to it in a conference plenary session by keynote speaker Pete Sharma (co-author of *Blended Learning*, 2007). Furthermore, as Burston (2014) argues, outside distractions make mobile-based language learning better suited for short bursts, rather than longer stretches of concentrated attention. The software uses an offline database and creates a shortcut icon on users' smart phones, thus providing convenient, instant access. Secondly, the Quizlet mobile app was expected to be compatible with the needs of the current generation of learners and their learning styles. Nicholas (2008) points out that millennials expect communication [and instruction] via technology; therefore, by suggesting a study option that resonated with them, it was hoped that its adoption rate would score high on the "actual uptake continuum" (Davison, 2013), i.e. more students would be interested in giving it a try. Finally, Quizlet employs an interactive, almost game-like approach, and the satisfaction of being at the top of the leader board in one of its mini-competitions was hoped to further motivate students to playfully acquire academically relevant English vocabulary.

5. Research Design

Data for this project was gathered between mid-October and early November 2015 from 121 first- and second-year EFL learners. They were enrolled in an undergraduate, intermediate-level (English II) course at Assumption University, Bangkok, Thailand. Participant selection followed a convenience sampling model: faculty members were requested for assistance, and all the students in their randomly assigned classes were surveyed.

In the orientation phase, students took part in a 20-minute demonstration, were shown the features of the software, and were assisted in downloading, installing and registering it on their mobile devices. Phase 2 took place about one week later. In compliance with ethical guidelines, each participant signed a consent form which outlined the purpose of the study and highlighted its voluntary and confidential nature. Pages 2-4 of this self-completed questionnaire package, which on average took about 15 minutes, contained a total of 35 descriptive, factual, behavioural and attitudinal questions. Responses were organized under the headings “Biographical information” (6 items, structured), “Actual Use” (9 items, Yes/No), “Perceived Ease of Use” (6 items, Likert-scale), “Perceived Usefulness” (4 items, Likert-scale), “Attitude toward Using” (6 items, Likert-scale), and “Intention to Use” (4 items, Likert-scale). Two questions in the Likert-scale categories were reverse coded to avoid response bias, and these scores were inverted during evaluation.

Between Phases 1 and 2, i.e., during the one-week experimental period, students were encouraged to freely explore the program and to form opinions about its strengths and weaknesses. It was hoped that their insights and reflections would reveal positive relationships for the hypotheses of this study, which are outlined below.

Digitally literate Millennials expertly handle mobile software that requires them to tap or swipe items on a smart phone screen. Familiarity with navigating within these applications was expected to make Quizlet use easy. Past experience with similar program designs and modes of manipulation, and the fact that learning to use this program requires only a moderate amount of effort are three factors that were expected to characterize student impressions.

Hypothesis 1: Perceived ease of use positively influences attitude toward use.

Although a crucial factor in itself, a user-friendly interface does not guarantee acceptance. It is likely that students preparing for examinations focus on end results, on usefulness instead. Expected benefits of educational software must also be taken into consideration when attitude toward use is defined.

Hypothesis 2: Perceived usefulness determines attitude toward use.

Positive beliefs about the ease of use and usefulness of a program, or satisfaction with its demonstrated features do not necessarily lead to intentions. A user may acknowledge the benefits of an activity, but still be unwilling to try it themselves. The next hypothesis posits a close correlation between positive attitudes and a student’s intention to use Quizlet.

Hypothesis 3: Attitude toward using leads to increased intention to use.

Regardless of a user’s willingness regarding a specific program, he or she may still not get around to actually using it. Time constraints, other commitments, or forgetfulness are important factors that negatively affect whether or not a user actually launches the app. Conversely, a person will not use a program voluntarily if they are not convinced of its merits.

Hypothesis 4: Intention to use is directly and positively associated with actual use.

In a blended classroom, information flows in multiple directions. Students help each other (S2S), and sometimes even advise their technologically less inclined instructors (S2T). In addition, if they are satisfied with a program, they might tell their friends in other classes about it. During Phase 1, they were not overtly encouraged to share their experiences, but two items of the questionnaire in Phase 2 specifically asked about the future likelihood of recommending Quizlet to others.

Hypothesis 5: Satisfied active users will recommend Quizlet to other students.

The conceptual model proposed in this study and its hypotheses are presented in Figure 3.

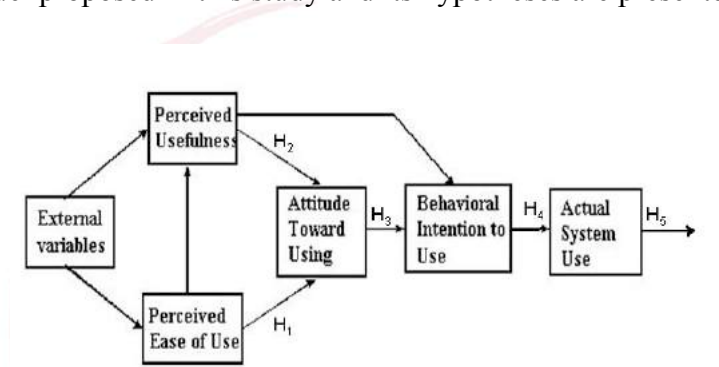


Figure 3. TAM model for Quizlet with hypotheses

5. Data analysis and results

Raw data from the questionnaires was processed using IBM SPSS 23.0 analysis software. Descriptive biographical statistics of the participants are presented in Table 1.

Respondent characteristics	Frequency	Percentage
<i>Gender</i>		
Male	41	33.9
Female	80	66.1
<i>Age (in years)</i>		
17-18	3	2.5
19-20	107	88.4
21-22	9	7.4
23-24	2	1.7
over 25	0	0
<i>Owns a smart phone</i>		
Yes	121	100
No	0	0

Has mobile Internet

Yes	119	98.3
No	2	1.7

Hours spent online / day

less than 1 hour	2	1.7
1-3 hours	19	15.7
4-6 hours	52	43.0
over 6 hours	48	39.7

Table 1. Descriptive respondent statistics

Cronbach's alpha values were all above the recommended benchmark of 0.7, proving the reliability of the model. Exploratory Factor Analysis batteries returned .822 for Kaiser-Meyer-Olkin (KMO) measure for sampling adequacy (checking for variance among variables, with suggested values above 0.5), and 1265.659 for Bartlett's test of Sphericity at the .000 significance level. According to Factor Extraction and Eigenvalues, the eight strongest factors accounted for 62.684 % of total variance overall. Finally, a Multiple Ordinary Least Square Regression sought to identify possible cause-and-effect relationships between dependent variables (Attitude, Intention and Actual Use). Figure 4 shows the results of hypotheses testing, relationships between variables, and their significance.

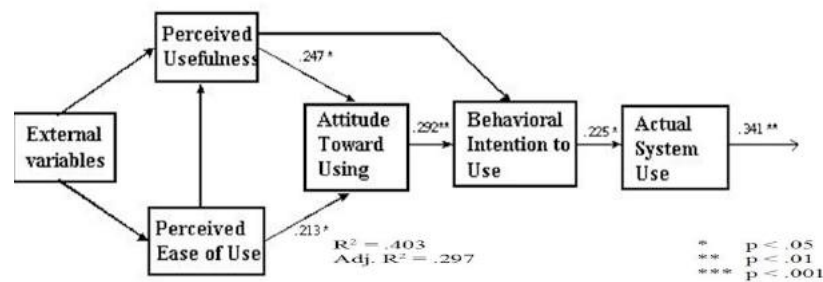


Figure 4. Hypothesis diagram and test results

Actual use is a reliable indicator for educational technology acceptance. Tables 2 and 3 summarize the results of the Actual use regression equation, with statistically significant evidence for both current and projected system use.

ANOVA^a

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	6.397	1	6.397	8.241	.005 ^b
	Residual	92.380	119	.776		
	Total	98.777	120			

Table 2. Regression analysis for Actual use (1)

Coefficients^a

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
(Constant)	1.880	.176		10.669	.000
Did you use Quizlet during the past 7 days? (Yes=1; No=0)	.568	.198	.254	2.871	.005

Table 3. Regression analysis for Actual use (2)

The frequency graph in Figure 5 presents actual system use in a visual form, highlighting student groups that are of special interest for long-term success.

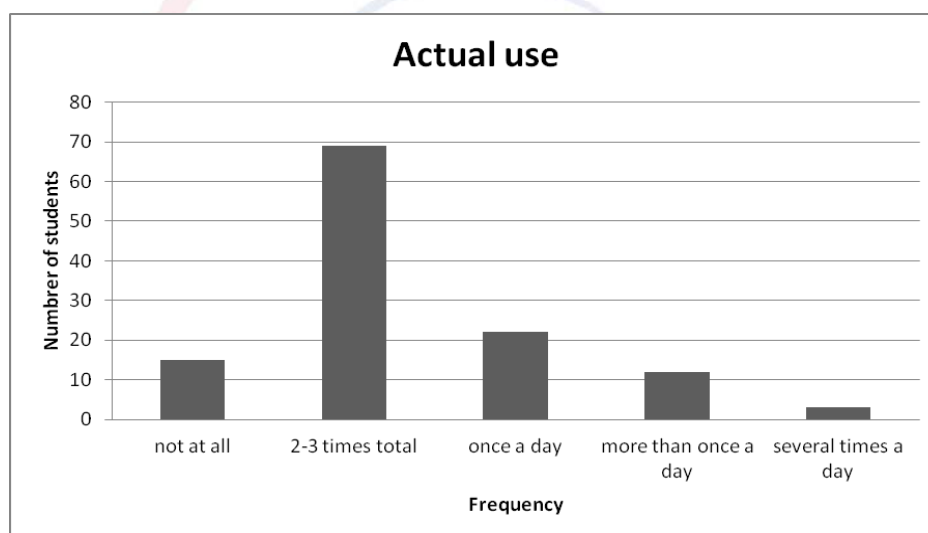


Figure 5. Actual use

Quizlet allows registered users the freedom to create card sets in any language. A reliable indicator for Actual use is students designing their own word lists, especially if they do so without being prompted by their instructor. Several participants figured out how to modify the original English input, generating personalized sets in their mother tongue. As computer text-to-speech and an auto-play feature are both available for a number of languages, a smart phone and a pair of Bluetooth headphones were all they needed for a hands-free audio dictionary to review the target vocabulary lists – without the mobile ever having to leave their school bag.

6. Conclusions and discussion

The aim of this paper is to explore how attitudes and intentions can predict the use of an educational software application called Quizlet. It examines whether access, ease of use and usefulness lead to acceptance of digital technology; whether learners find it beneficial enough to add *education* to the many functions they associate with their smart phones. Almost every participating student had a mobile internet package, and by their own account, 43 % spent between 4-6 hours a day online, with almost as many admitting regularly spending over 6 hours every day on the Internet. Since Quizlet is free to download and use, by having a phone with Internet connectivity, the majority of today's language learners can overcome the single most important obstacle to technology integration: access. Schools no longer need language laboratories, or to invest in expensive IT infrastructure: every student comes to school with a mobile device that can facilitate language learning both in- and outside the classroom – even in cyberspace.

However, it would be a mistake to equate access with success. As Hyland (2013) warns, access does not, by itself, guarantee learning. Teachers need to motivate, to constantly encourage students, and when in the classroom, to monitor that phones are used for educational purposes only. Online entertainment or social media are irresistible distractions, but with clearly communicated and enforced guidelines – which students should help create – this interference can be kept to a minimum.

The threat of disciplinary action is a poor, short-term motivator. Being creatively involved in content creation, on the other hand, may instil in students a long-term perspective, getting them one step closer to their future goals with English. Encouraging students to participate in making Quizlet sets on their own may result not only in a sense of ownership, but also in increased willingness to actively learn, rather than passively consume, content that is tailor-made for (and by) them.

Nation (2006) explains learning burden as the relative difficulty of acquiring new words in a foreign language, “how closely [form, meaning and use] relate to knowledge the learners already have” (page 448). Academic vocabulary, by definition, has a heavy learning burden. Its inherent difficulty is in stark contrast with its relative usefulness for success at university. Once students realise the value of Quizlet as a learning tool, this new format of content delivery and review may take away some of the burden of memorizing long lists of complicated words.

In statistical analysis, Eigenvalues indicate factors that account for variance. The most significant components of this analysis in descending order of strength include students using Quizlet often to prepare for exams, recommending it to their friends, and using, but not necessarily insisting on, the audio feature. In other words, computer text-to-speech synthesis is not advanced enough for pronunciation teaching, but on the other hand, participants intended to use the software (thus proving Hypothesis 4) and they told others about it (proving Hypothesis 5). Regression analysis found a strong correlation between perceived ease of use and attitude (verifying Hypothesis 1),

between perceived usefulness and attitude (supporting Hypothesis 2), and finally, between attitude and intention to use (proving Hypothesis 3).

Actual use data is presented in Tables 2 and 3, as well as Figure 5. The p-value for F is .005 (very significant), a result which means that no sampling error occurred during the procedure. The unstandardized β value of .568 (at the $p=.005$ significance level) suggests that the slope of the equation for Quizlet users is positive, meaning that the more often a student uses the software, the more likely it is that he or she is going to return to it. Figure 5 identifies 12.4 % of the target population that reported no use whatsoever. Reasons for use/non-use were not part of the original survey; therefore, the motives of this group of students are unclear at the moment. Future investigations of student resistance would be a possible complementary study to fill the gap in understanding left by this research project.

7. Limitations

This paper set out to explore student beliefs, intentions and behavioural attitudes toward a multimedia software application called Quizlet. It provides a cross-sectional snapshot (Dörnyei, 2007) of the perceptions of undergraduate EFL learners regarding the integration of a specific digital educational technology tool into the curriculum. This section of the paper outlines four occasionally overlapping factors that have been found to affect Quizlet use: deadlines, cognitive bias, scope and logistics.

Firstly, students are less inclined to practice if the exam is weeks away, but a test the following morning may provoke a last-minute effort. Nation (2006:452) highlights the difference between massed learning (“words studied intensively for a period of time”) and spaced/distributed learning (“[the same words] repeatedly studied for briefer periods of time at increasingly spaced intervals.”) This definition implies that cramming for tests the night before rarely results in long-term retention. A quick flip through cards or a mini-game in Quizlet, on the other hand, takes but a few minutes, and regular, cyclical review sessions may bring about long-term benefits. Secondly, the bandwagon effect in psychology “describes the tendency to think or act in ways because other people do” (Taylor, 2011). The final outcome of many political or marketing campaigns also revolves around the concept of *the more people think or act in a certain way, the higher the probability that others will follow suit*. Millennial adolescents and young adults are sensitive to trends, especially if influential peers are perceived as having an advantage by using a certain product. The present paper found the bandwagon effect to be an important, if unexpected external variable that, while not tested specifically, still influenced the end results. The third area that would benefit from further scrutiny is scope. This research project involved 8 out of a total of 91 classes in the English II program offered in that particular semester. There were 121 respondents, covering 5.49 % of the target population, thus satisfying requirements for external validity. At first glance it would seem that results obtained here could be generalized for the entire English II student body. However, a shift in attitudes and behaviours cannot be expected to come about overnight, nor without help from faculty – most likely through a relatively large investment of energy and enthusiasm on behalf of instructors. Gartner’s Hype Cycle (Figure 2) begins with a sharp rise; if this surge could be sustained with the help of the bandwagon effect, if

Quizlet could become both trendy and popular – as well as seen as a possible contributor to long-term academic success – this positive image would probably support its widespread adoption.

Finally, the logistics of integration must also be considered when proposing changes to curricula. Following institutional guidelines, teachers will have to make decisions about the extent to which they wish to make Quizlet a part of their classroom routine. Should they use the official academic word sets or create their own? In an otherwise tightly packed syllabus, how often and for how long should they let students “play around” on their phones? Should they devote valuable class time to Quizlet games at all, or assign vocabulary learning as homework and count on students being responsible enough to actually do it? These are all questions that will need to be answered during continued evaluation and improvement of the Quizlet initiative.

8. Recommendations

Offering instant results, creating inflated expectations among students, faculty or school administrators would be unrealistic, unwise and probably untrue. Quizlet integration should be perceived as an extension to the current AU teaching/learning framework where technology-assisted language teaching is already expressly emphasised. Giving students an option to take English language learning into their own hands – literally speaking, – making allowances for their personal digital devices and the resulting attitude shift, on the other hand, may yield positive effects. Pedagogical implications that point towards recommendation to adopt include student autonomy, interactivity, automatic error correction, immediate feedback, and the fact that the rationale behind the activity (acquiring academic vocabulary) is never in doubt for anyone concerned.

Results of the present study may be interpreted as that of a needs analysis, with findings that seem to support a move toward adoption. Its subjects are members of the millennial generation who are empowered to create and encouraged to be responsible for their own learning. Working in teams on academic vocabulary fosters interpersonal skills; networking socially offers a chance to creatively and collaboratively approach problem-solving, while having a degree of control over subject matter, however small, inspires them because they feel their input is valued, that they are taken seriously.

Heterick & Twigg (2003) assert that a blended learning experience is mutually beneficial for both students and their *alma mater*. Reporting on the findings of a survey of student performance and achievement carried out in 30 academic institutions in the United States, they indicate “increased course completion rates, improved retention, better student attitudes toward the subject matter, and increased student satisfaction.” This paper makes no such bold claims; it does contend, however, that Quizlet integration has the potential to make a modest contribution to the teaching and learning of English as a foreign language at Assumption University. The ultimate question is not *whether* or not Thai academic institutions should augment existing blended and online curricula, but *when*. Methodology that incorporates multi-modality can reach students any time, anywhere. This personalized, constantly updated and available training can effectively engage Millennials, and make them feel that “teachers finally speak their language.”

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Five Years of Online Teaching Lessons Learned: An Autoethnographic Study

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Abstract

This paper outlines the researcher's individual growth and evolution of online instruction over the span five years. The details of this paper include a synthesis of recent research combined with online teaching experience. The method used is autoethnography in which the author seeks to analyze personal experience within the cultural context of teaching in the virtual classroom. The author seeks to answer: what makes an effective online learning experience? The data collection included instructor notes, faculty peer and student evaluations, and course materials. The result is a document that serves as a guideline for current and future online instructors. The paper provides a glimpse into the process of learning how to embrace and understand the pedagogy of online teaching. The author recognizes that this type of research does not utilize quantitative data, but relies on data collected through qualitative means. However, the information provided in this paper is grounded in research and enhanced by personal experience.

Keywords: online teaching, online instruction

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Introduction

A simple Google search of the best practices of online teaching will provide millions of hits. However, as a professor who teaches in higher education in a variety of formats, I have learned that implementing best practices is harder than one may think. I began teaching online approximately five years ago. I teach in face-to-face, blended or hybrid, and fully online formats. The learning curve has been hard at times. This paper is a journey describing the progression of becoming an online instructor. It serves the purpose of assisting others through their own journey.

The decision was made to utilize an autoethnographic approach. Autoethnography is an approach to research and writing that seeks to describe and systematically analyze personal experience in order to understand cultural experience (Ellis, 2004; Holman Jones, 2005). In this case, the cultural experience is the online or virtual classroom. This analysis involves examining data collected over five years to answer the question: what makes an effective online learning experience? The exploration is grounded in research, and the author's learning and experiences. This researcher acknowledges the influence one may have on the outcomes. In fact, Ellis, Adams and Bochner state, "Autoethnographers recognize the innumerable ways personal experience influences the research process" (para.3, 2010). Ultimately, the researcher seeks to create a document that is informative and useful to the audience through providing a plan for entering the online arena and improving oneself as an online instructor.

Literature Review

Online learning continues to gain momentum and is unlikely to ebb in the future. In Fall 2013, there were 5,522,194 students enrolled in distance education courses at degree-granting postsecondary institutions (National Center for Educational Statistics). It is essential to continue to develop methods to address the needs of these students and to assist the instructor in providing a quality learning experience.

Faculty Perceptions

In light of the increased participation in online courses, several researchers have examined the perceptions of instructors and students to online learning. Philip and Cain (2015) interviewed six online instructors. The instructors shared their perspectives of their first experience teaching online. The results of these interviews were broken down into five categories: perspectives of online teaching, online pedagogy, benefits of the online classroom, challenges, and instructor identity. Several key findings were explained. Instructors indicated that they felt that online instruction provided better accessibility for the adult learner. One instructor felt that the face-to-face class provided more opportunity for creativity and flexibility. Philip and Cain (2015) identified one major issue as the management and participation of the student in the online class (p. 445). In reference to instruction transition to online teaching, some professors simply attempted to recreate their face-to-face class into the online environment. Several indicated that they had to confront their own pedagogical beliefs about teaching and their identities as instructors.

Wray, Lowenthal, Bates & Stevens (2008) surveyed 10 online and face-to-face instructors concerning how they plan differently for these formats. Wray et al (2008) determined that instructors do think and teach differently in the two formats. The researchers concluded that instructors need faculty development and instructional design support (p.243) to determine what works and does not work in the online classroom.

Student Perceptions

In a review of research, Kauffman (2015) examined the perceptions and characteristics of a strong online student and found that students with high emotional intelligence and self-regulation skills are often the most successful. In addition, Kauffman (2015) found other factors to be relevant such as organizational skills, time management, and reflective abilities to play a role in the student's success. In reference to factors that enhance learning, Kauffman (2015) indicated that clear outcomes and organized course design are both important. Hamid, Waycott, Kurnia, & Chang (2015) determined several key components that students perceived as leading to success in the online classroom. These included engaging, enjoyable, and interactive content and lectures, learning with peers, promoting critical thinking, and learning that is self-directed (p.4).

Quality Instruction

Yang and Cornelius (2005) discussed issues with the quality of online course and suggest methods to ensure effective online instruction. These researchers explain that the role of the instructor changes in the online classroom; online education is student-centered education, whereas the traditional education is regarded as professor-centered education (Yang & Cornelius, 2005). The instructor becomes more of a facilitator than a lecturer. These researchers also indicate that the role of the student changes as the learner must become more active and motivated, rather than passive as in a lecture classroom scenario. In addition, Yang and Cornelius (2005) discuss the areas concerning new technologies and assessment in this environment. Moreover, the Yang & Cornelius (2005) suggest that the design of the course is integral to the success of the course. Instructors must structure discussion to be motivating and engaging. This can be accomplished through a variety of media, varying assignments, and through problems solving. The learner must be considered in the design. Another essential consideration, as stated by these authors, is creating and fostering an online community.

Other researchers have made suggestions for quality instruction in the online classroom. McAlister, Riveria and Holman (2001) recommend that faculty use a self-evaluation processes of their online courses indicating that this procedure will help instructors better prepare, design, and deliver online courses. Alley and Jansak (2001) identified 10 keys to essential qualities online learning. This includes student responsibility, motivation, and reflection. These authors also suggest considering student learning styles when designing the course (p. 617). In addition, Alley and Jansak (2001) suggest keeping in mind that knowledge is constructed, not transmitted. Brown (2002) also provided suggestions that included considering a more informal tone to build community.

More recently, Eliot, Rhoades, Jackson, & Mandernach (2015) expressed the need for quality professional development experiences for online instructors and ultimately “fostering student learning” (p. 161). These researchers indicate that faculty prefer professional development experiences that provide information they can readily apply to their courses. Eliot et al (2015) also state that faculty also prefer opportunities that are offered in flexible formats due to time constraints.

Methodology

For this research, the author chose to use an autoethnographic method to gather data to respond to the question: What makes an effective online learning experience? In this, the author examined student course evaluations compile over five years from fully online and hybrid (blended) courses, faculty peer evaluations of online courses, and anecdotal personal experiences.

The value of the autoethnographic method is that it combines autobiography where the author relates an experience using hindsight (Ellis, Adams & Bochner, 2011) and insight. In addition, this method includes ethnography, “when researchers do ethnography, they study a ... shared experiences for the purpose of helping insiders (cultural members) and outsiders (cultural strangers) better understand the culture” (Maso, 2001, as cited in Atkinson, Coffey, Delamont, Lofland & Lofland, p.136-144). In the study presented here, the culture examined is the online classroom.

The student course evaluation consists of two parts. The first section contains statements in which the student rate, strongly agree to strongly disagree. The second section asks the students to comment on what contributed most to their learning? The latter is the focus of this research analysis. In the examination of 184 students’ free responses, a word/phrase frequency analysis was conducted to determine significant trends. Using the online resource, *Text-Alyser* students’ responses were entered and analyzed.

In a separate analysis, three peer evaluations were collected over the past three years and examined. There are several components to the faculty peer evaluation form. However, this study examines the section pertaining to online instruction only. The focus areas are: Content, Organization and Preparation, Online Management, Assessment and Evaluation, and Other Environmental Concerns. Using the same text-analysis resource, faculty peer evaluation comments were analyzed for commonalities within these categories.

Anecdotal information was also gathered from teaching experience, as this researcher has grown as an online educator. This has been compiled from professional development experiences, individual research, teaching experience and course materials. The results are reported as suggestions and recommendations for the online instructor.

Results

Students were asked: What contributed most to your learning? One hundred eighty-four responses were analyzed for word/phrase frequency. This analysis was

conducted to determine what students feel is most important in the online classroom. In order of frequency, the 6 most utilized phrases appear below:

- Timely feedback
- Consistent communication
- On-going support & interaction
- Helpful & knowledgeable instructor
- Clear directions
- Engaging assignments

Similarly in a second analysis, three faculty peer evaluations were examined for word/phrase frequency. Categorically, the word/phrases appear below in order of frequency:

- Content – variety, knowledgeable, appropriate
- Organization and Planning – clearly, reasonable, current, design
- Management – overview, clear instructions, orientation
- Assessment and Evaluation– clearly stated, rubrics, goals
- Other Environment Concerns – enjoyed, discussions, responsive, collaborative

The intention of the word analysis was to determine commonalities in students' and faculty's responses. Although taken out of context, meaning may be lost. However, this does not appear to be the case in this situation. The results of student and peer analyses are consistent. In fact, they reflect the similar word/phrases and descriptors.

Seeking to determine what makes an effective online learning experience, this research provides some key findings. One can interpret that both populations expect and desire clarity in instructions. This was exhibited in phrases such as clearly stated, clear directions and instructions. The phrase such as knowledgeable instructor was also consistent with both populations, referring to the area of content knowledge. One may assume that this is not different from the traditional classroom expectations. Faculty used the term "responsive" while the students used the words "helpful, consistent communication". This appears to be an integral expectation of both populations. Instructor communication was also identified in the research as a component needed in building the online community and providing students with on-going feedback within this setting.

In reflecting on this researcher's journey of becoming an online instructor, the process has been at times tedious and challenging, but also rewarding. Process is a key to the journey. In the beginning when assigned the first online course, it was much like a mourning period of the traditional class. It may sound extreme, but the emotions reflected denial, anger, anxiety and acceptance. Fortunately, the institution provided excellent professional development opportunities to assist in moving forward.

One particularly beneficial professional development experience explained how to create an interactive syllabus that aligned course goals with learning activities and coinciding assessments. This was extremely helpful in creating an organized course and enhancing student engagement. Other colleagues with more experience made themselves available to assist in learning how to navigate the online management

system, often referred to as the LMS (learning management system). Furthermore, the Instructional Technology department also was available to assist in creating video and utilizing other technology resources. These experiences made moving to online instruction a bit easier, but still not seamless. However, it is essential to incorporate these learning opportunities for the instructor. Without professional development experiences, online instructors will flounder and the learning process will take much longer.

Online instruction is a very time consuming process. In the experience of this author, everything takes longer that one may think. The quandary becomes the balance between the content, the activities, and the assessment. An instructor may feel they need to “tell” the student everything. However, by varying the learning activities this is not necessary. Using supplemental readings, videos and other sources can alleviate the need for long lecture videos. In fact, this author finds that short screencasts, can provide just what the students need. Research shows that long lecture videos are not viewed by the student and shorter clips are much more valuable. In fact the average viewing time for students is four minutes (Hibbert, 2014).

The commitment to teaching online is just that “a commitment”. The suggestion by many is to begin with a simple course design and then in subsequent offerings begin to include more technology and learning opportunities. This has worked well over the past five years for this author. Each semester, the commitment is made to learn and add one new technological component and to refine existing content. By thinking in this manner, the instructor does not become overwhelmed.

The individual anecdotal analysis resulted in a list of essential considerations. There are as follows:

- Does the course fit into an online or hybrid/blended format?
- Talk to colleagues, seek professional development opportunities
- Teaching online takes more time that you think
- At the start, keep it simple and short
- Not easy to simply transfer a traditional course to online. Consider redesigned not transferring.
- Face the challenges of managing the content and learning the online management system

Conclusion

One can utilize the information gathered as a way to help improving the online learning experience. The literature provides the background and this study confirms the research and provides suggestions for the online instructor. Analysis of students’ and faculty’s perceptions resulted in consistency in the needs and desires in the online classroom. This is an important finding as it serves to acknowledge the recommendations as online instruction moves forward.

Online instruction will continue to grow and change in the future and it will be interesting to see how the field progresses. Avoiding online instruction is no longer possible, but embracing this format with knowledge, support, and research is invaluable. This paper serves to continue the conversation of online instruction.

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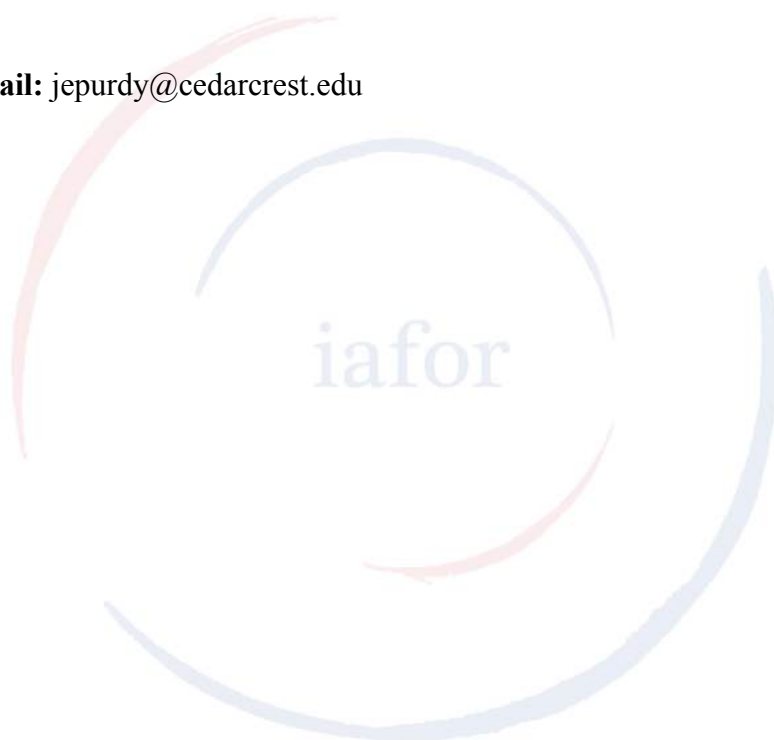
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Ethics Issues of Digital Contents for Pre-Service Primary Teachers: A Gamification Experience for Self-Assessment with Socrative

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Abstract

The Knowledge Society has brought many possibilities for Open Education practices and, simultaneously, deep ethical challenges related to the use, sharing and reuse of digital content. In fact, even at the university level, many students do not respect the licences of digital resources. As part of the contents of a third-year Educational Technology course for Primary Teacher Training at the University of the Balearic Islands (Spain), students learnt about these ethics issues. During the 2015/16 academic year, 125 students from two groups of this course were involved in a gamification experience, using Socrative in real-time in the classroom, in which they had to answer different questions related to digital ethics. Its aim was not only to find out what the students knew before working directly with the topic – an initial self-assessment – but also to arouse interest and encourage dynamic participation and interaction. At the end of the course, students answered a questionnaire in which they were asked about their perceptions of the use of this kind of educational strategy and their transference in the future. Data were also collected from the same Socrative quiz and the final exam results related to digital ethics. Overall, the assessment from students was highly positive, as well as the scores of the questions related to digital ethics in the final test, and the conclusions of this study highlight both the importance of using more interactive educational strategies in the classroom and the need for training on digital ethics issues in teacher studies.

Keywords: gamification, higher education, teacher training, digital ethics, Socrative, self-assessment.

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Introduction

The Internet has made it possible to access information and digital content to be reused in other contexts, which creates important ethical challenges (Farrow, 2016). Open education is especially interesting for future teachers of any level, who can create their educational materials by readapting the already available resources – images, sounds, videos and so on – on the Internet. However, the ethical challenges suggest that many students do not respect the licences of these resources, mainly because they are not aware of them.

Digital ethics is a part of the digital competence that every teacher needs to develop (UNESCO, 2011). Thus, many Teacher Training programmes consider modules or contents related to this aspect. At the University of the Balearic Islands (Spain), the students in the Primary Teacher Training programme must attend a course on Educational Technology, which includes digital competence and digital ethics, in their third year.

During the 2015/16 academic year, the students of two groups of this course were involved in a gamification experience using Socrative – a web 2.0 technology to create interactive tests – in real-time in the classroom to work on concepts and ideas related to digital ethics. The aim of this experiment was to connect students with their prior knowledge as an initial self-assessment, arouse interest and encourage student participation. After the experiment, students were given a questionnaire in which they were asked about their perceptions of the use of this kind of educational strategy and their transference in the future.

Therefore, the present work describes the educational gamification experiment with Socrative on pre-service student teachers for primary school, the results obtained from the same experiment, a final student questionnaire and the final test scores of the course (questions related to digital ethics). The conclusions show the value of the experiment and future lines of work.

Reference framework

The educational experiment is based on two main topics: ethical issues of digital contents, as part of the digital competence; and gamification, as the didactical strategy used for the experiment.

Digital ethics

The new technological and digitalized world comes with deep ethical challenges, especially related to open education (Farrow, 2016). Open education practices are based on four main principles (Valverde, 2010): i) knowledge should be free and open to be used and reused, ii) collaboration in the construction and reelaboration of knowledge should be enhanced and promoted, iii) sharing knowledge should be rewarded for its contribution to education and research and iv) educational innovation needs communities of practice and reflection that provide free educational resources. The practices and technologies from educational contexts considered ‘open’ could include access to educational or published research, software, policies, teaching methods, data sets or other educational resources (Farrow, 2016). However, the Open

Educational Resources (OER) that are most considered in Teacher Education are educational tools, learning contents/resources and implementation resources (licenses and interoperability) (Valverde, 2010).

Although there are important advantages of OER, derived from the open education principles, there are also some concerns. Two of the main issues in Digital Ethics, derived from ICT dissemination on a large-scale, are privacy and the protection of intellectual property (Maggiolini, 2014), which could be included as part of ethics and digital competences.

On the other hand, there is a need for students from different educational levels to develop these kinds of competences, including students in teacher training. New teachers must show competences that allow them to incorporate the digital world into the class – the use level – and enable them to behave coherently with the theory – the sense level (Burguet & Buxarrais, 2013; García-Gutiérrez, 2013). In fact, one of the areas to develop within the digital competences of teacher education (concretely framed in the information literacy) is digital ethics, which considers intellectual property rights, copyrights and ethics (UNESCO, 2011).

However, as Burguet and Buxarrais (2013) point out, training in the ethical dimension is lacking not only in the study programmes of teacher education but also in schools, in general. According to the same authors, teacher training should include the development of the ethical capacities of educational professionals, who can (in turn) secure the development of the autonomy of students so that students can think and reflect by themselves, considering ethical issues of digital content.

In this study, we focus on the work done within the university programme for primary teacher training related to digital ethics in the module of technologies applied to education.

Gamification

Gamification is defined as the use of game dynamics, mechanics and elements in non-game contexts (Deterding, Dixon, Khaled, & Nacke, 2011). As the main advantages in the educational context, gamification affects students' behaviour, commitment and motivation, which can lead to improvement of knowledge and skills (Hsin Yuan Huang & Soman, 2013).

The game elements can be shown in Figure 1:

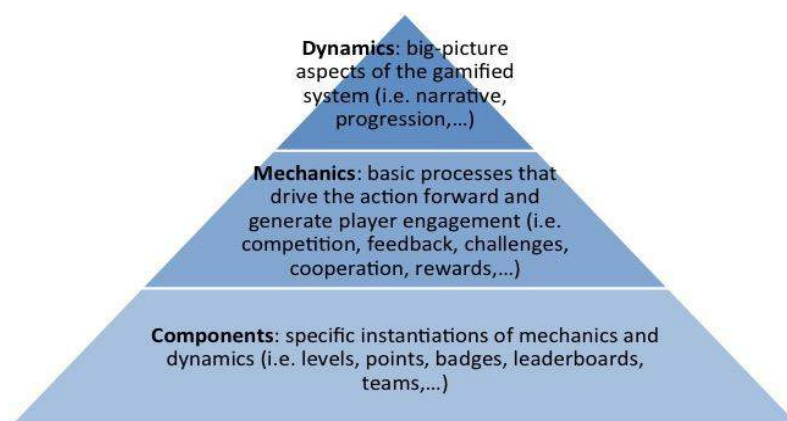


Figure 1: The Game Element Hierarchy, adapted from Werback and Hunter (2012, p. 82).

Some of the more accepted game elements that can be used in the learning context are: points, numerical values given for any single action or combination of actions; ranking, a classification or comparison among students from the same class or year; levels, a system to show student's progress in the assigned activities; badges, distinct awards for the consecution of an objective; and progression, a dynamic in which success is granularly displayed.

In the educational context, gamification includes a range of activities that cover: 1) the incorporation of game rules and structures into class activities or management, 2) learning activities through didactic games or serious games and 3) the gamified development of complex didactic strategies, which include different activity sequences such as the resolution of a case in a learning problem/project-based methodology. The latter is associated with a gamification vision that differs from the classical vision called 'game thinking' in which the goal of gamifying is to present a learning-teaching process centred on the students, where they (as players) get involved, make decisions, achieve progress, assume new roles, participate in a social environment and receive immediate feedback (Gallego, Molina & Largo, 2014).

In recent years, the number of courses that implement gamification strategies in higher education for different kinds of studies has been growing. These strategies are an effective way of maintaining students' motivation, concentration and engagement in the curriculum, such as in technical studies (Barragán, Ceada, Andújar, Irigoyen, Gómez & Artaza, 2015; Iosup & Epema, 2014; Villagrasa, 2016), economics (Arias & Djundubaev, 2015), medicine (Martín, Martín, Sanz, & Martín, 2014) or educational sciences, including teacher training (Villalustre & del Moral, 2015; Shiota & Abe, 2015).

Among the ICT tools that can be used to introduce game mechanics and dynamics into educational contexts are webtools, platforms and software (commercial and free). Some of them are Badgeville (<http://www.badgeville.com>), Openbadges (<http://openbadges.org/>), Classdojo (<http://www.classdojo.com>), Atta (<http://www.attacommunity.com>), Schoology (<https://www.schoology.com/home.php>), Kahoot (<https://kahoot.it>) and Socrative (<http://www.socrative.com/>).

Socrative is a free webtool that allows teachers to create questionnaires and use them in real-time to empower the engagement and assessment of students, individually or in teams. While the students are answering, the results are aggregated and visualised in real-time, which enables teachers to have instant insight into students' level of understanding concerning a specific topic related to the curriculum. This tool is very accessible, as it can be used by any device that has Internet connection (after the teacher gives the code to the students).

In the current experiment, Socrative was used to identify the initial knowledge and possible misconceptions regarding digital ethics.

The educational experiment

Context and methodology

The experiment was carried out with 125 third-year students of Primary Teacher Training at the University of the Balearic Islands in the course *Media and Technology Resources for Teaching and Learning in primary education* during the 2015/16 academic year. Students were organized into two groups with different teachers. The course followed a blended modality in which most of the hours were presential, but there was also online support using the virtual learning environment from the institution based on Moodle. This support basically consisted of the delivery of online materials that were used for in-class work, study preparation or assignment submissions. The activity (described below) was conducted face-to-face, in class, with the support of the classroom's computer, projector, whiteboard and the personal technological devices of the students – mainly laptops and smartphones.

A gamified questionnaire was created using Socrative with 27 items related to digital ethics, including copyright and the right to use and reuse digital information, as part of the second content module of the course. They had previously worked in the first module with the concept of digital competence and its areas, one of them being information literacy in which digital ethics is included.

Twenty-five of the items of the questionnaire were statements about students' knowledge, beliefs and personal use of digital information, 23 required a true or false answer and two required a multiple-choice response. The remaining two were short answer questions. Students entered their names and had to answer questions without the possibility of skipping items or changing their answers. Some of the students worked in pairs to answer the questionnaire.

After each response, students received immediate feedback on the answer chosen – the system showed them if it was correct or incorrect (self-assessment) – a brief explanation of the correct answer and some references to consult related to the answer. As students answered the questionnaire, the display of their progress with a table of results was shown in the whiteboard of the class in real time. At the end of the questionnaire, students received information on their scores in relation to the scores of their peers.

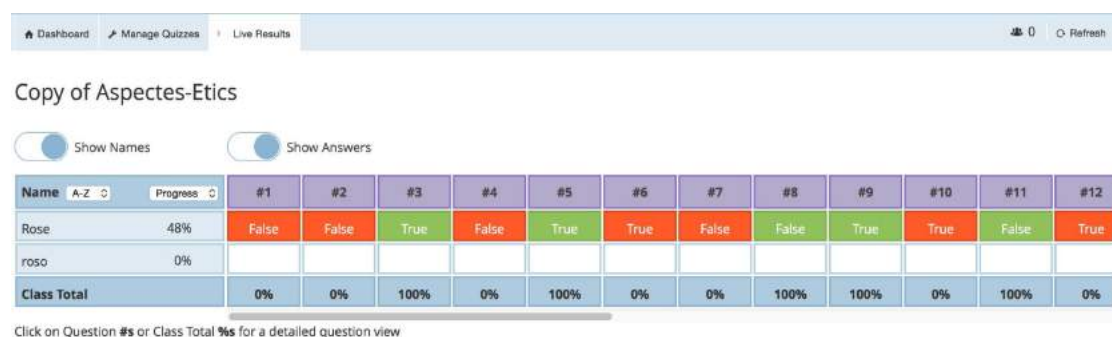


Figure 2: View of the live results of the Socrative questionnaire.

With this questionnaire, we aimed at connecting students with their prior knowledge, arousing interest and encouraging participation. The didactical sequence was developed through two main activities in a 1.5 hour session:

1) A questionnaire was administered in a face-to-face class session. The students answered the questionnaire individually or in pairs using their personal technological devices in 15–20 minutes. This part is related to self-assessment since students received the feedback on their answers immediately.

2) After the questionnaire, the teacher presented and assessed the global results of the questionnaire by starting a dynamic participatory class on the subject/topic. After the questions were discussed and the answers were justified, the students posed new questions in the form of use cases of digital information to answer in class with the aim of consolidating their learning.

Results and discussion

To assess the experience, information was obtained and analysed based on: 1) the opinion of the students through a final online survey and 2) the score obtained by the students in the Socrative questionnaire regarding prior knowledge of the ethical use of digital information aspects and examination of the subject.

The data obtained shows that the experience allowed students to connect with their prior knowledge and encouraged them to reflect on it. The results of the questionnaire show little prior knowledge and false beliefs, but the good grades obtained in the final test show the improvement of their knowledge of digital ethics.

About the gamification experiment

Data gathered from the student questionnaire

The final student questionnaire was answered by 78 students (out of 125) that participated in the educational experiment.

Among other items related to different aspects of the course in the final questionnaire, students were asked to score (from 1 to 5) their agreement with the statement *the use of quizzes or games to detect previous knowledge (as the quiz used on the topic of ethical uses of digital information) encourages learning and reflection*, 1 indicating disagreement and 5 indicating agreement. As can be seen in Figure 3, students' answers (groups 1 and 2) show a high agreement (79.3%). To indicate if there were significant differences between the two groups, students were also asked about their perceptions of the use of gamification strategies in other activities, such as for managing participation in classes and monitoring by using badges. The results show less agreement with the statements.

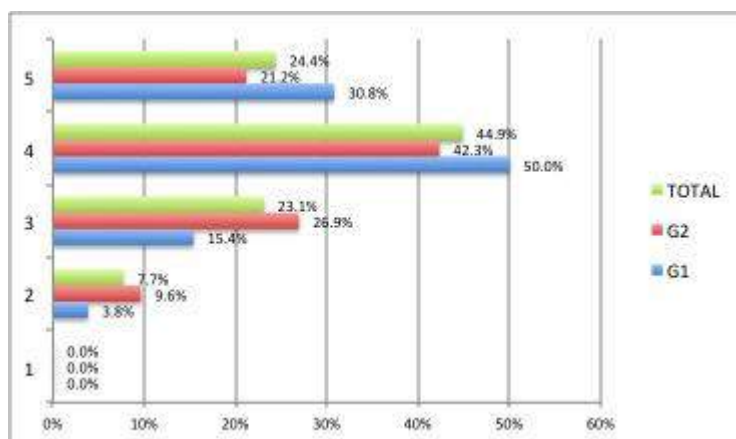


Figure 3: Results from the student questionnaire on the agreement with the statement *the use of quiz or games to detect previous knowledge encourages learning and reflection.*

Sixty percent of respondents show a high degree of agreement with the statement *the use of tools to manage student participation in classes (random selection of students who will participate) would speed things up in a fun way* with a deviation of 1.18 points in group 1 and 0.95 in group 2. Thus, there is greater variation among the responses of group 1 (see Figure 4). Similarly, 65.9% of their answers show a high degree of agreement with the statement *using badges in the working sessions of workshop (in the computer lab) would be a good strategy to motivate and track our activity in class* with a deviation of 0.8 points for group 1 and 0.7 for group 2.

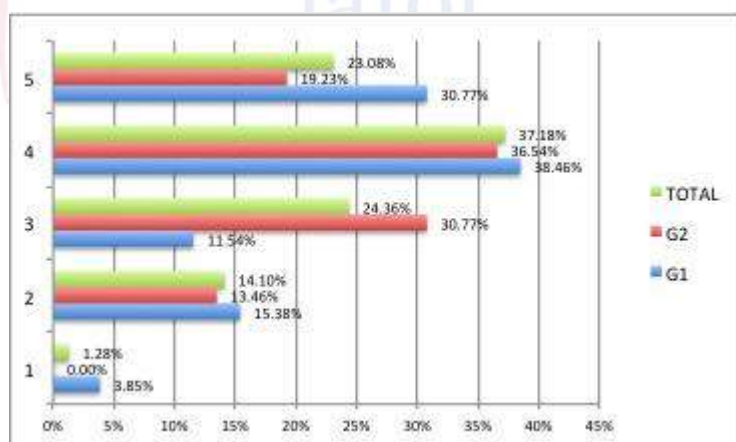


Figure 4: Results from the student questionnaire on agreement with the statement *the use of tools to manage student participation in classes (random selection of students who will participate) would speed up in a fun way.*

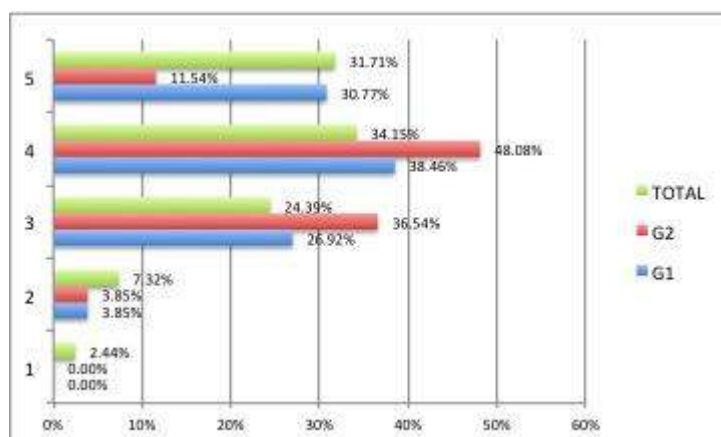


Figure 5: Results from the student questionnaire on the agreement with the statement *Using badges in the working sessions of workshops would be a good strategy to motivate and track our activity in class.*

These results indicate that there are low expectations of students in certain gamification strategies. Perhaps this could be explained by the lack of experience with this type of activity and the association of these aspects with games. This might shed light on the lack of knowledge related to gamification strategies in education.

About the class scoring

The total, averaged score of the Socrative quiz is 64% (64.3% in group 1 and 63.7% in group 2) with 16 correct answers out of 25 (15.4/25 in group 1 and 15.9/25 in group 2).

Total Score	Group 1 Score	Group 2 Score
64%	64.3%	63.7%
Total Correct Answers	Group 1 Correct Answers	Group 2 Correct Answers
16	15.4	15.9

Table 1: Scores of the Socrative quiz on the ethical use of digital information.

As illustrated in Table 2, items with the highest percentages of correct answers relate to broader issues in digital ethics, and items with the lowest percentages of correct answers include procedures or more precise aspects of the ethical use of digital information, which are especially important to incorporate in their educational practices as future teachers.

Statements with higher percentages of correct answers	
10. Using a fragment of a text segment to quote authorship is a communication act against an author's rights.	96.7%

16. Authors can authorise to distribute, copy or reuse the work.	92.7%
1. An author's rights of a work recognises intellectual property as a natural right to the individual creator.	92.2%
19. Creative Commons allows the authors to distribute their works with specific rights under certain conditions.	92%
Statements with lower percentages of correct answers	
12. A work is protected with copyright when the author registers it as such.	3.7%
6. Author rights allow the authors to adopt measures to preserve their authorship of the work—for example, in the promotion and recognition of authorship.	5%
20. Which one of these uses of information is adequate? A) Publishing a document that belongs to another person on a website or blog B) Making a copy of a musical work that is public domain C) Accessing and downloading free content D) Distributing our works with a Creative Commons license E) Creating a website or blog with links to other pages	12%
8. Making a copy of a CD is a reproduction act against author's rights.	18%

Table 2: Questions in the quiz with higher and lower percentages of correct answers.

The final exam of the course, which was a multiple choice quiz, included questions on the topic of digital ethics. The scores of these exams are high (around 90%). Group 1's exam included two questions (out of 20) with 94% and 83% of correct answers, respectively. Group 2's exam included one question (out of 20) about digital ethics with 94% of correct answers.

Conclusions

The educational experiment with Socrative has been an interesting experience that has achieved the expected objectives of the teachers and authors of the current paper, which were: 1) to expose the prior knowledge of students on the topic of digital ethics while removing misconceptions, 2) to motivate learning and 3) to encourage participation. In fact, the answers to the questionnaire resulted in a dynamic participatory class that addressed these aspects in-depth and in response to student interests (and/or their false beliefs).

It is possible that the ludic/gamified elements in the learning activity have been useful to students to be willing to verbalize and participate. In the activity, some of the dynamics, components and elements of games were identified (Werback & Hunter, 2012), i.e., progression in the quiz (a dynamic), competition among peers – or collaboration in the case of working in pairs – and immediate feedback (components) and the existence of a leader board and punctuations (elements).

However, students' perceptions of the educational possibilities of gamified elements were rather low. This is probably related to the fact that they had not experienced this kind of activity during their studies, so they did not know what the educational possibilities related to gamification are or how to design educational experiences that use these strategies in an effective way. Or, perhaps, they considered that these elements cannot be useful in other contexts; this is the kind of thinking that students usually have towards any technology that they do not consider to be for academic purposes. Therefore, for future research, it would be interesting to go deeper into the reasons for these scores and see the actual motives, contrasting with successful gamification experiences, like the one explained in Villalustre and del Moral (2015), which show a high level of motivation and satisfaction by the students and the development of generic competences.

Despite the limitations related to the coverage of the educational experiment on gamification, this study has shed light on the importance and need of teaching Primary Teacher Training students about aspects related to the use of digital information, as they will be the teachers of the future (Burguet & Buxarrais, 2013; García-Gutiérrez, 2013). Technology is becoming increasingly more present in every aspect of life, so it is essential that every citizen now and in the future uses digital contents and manages licensing in a proper way, being respectful to others' authorial rights when using contents and conscious of the rights of their own works when creating new contents. Of course, this also applies to any educational resource – images, videos, audio, activities, documents and so on – that teachers use and/or create. This idea is also one of the trends that was included in the Horizon 2016 report for university teaching (Johnson, Adams Becker, Cummins, Estrada, Freeman & Hall, 2016).

On the other hand, in the current Knowledge Society (where information is available everywhere), every educational institution needs to find ways to engage students with the contents of the course, arouse interest in them and motivate students' dynamic participation and interaction in the classroom. This educational experiment has shown a successful way to do this based on a small-scale gamification experience. As future work, a large-scale gamification experience could be considered, as well as transversal experiences, including different courses in the academic year.

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The Videogame Technologies for a Neuroscience Program

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Abstract

In this paper we present the advances corresponding to the implementation of a laboratory of technologies for neuronal rehabilitation using videogames technologies. In this laboratory we develop interactive technologies (videogames, virtual reality material, specialized devices, etc.) to be used and introduced in the Neuroscience bachelor's degree program, which will be offered by Universidad Nacional Autónoma de México in brief.

Some of the projects developed and under development in this laboratory correspond to the bachelor thesis of some computer and electrical engineering students of the Engineering School. In particular, we present videogames based on the Unity game development platform, integrating some devices such as kinect, leap motion, oculus rift, data gloves and others. Some the devices were developed by us, such as a data glove. Additionally we are developing virtual scenes using Google cardboard as material to be used by the students for phobias treatment, considering almost any student has a smartphone.

We can say in this laboratory we have integrated and coordinated a group of engineering students according their skills, which work together making easy the development of their projects that will be employed in the courses of the Neuroscience program.

Keywords: Virtual Reality, Videogames, Interactive Technologies

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Introduction

A group of professors, researchers and directives of the Universidad Nacional Autónoma de México (UNAM) have worked in the creation of a bachelor's neurosciences program.

The neuroscience program is an original and novel proposition in Mexico, where are involved different entities such as the Medicine, Psychology and Sciences Schools, the Cell Physiology and Neurobiology Institutes.

The program gives answer to social, economical and cultural questions, related to the actual research and dynamics of the mental health public attention. This bachelor program was previously created in USA and Canada due the necessity of neuroscientists, which have professionally developed in basic, clinic and technological fields.

At present, students who wish to study neuroscience in México invest a lot of time in their training and education, because most of the neuroscientists come from medicine, psychology, biology and biomedicine programs or similar. Once the students have finished the bachelor's program, they begin a doctoral program, and even a postdoctoral stay. At the end, Mexican neuroscientists invest between 10 and 12 years in their training.

The neuroscience program is directed to involve bachelor students in this area, focused in the research and the knowledge of the areas that belong to neurosciences.

The expectation of the neuroscience program is to be as successful as other programs at the UNAM, such as the Basic Biomedical Research Bachelor Program, where 57% of the graduated actually are researchers in Mexico, and the others work in basic research abroad.

The neuroscience program offers an interdisciplinary background in the basic sciences related to neurosciences; the mathematical knowledge necessary to study neural networks, find solutions to different problems, model, obtain quantitative answers to biological, behavioral and neurological phenomena, and also for the interpretation of the research results.

The program also introduces the students, early in their training, in clinic areas related to neurological diseases and addictions, the use of different diagnostic techniques and the employ of information and communication technologies (ICT) for neural rehabilitation. In this way, the graduates of this program could be integrated in multidisciplinary research groups or continue their studies in applied research.

In particular, for the use of ICT, it was necessary to set up a laboratory where these technologies were developed. The laboratory was established in the Cell Physiology Institute and begins to work in 2013.

In this paper we present the advances corresponding to the implementation of this laboratory, where are developed interactive technologies consisted of videogames, virtual reality material, specialized devices, etc.

The Competency-based Neuroscience Program

The Neuroscience program considers five knowledge areas for an integral and interdisciplinary training of the students.

1. Basic Sciences. Provides the concepts and fundamentals of neurosciences, strengthen the scientific thinking and encourage the logical reasoning, which allow to understand, from a physical and chemical perspective, the cellular and molecular organization, also the structure and functions of the living beings. Also provides the mathematical knowledge to extrapolate the mathematical thinking to biological problems.

2. Neurobiology. This area provides the knowledge of the central nervous system (CNS) from an integral point of view. Also provides key elements to understand the principal cellular processes linked to the acquisition, storage and recovering of information, just like the most common pathophysiologic processes that affect the CNS.

3. Behavioral Sciences. Provides the knowledge about the relationship between structures, the functioning of the CNS and the cognitive-behavioral processes as the perception, attention, learning, speech, memory and awareness. This area provides tools to analyze the neuronal lesions and their cognitive-behavioral correlation.

4. Humanistic Area. Provides the fundamentals for an ethic reflection considering the social, economical, scientific and political everyday changes, which allows the student to develop a creative and reflective thinking and a critical vision of the scientific knowledge and the research when they are carried out in humans and animals.

5. Instrumentation. This field of knowledge provides to the students the skills for mastering the laboratory techniques and to apply the principles of the scientific method in their research. The student will use different instruments such as behavioral tests, electrical activity record of muscles and the central nervous system, and will make its interpretation during the clinic activities. He will be familiar with technological devices through systemic protocols that include the ethical handle of instruments, computational models, materials and reagents. The student will develop the skills to apply and use different techniques and instruments in the search of solutions to neurological problems and he will approach to the translational research.

The interaction of the student with different knowledge areas models its profile as a professional qualified to continue postgraduate studies and strengthen the research in neurosciences, acquiring the desired competences to incorporate in different health groups and the neurological rehabilitation.

The neurosciences program considers three stages:

Basic stage. Corresponds to semesters one to three, where the courses are related to basic sciences, such as mathematics, physics, biology and chemistry, which provide to

the students the fundamental tools in their professional training, and the knowledge that establishes the platform for the analysis and comprehension of the CNS.

Intermediate stage. Corresponds to semesters four to six with courses that offer a panorama of evolutionary neurobiology and development, neuropathology, neuroplasticity, neurobiology of the behavior and addictions, neuropharmacology, neuroimmunoendocrinology, the introduction to neurological rehabilitation, and fundamentals of neuroimaging. In this stage, computational modeling and virtual reality for rehabilitation are introduced. The students begin their professional practices being in touch with different aspects of the professional life in real scenarios, including basic, clinic or applied research. If the student focus its practices in basic research, it will be inserted in laboratories of schools and institutes; in case of clinic research, it will attend hospitals and health institutes to make protocols of applied research under the direction of doctors or neuropsychologists; and in the technological case he will be inserted in research centers as the Cell Physiology Institute where the laboratory of technologies for neurorehabilitation was established.

Advanced stage. Corresponds to last two semesters. The activities program includes the continuation of professional practices. The student will decide the optional courses to take for its specialization.

Laboratory of Technologies for Neurorehabilitation

The first scientific works concerning to neurotechnologies were performed 50 years ago, but the most important advances appear until this century. Neurotechnology presents a high potential in the enhance of human activities, involving technologies in areas such as neural rehabilitation, diagnostic and neural monitoring, and other combinations of neurological and biomedical knowledge with engineering technologies.

In 2012 our workgroup begins to explore the advances in the area of interactive technologies for neuronal rehabilitation, and we find a few of them in hospitals where they employed videogames as a reinforcement tool for conventional therapies (see References section). However, such videogames were directed to healthy people and they are not suitable for people with a disability. Actually, we can find projects focused in similar objectives those delimited for our laboratory.

The aim of the laboratory is the development of interactive technologies for the new neuroscience program at UNAM: systems integrating position and motion sensors with computer programs (videogames), some of them connected to Internet, other to be executed stand-alone.

The fast growing of interactive projects for rehabilitation is a sign that we were introducing in a new field of technology development with a promising benefit for patients with some kind of disability. And most important, these technologies can be connected to Internet expanding their application field and services.

We define some lines of technological development to follow in the laboratory: videogames, virtual reality and devices for neurorehabilitation. In videogames development we integrate commercial devices such as leap motion, kinect, infrared

frames and data gloves. In particular, we have developed a data glove based on Arduino because the commercial one does not fit our requirements. In virtual reality projects we are working with the Oculus Rift and Google Cardboard.

The final idea is all software and hardware we develop was available for students of the neuroscience program, in an Internet server of the UNAM or in the laboratory.

Finally, an additional aspect of the laboratory is considered a space attended by engineering students to carry out their bachelor thesis, where always there are interesting topics for them.

The Advances

The first prototypes we have developed using the Unity SDK and other specialized SDK (for leap motion, oculus rift, Google cardboard, etc.) are:

1. Charlie's escape. This videogame can be used with the leap motion or data glove (commercial or developed by us) devices. There are two rehabilitation positions defined for the hand: open and close. The aim of the game is Charlie walks if the hand is close and jumps if it is open, avoiding some obstacles. The patient must repeat the action (open and close) some previously programmed times, rest some seconds and continue until complete the exercise. Figure 1 presents a screen of the game.

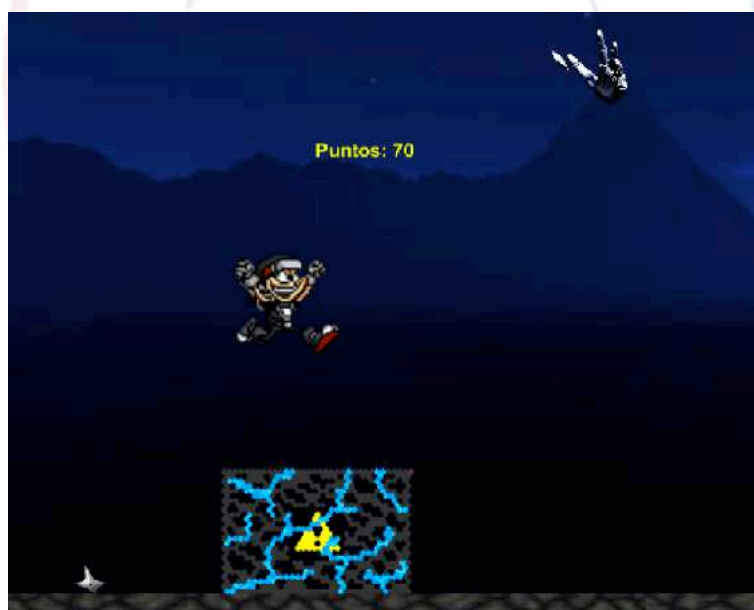


Figure 1: Videogame for hand rehabilitation using leap motion or data gloves.

2. Penal Madness. This videogame is used with the kinect 360 device. There was defined a set of 14 positions for the arm. The aim is the goalkeeper (the user) stops the balls that will go to the targets that are appearing during the exercises. Figure 2 shows a snapshot of the game.



Figure 2: Videogame for arm rehabilitation using kinect 360.

3. The sandwich. This videogame is for hand rehabilitation using a data glove. We consider five position or finger touches. The aim is to prepare a sandwich where each ingredient is selected according the finger that is touching the thumb. Figure 3 shows a snapshot of the game.

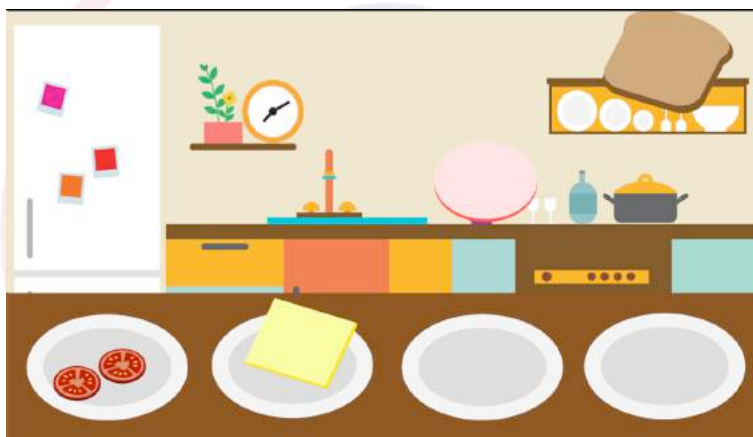


Figure 3: Videogame for hand/fingers rehabilitation using data glove.

4. Dance-arm. This videogame uses the kinect 360. The user must move one of its arms (the one in rehabilitation) from left to right or vice versa and the character, which is dancing, moves according the trajectory of the arm. Figure 4 shows a snapshot of the game.

5. Mexico City Airport. This 3D scenario of the terminal 2 of the Mexico City airport was developed to use with Google cardboard. It is intended for phobia to fly treatments. The user arrives to the terminal and walks inside it until reach its seat in the airplane. Figure 5 shows a view of the airport scenario.



Figure 4: Videogame for arm rehabilitation using the kinect.

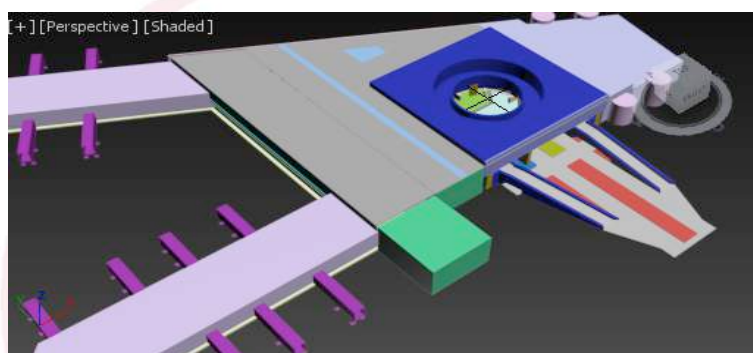


Figure 5: 3D scenario for the Google cardboard.

6. Dataglove for videogames. We developed a data glove for hand and finger rehabilitation. It is based in the arduino nano board, we are including three flexors to detect when the hand is contracting and notify to the patient via the videogame. Figure 6 shows the data glove.



Figure 6: Data glove for neuronal rehabilitation videogames.

7. VR for neurorehabilitation. We developed a VR system for ocular and head/neck rehabilitation that includes three different scenes of a certain size each case. In this system, when the user puts on the Oculus Rift, appears a view with a menu to select the scene to use for the rehabilitation. In case the patient cannot select the scene, other people can help to choose it using the mouse. Figure 7 shows the first scene, which is a planet moving around the space. Previously to start to move, a 3D arrow appears indicating the sense of the movement of the planet. Figure 8 shows the second scene, which is a macaw flying in a jungle. Finally, Figure 9 shows the third scene, a turtle swimming in the sea.



Figure 7: Planet and galaxy scene



Figure 8: Macaw and jungle scene



Figure 9: Turtle and deep-sea scene

This VR system can be employed for gradual motor rehabilitation therapy and it suggests to begin with an ocular rehabilitation, followed by the head/neck recovery and then the arms, hands, and so on.

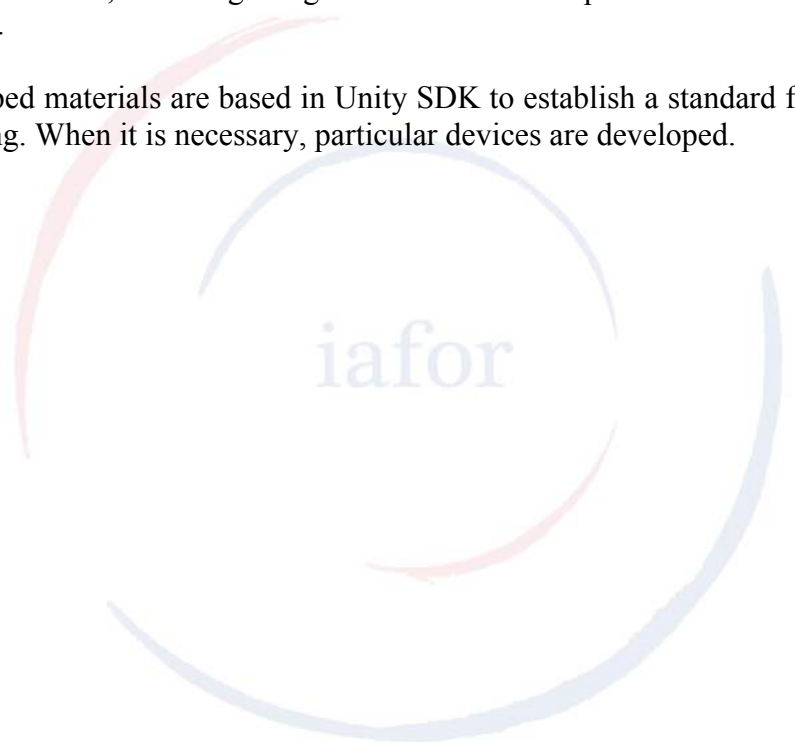
Conclusions

We have presented the advances corresponding to the interactive materials we have developed in the laboratory of technologies for neurorehabilitation, this laboratory is relatively new and was sited in the Cell Physiology Institute of the UNAM.

The objective of the laboratory is to accept students from a Bachelor's Neuroscience Program, which will be offered by the UNAM. The laboratory. Also, set up a server where most of the materials will be available for students, in special those were there is not necessary a specialized device (i.e. the oculus rift), but a smartphone or non-expensive commercial devices. In this way, the students could uses these materials at classroom or at home depending the course they are taking.

The laboratory also has been a place where engineering students attend to develop their bachelor thesis, receiving the guide and advices of professors and researches of the Institute.

The developed materials are based in Unity SDK to establish a standard for computer programming. When it is necessary, particular devices are developed.

The logo for 'iafor' is centered on the page. It consists of the lowercase letters 'iafor' in a light blue, sans-serif font. Surrounding the text are several concentric, semi-transparent circular arcs in shades of red and blue, creating a stylized, abstract background for the logo.

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***Conceptualizing a Model for ICT Implementation in Teacher Education
Programme in Nigeria***

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Abstract

ICT implementation for teaching and learning has been a research topic for many research studies, but there is no generalize process to implement ICT in teacher education. This study aims to examine the variables that influence teacher educator's intention to implement ICT in classroom. Using Ely's condition of change (1990) as the framework, a research model was developed to include attitude and ICT use. It is reasonable to expect attitude to be associated with ICT use. In addition, the study investigated the influence of dissatisfaction with status quo, time, knowledge and skill, resources, reward and incentive, participation, commitment, leadership on teachers' intention to implement ICT. With data gathered from (N = 302) participants using a survey questionnaire, structural equation modelling (SEM) analysis revealed that the proposed model in this study has a good fit, and empirical support for four of nine hypotheses. Teachers' attitude was found to have a direct significant influence on ICT implementation. Other factors were found to have an indirect influence on ICT and were not statistically significant to influence ICT. Practical implications were addressed either to guide practitioners in designing an implementation model for teacher education program or assist researchers in their future study.

Keywords: ICT implementation, Teacher education programme, Structural equation modelling

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Introduction

Information and Communication Technology (ICT) in education's major essential component is in complementing and enriching traditional educational system in education delivery and instructional materials (Olabode, Oyewole & Oke, 2013). ICTs provide an array of powerful tools that may help in transforming the present isolated, teacher-centred and text-bound classrooms into rich, student-focused, interactive knowledge environments. In the new teaching and learning environment of ICT use, the role of the teacher changes from knowledge transmitter to that of learning facilitator, knowledge guide, knowledge navigator and co-learner with the student. The new role does not diminish the importance of the teacher but requires new knowledge and skills (UNESCO, 2002). Quality education is dependent on the development of high quality teachers (Haddad & Jurich, 2006) for teachers are indispensable within the teaching and learning process.

In teacher training colleges much of the good practices are in teaching ICT as a subject, but less as learning tools for ICT practices and effective teaching strategies using ICT. There is a lack of clearly stated ICT applications since teachers lack the basic understanding of the precise method ICT can enhance teaching and learning. The knowledge and skills teachers receive at training have a great impact on their transitive future use of pedagogical ICTs when they enter job markets as qualified teachers (Kihzoza et.al. 2016). Teachers will teach in the same way they were taught. Teachers need to develop knowledge and skills on current ICT facilities in order to gain the experience necessary to understand the potentials of dynamic technologies in education

Mooij and Smeets (2006) posits that the lack of interest that has been displayed by teachers in most countries may be due to the misconception of the concept "integration" which is due to the insufficient knowledge they possess. A further inhibiting factor would seem to be the lack of or inadequate teacher training. It is through the training of teachers that the objectives of ICT implementation can be clarified. Furthermore, the attitude of the school management in supporting the process is also viewed as influential to teachers' use of computers. The attitude of the school management may not directly affect the teachers' perception of ICT, but may indirectly influence teachers' perception of the quality and quantity of ICT resources that the school needs. Kuhn (1996) calls for a "paradigm shift", a change in theory and methods, when old theories and methods will not solve new problems. A paradigm shift in view of the learning process, coupled with applications of the new information technologies, may play an important role in bringing educational systems into alignment with the knowledge-based, information-rich society. The shift also demands new knowledge and skills in the work force (UNESCO 2002).

Fullan (2001) research on educational change helps to identify seven major stakeholder in the change process as the dean, teaching staff, senior administrators, student teachers, school teachers/ICT coordinators in schools/principals, government agencies and business and industry. With the introduction of ICTs in teacher education programs, the seven groups of stakeholders listed are clearly distinguishable as their role is in the formative evaluation and dissemination of initiatives for ICT teacher education. The deans provide leadership and lecturers or academic staff of teacher education programs implement the change. All innovations

are expected to succeed. What characteristics and/or attributes of the innovation could be used in the introduction of the change process to encourage its adoption by teacher educators? Therefore the question is where do leaders and those who implement change start in introducing ICT in teacher education? This study therefore focuses on Ely's educational change model to help answer the research questions.

Theoretical Framework: Ely's Condition of Change

The theoretical framework for this study is the condition of change developed by Donald P. Ely in 1990. Ely (1990) points to conditions of successful change, being the first to emphasize the environmental conditions that promote change in his pioneering study of change libraries, used the term conditions of change to refer to a set of factors to describe the environment. Ely's (1990; p. 299) study has been refined over the years, and broadened to cover "the implementation of educational technology in a variety of education-related context". Ely's approach recognizes that the characteristics of the innovation are not the only factors influencing its adoption, his research suggest that the environment in which the innovation is to be introduced can play an equally important role in determining a change effort's success.

One type of change is innovation, "an idea, practice, or object that is perceived as new by an individual or other unit of adoption" (Rogers, 1995; p. 11). Because acceptance or adoption of an innovation usually demands some type of change, innovation infers change (Ely, 1978). This process of change occurs when an individual or institution adopts and implements an innovation. Implementation models describing an effective processes of change indicate that the most important stage is the stage in which those involved in the implementation process understand the need for this change (Cook et al. 2007), but even after understanding the need for the change, differences may exist between various interested parties in their perception of the goals of the change, in their personal and organizational interests, and in their attitudes toward the desired nature of the change, a sense of urgency is thus created among them, regarding the change as essential for improving and advancing the organizational system (Hargreaves and Goodson 2006).

Ely states that though the eight conditions are ordered numerically, he argues that it is not a sequential system but a list of conditions that should be considered. Ely further states that "The setting in which these conditions are used is the ultimate determinant of their utility. Care should be taken to allow for cultural and personality variables" (Ely, 1990, p 300). Depending on the "local condition" of the environment, some conditions may play more prominent roles having a greater affect than others on the change process. Another argument against the attempt to impose sequence or rank in order of importance is the fact that some conditions overlap and all are interconnected and related to one another to varying degrees. This in turn also explains why when one condition is absent the overall probability of success is weakened. Ely's studies have identified eight of these conditions and validated them across various educational and cultural settings. (1) There must be dissatisfaction with the status quo; For change to be voluntarily embraced participants must perceive the status quo to be less comfortable, things could be better, that something needs to change, measuring dissatisfaction with the status quo can provide much more than just a number; is the source of disaffection internal frustration with textbooks full of out-dated information or is the frustration external, such as pressure from the state, parents? There is a need

to know if the current situation is unsatisfactory to the participants; that is, if everyone is happy with how things are, change is less likely to be successful.

(2) The people who will ultimately implement any innovation must possess sufficient knowledge and skills to do the job; Ely (1990) notes “people may believe that changes are in order, but without the specific knowledge and skills to bring about the change the individual is helpless” (p.300). Relevant support and training is a critical factor in the success of innovation. Support could be in tutorial assistance, formal education, and more commonly, faculty development programs and workshops.

(3) The things that are needed to make the innovation work should be easily accessible. Resources are broadly defined as those tools and other relevant materials that are accessible to assist learners to acquire learning objectives (Ely, 1990). This condition relates to the general infrastructure of the organization and how well that infrastructure can support the innovation. Such as computers, classroom remodelling, personnel salaries and teacher training, it also covers things so small that they may be overlooked. If resources are unavailable, acquisition of learning objectives will be impeded.

(4) Implementers must have time to learn, adapt, integrate and reflect on what they are doing; Time is a separate condition for success because it is vitally important to the process of change (Ely, 1990). Teachers who are expected to change what they do and how they do it must be given time to play, use, and create (Szabo, 2002). This involves a long period of time to follow the process of innovation as well as time at each step of the process to explore and adapt the technology to the needs of the classroom. Adequate time and compensated time be made available for users to become educated and skilled in how to use the innovation.

(5) Rewards or incentives (must) exist for participants; The existence of incentives that motivate users to employ the innovation, or rewards provided by the organization for those who do use the innovation (Ely 1990, 1999). External rewards are provided to intended users as means to motivate them to employ the innovation. Strategies for developing incentives reside in allowing users to see successful implementation efforts (“observability”), outcomes, savings in time through automation (“relative advantage”) and enabling access to resources (Rogers, 1995). Ensuring that financial incentives (bonuses), professional opportunities, and intrinsic rewards such as social praise, achievement certificates are a product of implementation. A critical part of Ely’s condition of rewards and incentives is the removal of disincentives.

(6) Participation in the change process must be expected and encouraged; The key to making a technology plan work is buy-in. As Ely (1990) puts it, participation is expected and encouraged, shared decision making, communication among all parties involved and representation where individual participation is difficult. Buying-in to the process with one’s time, effort and ideas in this way contributes to a sense of ownership in the innovation. It makes it difficult for participants to advocate rejection, meaning the involvement of key stakeholders in decisions that relate to the planning and design of the innovation.

(7) An unqualified go ahead and vocal support for the innovation by key players and other stakeholders is necessary. Administrators need to show a commitment to the

innovation. Commitment and the perception by users that the powerbrokers of the organization (i.e. principals, heads of units, head of departments), actively support the implementation of the innovation (Ely 1990, 1999). Commitment refers to “visible” support by the upper level leaders or powerbrokers.

(8) Leadership must be evident. Leadership refers to the level of ownership and support given by the leaders who will manage the daily activities of those using the innovation (Ely, 1999, 1990). The enthusiasm of these leaders directly affects the motivation of the users of the innovation. Immediate supervisors must provide support and encouragement, answer questions, address concerns, and serve as role models.

Ely advocates these guidelines as “suggestions for successful implementation” but not ‘formula or rules’ (Ely, 1990, p.303) and that they cannot all be realistically achieved for all innovations in all environments. The works which are wholly directed to the investigation of Ely’s framework and the relative importance of Ely’s conditions with regards to modern technology over the years are small (Ellsworth, 1998; Varden, 2002; Hajar Mohd Nor, 2004; Nawawi, 2005). All these studies provided useful insights as to the existence of the conditions in educational settings in different cultures. Earlier studies had investigated the importance of Ely’s conditions in implementing innovation (Bauder, 1993; Ravitz, 1999). These studies had also explored the role Ely’s conditions play in the implementation of technological innovations, processes innovations, and program innovations. The research studies reveal that Ely’s conditions do facilitate implementation. Ensminger and Surry (2008), in their studies using scenario-based questions measured the relative importance of Ely’s eight conditions. Their study was the first major attempt to explore the relative importance of the eight conditions prior to the implementation of an innovation. The study became useful and precipitated for the design of an instrument to measure implementation profiles, and also provided the base for the theoretical view that by evaluating the eight conditions before implementation, institutions could develop structured implementation goals to facilitate the needed change.

Ajzen and Fishbein (1977) argued for the need to conduct ICT planning alongside attitudes since attitudes allow us to understand and form an opinion about an individual’s behaviour towards an object (i.e. change) and to identify how the individual’s behaviour is affected (Albirini, 2006). Just as a person’s knowledge affects their attitude towards an object, the knowledge is also affected by the person’s attitudes. Furthermore, attitudes have three main components, cognitive, affective, and behavioural. These components indicate that attitudes can be measured in several ways instead of being one-sided. As behaviours are influenced by one’s socio-cultural setting, emotions are under the influence of experiences (Tezci, 2010).

Ely’s (1975) investigation of conditions for technological change in the environment and the 1989 review of cross-cultural applications of the conditions revealed the presence of these conditions in various cultures. This finding suggested that the presence of the conditions may be generalised to other settings and as such, provided a basis for this study to be adopted for the Nigerian setting. Furthermore, while an individual’s knowledge is also affected by attitudes, the individual’s experience and knowledge affect their attitudes towards a given object (Tezci, 2010).

Traditional educational practices no longer provide pre-service teachers with the skills necessary to teach students to survive in today's workplace. There is not much in literature on how teachers are conditioned to implement ICT as instructional tools. There is the lack of a clear instructional ICT application focus for the teachers and teacher trainees in teacher education programmes in the face of constantly changing technology as compared to literature on how teachers should be trained in the use of ICT. Without a defined ICT implementation model for instructional application, teachers will lack knowledge, skills, and competencies on current ICT practices. Therefore this study focuses on the number of essential conditions that must be met to successfully implement ICTs into teacher education programmes considering their own conditions, culture, and context. This study proposes nine hypotheses as demonstrated in the research frame work as shown in Figure 2.

Study Aims and Objectives

The purpose of this study is to examine the conditions that have significant influence on teachers' attitude to implement ICT as teaching tools in teacher education programme. This study has the potential to contribute to existing debates on the relevance of suitable conditions using Ely's condition of change as a framework to explain and predict ICT implementation in a teacher education context, findings from this study will allow researchers to assess the validity of these conditions. This study could serve to inform teacher educators and stakeholders on the conditions that directly impact on teachers' intention to implement technology in their teaching. Being guided by the findings of this study, teacher educators could be assisted to implement an ICT model and to use technology in their teaching of student teachers. Two research questions guide this study:

1. To examine teachers perceptions regarding the influence of Ely's conditions for ICT implementation in teacher education colleges?
2. To examine the condition's an implementation model incorporating ICT in teacher education must meet in order to be considered successful?

From the above, the following hypotheses were formulated:

- H1: Teachers' attitude towards ICT has no significant positive influence on their behavioural intention to implement ICT.
- H2: Dissatisfaction with status quo has no significant positive influence on teachers' attitude towards ICT Implementation.
- H3: Time has no significant positive influence on teachers' attitude towards ICT Implementation.
- H4: Knowledge and skill has no significant positive influence on teachers' attitude towards ICT Implementation.
- H5: Recourses has no significant positive influence on teachers' attitude towards ICT Implementation.
- H6: Reward and Incentives has no significant positive influence on teachers' attitude towards ICT Implementation.
- H7: Participation has no significant positive influence on teachers' attitude towards ICT Implementation.
- H8: Commitment has no significant positive influence on teachers' attitude towards ICT Implementation.
- H9: Leadership has no significant positive influence on teachers' attitude towards ICT Implementation.

Method

Participants and Procedure

Participants were 302 practicing teachers in a public-funded college of education in Nigeria. They were selected purposefully with the prerequisite that they have been practising teachers for more than 5 years and the majority of their classes are in technology, arts and science contents. Participation was voluntary. Questionnaires were distributed to participants with the purpose of the study and participants' rights to withdraw from the study at any time during or after the completion of the questionnaire were stated. In the instructions, participants were told to contextualize all the items in the questionnaire on ICT implementation for instructional method.

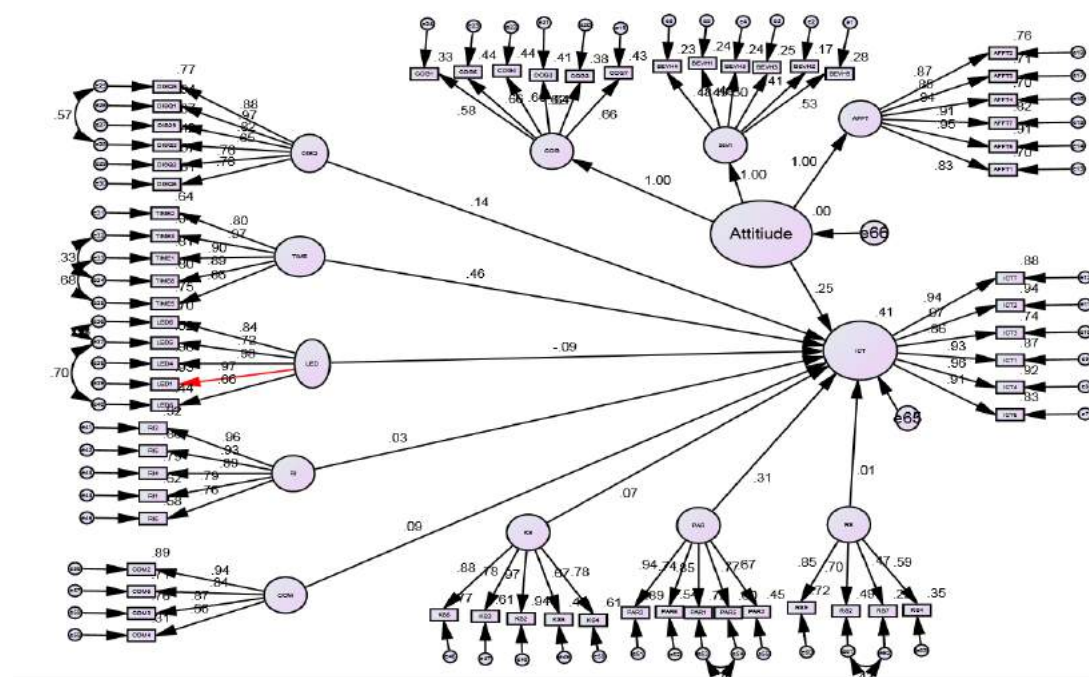
Measures

A multiple-item questionnaire was used, the items focused on all eight conditions as identified by Ely (1990) of five items each on the conditions. Each statement was measured on a five-point Likert scale with 1 strongly disagree to 5 strongly agree. These items were adapted from various published sources (e.g., Nawawi, 2005; Albirini 2006; Braak, Tondeur, and Valcke 2004). The reliability of these items has been well documented. Based on the exploratory factor analysis (EFA) conducted, a five factor loading was extracted with anti- image correlation, diagonal values of 0.5 as well as Kaise- Guttman retention criterion of eigenvalues greater than 1.0. In order to validate the model construct, the criteria are that the AVE should be greater than both the maximum shared variance (MSV), and average shared variance (ASV). The construct reliability (CR) score should be greater than 0.7. Also, average variance explained (AVE) score should be greater than 0.5, and lesser in absolute terms than the CR Score. Going by the output of the reliability test carried out, all these criteria's were met therefore the model is good for the research.

4.3. Data analysis

Data were analysed using structural equation modelling (SEM). SEM is aligned with how hypotheses are expressed conceptually and statistically (Hoyle, 2011) and it is useful for analysing the relationships between latent and observed variables, also the use of SEM produces more precise measurements of the items and constructs in research. In addition, random errors in the observed variables are estimated directly, something that traditional techniques (e.g., multiple regression, MANOVA) cannot do (Teo et al. 2016. In order to obtain reliable results in SEM, researchers recommend a sample size of between 100 and 150 cases (e.g., Kline, 2010). On this basis, the Hoelter's critical N, which refers to the sample size for which one would accept the hypothesis that the proposed research model is correct at the .05 level of significance, was consulted to assess the suitability of the sample size in this study, and, given that the sample size of this study is 302, structural equation modelling was regarded as an appropriate technique for data analysis in this study.

This study proposes nine hypotheses as demonstrated in the research frame work as shown in Figure 1.



4.4 Discussion of the Conceptualized model

The outcome of this empirical study was to establish teachers' perceptions regarding the influence of Ely's conditions for ICT implementation in teacher education colleges and to examine the condition's an implementation model incorporating ICT in teacher education must meet in order to be considered successful. Using the SEM analysis, the maximum likelihoods (ML) output as represented in figure 2 showing the estimate as well as associated significance influence level in the model. The research work is verified based on the outcome within the context of established hypothesized model. The model outcome indicates that ICT R^2 to be .41, which implies that all the eight conditions and attitude total variance contributed to .41 towards ICT implementation in teacher education. In addition the research result shows that three conditions were found to be statistically significant. The model indicates that dissatisfaction with status quo had a significant value of .004 on ICT use as its standard deviation value went up to .136, clearly indicating that the teachers were dissatisfied with their present instructional method for teacher education. Participation, Knowledge and skill on their part contributed .193 coefficient and .484 coefficient respectively towards ICT implementation in teacher education programme making it the highest amongst the conditions as shown in Table 1. This result implies the importance of teachers' adequate knowledge and skill in ICT implementation process. It was also observed that only three conditions and attitude were found to be statistically significant with a p -value < 0.01 , with evidence to reject four hypotheses and uphold five hypotheses which states that the conditions had no significant positive influence on teachers' attitude towards ICT Implementation in teacher education programme.

<i>Influence</i>	<i>Proposed Influence</i>	<i>Direct with mediation</i>	<i>Direct without mediation</i>	<i>Mediation</i>	<i>Results</i>
ATT-ICT	-			Mediation	H_1 is not supported

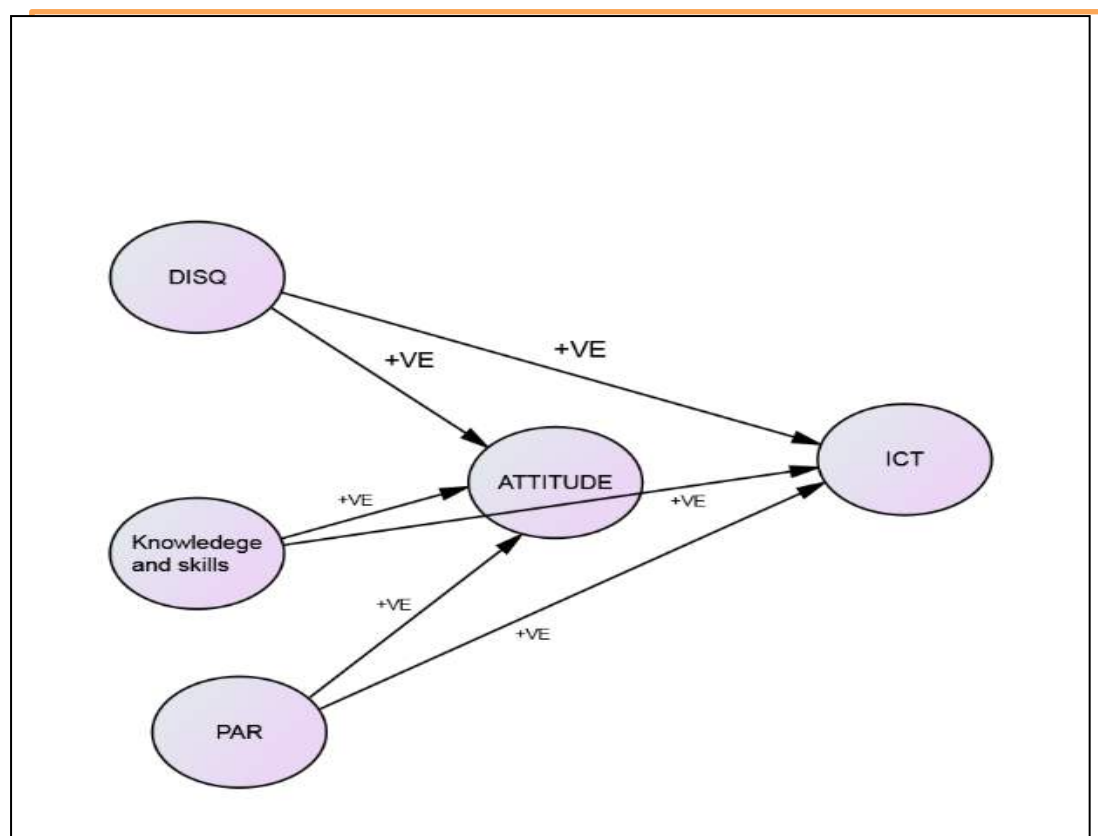


Figure 3: Conceptualized hypothetical model showing a casual influence of attitude on Dissatisfaction to status quo, knowledge and skill, participation also as mediated by attitude towards ICT. (Source: author, 2016)

The result outcome of the model as indicated in table 1 shows that there is a partial difference between the regression path coefficient (β) of dissatisfaction with status quo on direct without mediation and direct with mediation. The coefficient of direct without mediation is .136 while direct with mediation is .312. The difference is as a result of the influence that attitude has on ICT. The difference in regression path coefficient was equally observed for knowledge and skill as well as participation that were mediated by attitude. However the difference in regression path coefficient (β) was not significant as attitude had no direct influence on time, resources, reward and incentives, commitment and leadership, because the p-value of 0.532 is greater than the recommended thresholds of $p=0.05$ therefore, all five hypotheses supported the research study.

Teachers' ICT implementation knowledge and skill, participation and dissatisfaction with status quo in their ICT use for teaching are important conditions for the education system to meet the ICT implementation policy that demand teachers ICT use in teacher education programmes. However, teachers' high educational level has not significantly contributed to their knowledge and skill in ICT use. Teachers do not perceive themselves as advanced users of technology but indicate their willingness to participate in ICT implementation programmes with inputs and ideas towards a successful ICT implementation model.

4.5 Implication

The result of the research study has shown that attitude has an influence on teachers ICT implantation in teacher education. This implied that teachers' attitude towards

ICT has to be given priority by education stakeholders and policy makers in the education change process. The results are in line with Ndibalema (2014) whose study investigated teachers' attitudes towards the use of pedagogical ICT tools in Tanzanian Schools found that teachers who exhibited low familiarity with ICT use as pedagogical tools posed a serious problem.

The Nigerian National Policy on Education (FRN,2013) stressed the urgent need to integrate ICT into teacher education in Nigeria in recognition of its role in advancing knowledge and skills necessary for effective functioning in the modern world. Even as Tinio (2011) posit that effective implementation of ICTs into educational system is a complex, multifaceted process that involves not just technology but also the pedagogy and teachers' competencies among factors. Loveless (1996) identifies teachers as the most important factor to a successful ICT implementation in education. This implies that teachers are the major factor in ICT implementation process, where knowledge and skills are necessary for ICT pedagogy effective use as it has a direct positive influence on technology use of ICT by the teachers. Denoting that implementation of ICT into teacher education programme to a large extent depends on the pedagogical competence and technical skills of the teaching staff.

4.6 Limitations and future research work

The result of this study indicates that the data generated fits and is plausible as this should be. It is worth mentioning that in consideration of the model goodness of fit it can be contestable. The result of this study is limited to the sample collected for this present research in the study area, therefore, it is limited in scope. The research model however sheds light on the importance of all the conditions of change examined in the study. Further research studies can build on this study model to confirm this finding.

5 Conclusion

The research study was built on Ely's 1990 conditions of successful change, being the first to emphasize the environmental conditions that promote change broadened to cover the implementation of educational technology in a variety of education-related context, specifically adopted in the present study as ICT. ICT has the potential for aiding these new educational methods, when used appropriately, different ICTs are said to raise the quality of teaching and learning by transforming the classroom and the way teaching and learning is conducted. The model identified conditions that contributed significantly to a conceptualized model for ICT implementation in teacher education. Based on the outcome of the model, attitude was found to play a major role in mediating the conditions towards ICT.

Teachers remain the most important factor to strengthen the use of ICT in education in any education adoption reform. ICT implementation may appear too expensive, its benefits far outweighs the huge benefits for any nations education process. Base on the research result, this study therefore suggest an adoption of this model for ICT implementation in teacher education programs with participation of teachers for successful ICT strategy.

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Resource and Profitability Assessment of Transition to Flipped Video-Based Lecturing

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Abstract

In the current digital era, competitiveness of educational institutions is defined by the ability to satisfy the needs of smart video-learners. It explains active transition to video-based knowledge sharing, like substituting traditional lectures with ‘flipped classroom’ approach. However, creating video materials consumes huge amount of resources hindering adaptation of this practice by universities. This paper aims to estimate resources and profitability of flipped approach implementation. The assessment focuses on video-creation process for flipped classroom and is based on the experiments conducted in Lappeenranta University of Technology. Results of the research provide estimates of needed resources and expected payback period of adapting flipped classroom as well as reveal conditions under which it becomes more resource-efficient. Our conclusions suggest that despite initial resource consuming, flipped classroom realization leads towards lean and cost-effective lecturing.

Keywords: Flipped Classroom, Video Lecturing, Resource Assessment, Profitability Analysis.

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1. Introduction

Worldwide digitalization affects the way information is consumed, transforming the form of knowledge delivering. New era video learners study through blogs, social networks, online journals, open education websites, and unique social platforms like KHAN or TED. Universities as main institutions of educational system rearrange courses to satisfy the needs of millennials. For instance, the format of lectures switches to a short visualized reality with high level of attraction for students. Flipped classroom is one of the recently evolved concepts, which matches this format. According to it, a part of lecture material is substituted with video and is delivered before the class.

The growing body of research demonstrates effectiveness of the concept as an educational methodology (O'Flaherty, 2015). Mainly improvements of score, students' satisfaction, class activation, communication, engagement and personalization are revealed. Despite effectiveness of this blended learning approach, it consumes considerable amount of resources (Dharmadhikari, 2011). In addition, lack of economic assessment of this approach in the literature, alongside with teachers' reluctance to devote their time to its adaption constitute core obstacles in implementing flipped classroom.

This article reveals the economic benefits of flipped classroom video based approach from the university and/or professors' perspective. It specifically concentrates on the profitability analysis of transition from traditional lecturing to video with flipped delivering approach. Subsequently conditions for its implementation and pivotal to its development parameters are emphasized by means of break-even analysis. The input data is gathered and analyzed based on two experiments conducted in Lappeenranta University of Technology (LUT).

2. Background

The interest to Video Based Learning (VBL) increases with growing popularity of blended learning concepts, such as flipped classroom (Mohamed, 2014). New emerging tools and software provide opportunities for anyone to produce high quality videos. The diversity of video creation tools include but not limited to recording in studio with professional cameras and lightening, lecture captures systems like Echo 360 or PanoPro, and voice recording systems. For the distribution of material different open channels can be used like YouTube or iTunes. Universities apply different video creation tactics depending on available resources. In big universities video is produced in special studios with the help of a group of professionals. Consequently, this approach requires a lot of resources. Contrary, in small universities or in those making their first steps in the direction of video creation, the materials are developed by professors themselves by exploiting already available infrastructure. Generally, these professors-trailblazers are limited with resources and have no professional skills in video production. In both cases, video creation consumes a lot of time for its recording and development. Therefore, it is crucial for the developers to find an optimal video-approach, to make assessment of required resources and profitability beforehand.

Most of the articles consider flipped classroom or video production only from the students' perspective. Some of the authors describe their flipped classroom experience and report time of video development. Hollands and Tirthali (2014) state that approximately 40 minutes are needed for recording 1 minute voice over power point presentations. The flipped classroom practitioners from computer science department in LUT spent 20-25 minutes for creating 1 minute video without any practice (Herala, 2016). This time includes time for developing slides and voice recording on top of it. One professor from University of Trento declares that developing 1 minute video required him approximately 40 minutes (Fedrizzi, 2016). Overall, the reported time spent on video development ranges from 20 to 40 minutes per a minute of resulting video.

Flipped classroom changes the usage of classroom time moving the most of theoretical teaching out of the class and spending released time on interactive activities (Abeysekera, 2014). It means that flipped classroom frees time of the lecture (Mohamed, 2014). Notably, some of the authors draw a parallel between blended learning approaches and lean concepts, which mainly aim to eliminate wastes (Yip-Hoi & Welch, 2015). In this vein, flipped classroom concept can help in avoiding overburden in lecturing for the future.

Video based learning embedded into the flipped classroom concept empowers potential in resource savings despite its initial costs. Under certain conditions it becomes a sustainable and economically viable way of knowledge delivering, rather than being a pure investment of time and money.

3. Methodology

3.1. Experiment setup

We conducted two experiments of video elaboration in LUT. Both of video session experiments are applicable to the 'TRIZ¹ and Creative Problem Solving' course. First pilot experiment represents the low-cost option having low quality of video and low editing efforts, because of the small amount of resources involved. For the second experiment, the content and quality were significantly improved. Planning for the second session was more specific and accurate. The main preparation parts to be finalized were infrastructure, video design, and professor training of performance in front of the camera. A special studio in LUT, professional lightening, a generic camera and video editing program comprized the working process. With respect to the video delivering design it was decided to substitute the theoretical knowledge transfer part of the lecture that accounts for approximately 30% of the total lecture, leaving examples, discussions, and interactive activities for the class. Five main topics were distinguished in the course and for each of them the respective videos were developed. Duration of each video was from 10 to 15 minutes. According to the research of student perception (Wilson & Korn, 2007), it is the most effective and optimal duration. As far as after 5 minutes students normally become bored, the videos were segmented into parts.

The input data were gathered through the observations and interviews with the professor of the course. In the table below one can see the main parameters which were considered.

¹ TRIZ stands for Theory of inventive problem solving

Table 1. Specifications of input data

Parameters	Description
Professor's time	Meeting time + preparation time + discussion time + recording time
Assistant's time	Meeting time + preparation time + discussion time + recording time+ editing time
Video duration	Duration of the resulting video material
Compressibility rate	The rate of corresponding lecturing time to the time of the video material substituting it
Repetition Rate	The number of times the video material is used per year
Infrastructure cost	The costs of required supporting equipment and software
Professor's salary	Official registered salary of the participated professor
Assistant's salary	Official registered salary of the participated assistant

3.2. Valuation model and assumptions

To assess economic viability of flipping lectures with video materials we employ classical investment modeling, known also as capital budgeting analysis (Brealey, Myers, Allen, & Mohanty, 2012). Investment modeling involves estimating future cash flows generated by an investment and computing various profitability indicators. Among widely used are net present value (NPV) that reflects total project value in monetary terms; internal rate of return (IRR) that represents the threshold discount rate at which NPV would be zero; and discounted payback period (DPP) that shows a period of time after which the investment pays off (Graham & Harvey, 2001; Ryan & Ryan, 2002). Further, we complement investment modeling with the break-even analysis (Hussey, 1989) revealing critical values of input variables for investment profitability.

The investment modeling is applied for particular cases of the conducted experiments described above. The cash flows are defined based on the time resources spent/saved and their cost, in particular salary of the assistant and the professor. Thus, initial costs of video creation are calculated as the time spent by the professor and the assistant multiplied by their salaries plus some other so called infrastructure costs, whereas the revenue stream is defined as saved professor's time due to replacing lecturing with the video material multiplied by his salary. Here two important factors are involved, namely the repetition rate or how many times the video material is used per year and the compressibility that expresses how much longer the lecturing time substituted by the video in comparison to the duration of the corresponding video material. Though these values are course- and professor-specific, in our case they are equal to 4 and 2 correspondingly. The salary levels taken into calculation are 2400 euros for the assistant and 6000 euros for the professor. The effect of the replacing lectures with videos is calculated for 10 years and the cash flows are discounted at 1% rate to reflect the time value of money.

4. Results and discussion

A summary of inputs to investment modeling and its results for both cases is presented in the table below.

Table 2. Investment modeling assumptions and results

Case	I	II
Inputs		
Video duration, hours	0,67	1,07
Professor time (recording), hours	2	10
Assistant time (recording and editing), hours	28	86
Infrastructure costs, euro	50	250
Costs		
Assistant work related costs, euro	384	1 179
Professors work related costs, euro	69	343
Total investment (including infrastructure costs), euro	503	1 772
Revenues		
Saved lecture time, hours per year	5,33	8,53
Savings, euro per year	183	293
Results		
Development ratio	45	90
Net present value (NPV), euro	1 412	1 291
Internal rate of return (IRR)	57%	15%
Discounted payback period (DPP), years	2,8	6,2

A simple indicator of resources used in video creation is a proportion of the time spent for video recording to the video duration, here we refer to it as development ratio. It constitutes 45 and 90 minutes per a minute of video for two cases respectively. Indeed, in the second case the overall time spent for the video recording and editing is relatively higher due to higher requirements to its quality, heavier preparation and editing workload, as mentioned above in the experiment setup part. The higher the development ratio, the higher the associated costs for video recording and editing. Hence, the profitability indicators deteriorate with increasing development ratio *ceteris paribus*. Our results confirm this conclusion.

As can be observed from Table 1, video elaboration in both cases is profitable. NPV is above zero, IRR is substantially higher than the discount rate used (1%), and DPP varies from 3 to 6 years. All these signify economic viability of the projects. Mostly due to higher development ratio, the second case exhibits less attractive results in terms of profitability, but still remains financially attractive.

To highlight sensitivity of the results to different factors we run break-even analysis (Table 3). It indicates the minimum or maximum acceptable values of pivotal parameters, or in other words to what extent we can alter the parameters to keep the project profitable.

Table 3. Break-even analysis results

Case	I	II
Minimum repetition rate	1	3
Maximum development ratio	177	167
Minimum compressibility	0,52	1,16
Maximum assistant's salary	11 226	5 028
Minimum professor's salary	1410	3152

One of the most crucial parameters is the repetition rate that defines how often the video material is used. Nevertheless, the video creation project can sustain low repetition rates, such as once a year (in the first case), if the development rate is relatively efficient (45 minutes per a minute of video). With higher development ratio, e.g. for the second case it accounts for 90 minutes per a minute of video, the minimum repetition rate should be higher (at least 3 times a year) to maintain economic viability of the project.

The results demonstrate sound tolerance of project profitability to other factors, including the development ratio, compressibility of the video material, salary levels of the participating professor and assistant. Acceptable levels of the development ratio are far above experimentally gained values as well as achieved figures in practice of other universities. Tolerable compressibility is close to one for the second case and even lower for the first one, implying that even one to one correspondence of the lecture time to video duration is enough for keeping project profitable. Maximum acceptable assistant's salary is well above standard Ph.D. students' and postdocs' earnings in Finland, suggesting a possibility to hire professional staff. In contrast, professor's salary defines future savings, therefore the break-even analysis shows its minimum level, implying that recording lectures of even low-paid teaching fellows is reasonable.

In a nutshell, this profitability analysis justifies economic viability of flipping lectures with video material and demonstrates its tolerance to all influential factors suggesting notable flexibility in video elaboration.

5. Conclusion

In light of the modern digitalization trends in education, issues of effectiveness of flipped video-based learning implementation attract more and more attention in the academic community. One of the main obstacles in adaption flipped classroom is perceiving it by practitioners as resource-consuming. Furthermore, current literature lacks profitability assessment of this approach, hindering its wide implementation. Therefore, this paper presents an analysis of economic viability of transition from traditional to video-based lecturing.

Based on the conducted pilot projects in Lappeenranta University of Technology we demonstrate that video elaboration is profitable, because, its initial resource intensity, it saves considerable time in future lecturing. We show that one of the crucial to economic viability factors is the number of times per year particular video material is used to flip the lecture. However, with the development ratio equal to or less than 45 minutes per a minute of video that well corresponds to the observed rates in practice of other universities (20-40 minutes), employing video once a year is enough to pay off initial costs within less than a decade. In turn, more often use of video material allows even greater development ratio, indicating a possibility to spend more time on video elaboration keeping the project financially reasonable. Indeed, our experiments show that the development ratio can easily rise due to a number of factors, including quality of equipment and sophistication of software, amount of additional content to be visualized in the video material, experience of an assistant in recording and editing videos, professor's recording performance and even mood of participants. However,

with growing experience of participants, efficiency in video elaboration essentially improves.

Along with already proved educational advantages of flipped classroom, revealed by this work economic viability of flipping traditional lectures with video material is expected to convince broader public in its benefits and trigger further diffusion of this approach.

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