



PROCEEDINGS

INTERNATIONAL CONFERENCE
SUSTAINABILITY, TECHNOLOGY
AND EDUCATION

STE 2014



ICEduTech 2014

international conference on educational technologies

Edited by:

Piet Kommers
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New Taipei City, TAIWAN, 10-12 December



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**INTERNATIONAL CONFERENCES
ON**

**EDUCATIONAL
TECHNOLOGIES 2014
(ICEduTech 2014)**

AND

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AND EDUCATION 2014 (STE 2014)**

NEW TAIPEI CITY, TAIWAN

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FOREWORD

These proceedings contain the papers of the International Conferences on Educational Technologies (ICEduTech 2014), and Sustainability, Technology and Education (STE 2014), which have been organised by the International Association for Development of the Information Society and co-organised by the Tamkang University, New Taipei City, Taiwan, 10 - 12 December 2014. The conferences are co-sponsored by Curtin University, Curtin Business School, Australia, and ISPIM - International Society for Professional Innovation Management.

The International Conference on Educational Technologies (ICEduTech 2014) is the scientific conference addressing the real topics as seen by teachers, students, parents and school leaders. Scientists, professionals and institutional leaders are invited to be informed by experts, sharpen the understanding what education needs and how to achieve it.

Topics for the ICEduTech Conference:

- Education in Context: Education in the Network Society, Educational Games, Social Media in Education, Home Schooling, Students' Rights, Parents' Rights, Teachers' Rights, Student-Safe Searching, School Violence, Education and Tolerance for Peace and Education in Developing Countries.
- Education as Professional Field: Teacher Education, Teachers' Professional Development, Teachers' Workload, Teacher Support for Grading, Time Tabling, Grading, Learning Tools, and Online Learning Software, Teachers' learning in Communities of Practice, Web-based Communities for Teacher Support, Teachers' Career Planning, Legal and Financial Issues, Conflict Resolution and Mediation, Governance and Servant Leadership and Educational Policies.
- Curricular Evolution: Problem-based Learning, Critical Thinking Skills, Creativity Skills, Learning Citizenship, Global Education, Media Literacy / Pedagogy, Multicultural Education and Alternative Assessment Methods.
- Learner Orientation: Student-Oriented Learning, Peer- and Collaborative Learning, Learning Strategies: Learn how to Learn, Motivating Students, Recognizing Students' Learning Styles and Special Education.
- Integrating Educational Technologies: Social Media and Social Networking, The Semantic Web 3.0, Podcasting for Broadcasting Video Lectures, Podcasting feedback to students, Wiki and blogs in Higher Education, Mobile, Virtual and Vicarious Learning and Simulations and Modeling.
- International Higher Education: Marketing Higher Education as a Business Case, Pitfalls and Solutions in Joint and Double Degree Programs, Enculturation and International Teacher Accreditation, Web-based, Mobile, Virtual Presence and Social Media to Overcome Student Mobility, Blended Learning and Student Assessment at a Distance, Student Mobility and Distance Education,

New-Emerging Standards and Benchmarks for Higher Education, Education, Research, Exchange and Capacity Building, 21st Century Academic and Industrial Brain Exchange, Academic Salaries, Faculty Contracts, Residence Permits and Legal Issues, International Student Exchange Funding Programs: Erasmus Mundus, the U.S. Council on International Educational Student Exchange, and the Euro-American “Atlantis” program, Networks for International Higher Education in the Pacific, Australia, Europe, Asian and European countries and Higher Education, Cultural Diversity, Tolerance and Political Conflict.

The International Conference on Sustainability, Technology and Education (STE) aims to address the main issues which occur by assessing the relationship between Sustainability, Education and Technology.

Broad areas of interest are: Sustainability and Leadership, Sustainability and Green IT, Sustainability and Education. These broad areas are divided into more detailed areas (see below). However innovative contributes that do not fit into these areas will also be considered since they might be of benefit to conference attendees.

- Sustainability and Leadership: Sustainability and Management, Corporate Social Responsibility and Sustainable Design, Sustainable Design and Business Strategy, Sustainability and Accounting, Sustainability and Finance and Economic, Sustainability and Marketing and Branding, Technology Development and Innovation at Small and Medium-Sized Enterprises, Sustainability and Natural Resources, Sustainability and Sustainable Design, Sustainability and Ethics, Sustainability and Stewardships, Sustainability, value and business strategy, Sustainability and Social, Sustainability and Culture, Sustainability and Environment, Sustainability and Law, Sustainability and Developed Countries, Sustainability and Developing Countries and Sustainability and SME.
- Sustainability and Green IT: Sustainability and Social Media, Sustainability and Online Community, Sustainability, Green IT and Internet, Innovation of Green Technologies, - Green Procurement, Green IT and Energy, Green IT and e-Waste, Technologies and Green IT, Green IT and Sustainable Design, Green IT Development and Sustainability, Green Supply Chain and Logistics, Sustainability and Green IT Policy and standards, Green IT and Sustainability and escorting to change, Sustainability and Green IT business, Sustainability and Green IT Infrastructure and Cloud computing and virtualization.
- Sustainability and Education: Education and Training, Accreditation, Green IT and teaching, Sustainability and Green Campus, Education for Sustainability, Sustainability and Curriculum frameworks, Shifting toward Sustainability, Sustainability and Future Generation and Sustainability and e-Society.

These events received 112 submissions from more than 23 countries. Each submission was reviewed in a double-blind review process by an average of four independent reviewers to ensure quality and maintain high standards. Out of the papers submitted, 22 got blind referee ratings that published them as full papers, which means that the acceptance rate was 20%. Some other submissions were published as short papers and reflection papers.

Extended versions of best papers from ICEDuTech 2014 will be invited for publication in selected publications such as the IADIS International Journal on WWW/Internet (IJWI). Best paper authors from the STE 2014 conference will be selected to write extended versions of their papers as chapters to be included into a book from Springer entitled “Sustainability, Green IT and Education Strategies in the 21st Century”.

In addition to the presentation of full papers, short papers and reflection papers, the conference also includes three keynote presentations from internationally distinguished researchers. We would therefore like to express our gratitude to our gratitude to Chun-Yen Chang, NTNU Chair Professor, and also Director of Science Education Center, Taiwan, Dr. David Tawei Ku, Chair of the Department of Educational Technology, Tamkang University, Taiwan, and Prof. Pedro Isaias, Universidade Aberta (Portuguese Open University), Portugal.

A successful conference requires the effort of many individuals. We would like to thank the members of the Program Committee for their hard work in reviewing and selecting the papers that appear in this book. We are especially grateful to the authors who submitted their papers to this conference and to the presenters who provided the substance of the meeting. We wish to thank all members of our organizing committee.

Last but not least, we hope that participants enjoyed New Taipei City and their time with colleagues from all over the world.

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KEYNOTE LECTURES

CLOUDCLASSROOM: THE NEXT GENERATION

**By Chun-Yen Chang, Ph.D.,
NTNU Chair Professor,
and also Director of Science Education Center,
Taiwan**

Abstract

My research team has developed CloudClassRoom (CCR), a cross-platform instant response system, with the aim to help teachers in the orchestration of small-group argumentation activities, especially in the classroom. CCR has two main functions: (1) to enable every student in the classroom to respond to the teacher's questions instantly and anonymously by using a handheld device; and (2) to automatically form small groups based on student real-time responses. We have integrated CCR into a small-group socio-scientific argumentation activity, and initially explored the possible impacts of different automatic group-formation methods on Taiwanese college students' learning outcomes. In this presentation, I would like to carry out a live demo for the participants in terms of ways to engage classroom participation.

FROM SLATE TO TABLET: THE DEVELOPMENT OF NEW MEDIA FOR LEARNING IN TAIWAN

**By Dr. David Tawei Ku,
Department of Educational Technology
Tamkang University, Taiwan**

Abstract

The presentation will discuss the development of educational technology in Taiwan. It's an overview of the history in this field and the latest development of various areas in related studies. It will use the mobile learning and Sifteo Cubes learning system as the examples to show the integration of instructional design and new technologies. Recommendations and reflection for the related issues are also discussed.

EMPATHY, EMPATHIC INFORMATION SYSTEMS AND NEW DIRECTIONS FOR LEARNING

**By Prof. Pedro Isaias,
Universidade Aberta (Portuguese Open University),
Portugal**

Abstract

Empathy in the area of Information Systems has to do with empowering technology through focused emphasis on user feedback and user interaction. Therefore Empathic Information Systems have to do with applying software, information and communication technologies to enable empathic interactions.

This keynote will represent the above concepts, and will give an overview of the latest developments in this field through presenting several technologies and describing several cases in various areas that are being developed under an EU research project.

Further, this keynote will focus on an e-Learning specific empathic environment being currently elaborated within the EU research project. The specific e-Learning case will be presented, with its characteristics, shortcomings and a reflection will be made about its possibilities.

Full Papers

THE STUDY OF ADOPTING PROBLEM BASED LEARNING IN NORMAL SCALE CLASS COURSE DESIGN

Chia-ling Hsu

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New Taipei City, 25137, Taiwan*

ABSTRACT

This study adopts the Problem Based Learning (PBL) for pre-service teachers in teacher education program. The reasons to adopt PBL are the class scale is not a small class, the contents are too many to teach, and the technologies are ready to be used in classroom. This study used an intermediary, movie, for scenario to student to define the problems and to search for information in order to report their findings. Since this is not a required course, more than ten people took this course. Therefore, adopting PBL, the groups using, in the normal scale class in higher education is another modification. The purposes of this study are to evaluate this adopting PBL processing and to find the chance to improve the PBL course design. The methodology of this study is the text mining with KeyGraph technology. Thirty seven pre-service teachers' feedbacks are analyzed. The feedbacks were from those students who finished three cycles of the PBL processing. Two of the cycles of the PBL processing are the students learning educational special topics by themselves. The last cycle of PBL processing is to train the pre-service teachers how to run the PBL course in the future. The results indicate that the important factor is "discussion" and rare and important factor is "movie" (intermediary) for adopting PBL course.

KEYWORDS

Problem based learning, Educational issues, Instructional design, Teacher education, Learner center, Higher education

1. INTRODUCTION

Educational reform is not a new topic in education area. Nowadays, the technologies, ubiquitous learning, global education, and collaborated learning are the main topics over the world in educational system not only in K-12 but also in higher education. In other words, the educational reform is from teacher center to student center. All these topics emphasize in helping student to learn and to cooperate. Therefore, many teaching methods are provided which are different from the traditional teaching, such as, lecturing or systematic teaching. Most of these new methods emphasize learning instead of teaching. Problem based learning (PBL) is one of the powerful learning methods during this educational reform period. PBL includes the collaborated learning and technologies learning for student center. Therefore, PBL becomes a popular learning method in course design, especially in higher education.

Some study in PBL focus on to examine the issues involved in designing appropriate problems or scenarios and also design appropriate projects for students (Dobson & Tomkinson, 2012). Some study adopts the PBL in addressing the disengagement of apprentices with the existing assembly-style electronic laboratory program (Monks, 2010). Some study uses PBL courses to assessment the student outcome with elaborated learning theory (Kuruganti, Needham, & Zundel, 2012). According to these studies, PBL is widely used in courses to help students to learn. O'Neill, G., & Hung, W. (2010) even use hybrid PBL teaching method in their course. Therefore, the PBL learning method is used as well as is adopted in different courses. Those studies modify the PBL for their own purposes in their courses. At the same reason, this study adopts the PBL in a normal scale class learning in higher education system. Usually, the PBL is applied to small class learning. However, many classes in higher education are not a small class. As a result, this study modified the PBL strategies in a teacher education course in higher education for pre-service teacher.

Since Freidman (2005) proposed "the world is flat", we noticed that people connected to each other with technologies in societies, economics and other many fields. Nowadays, we are in a global world. To be a global citizen, there are many issues need to be learn, such as green environment, care for the disadvantaged

people, etc. At the same situation, there are many important issues in education area, such as gender equality, care about the remote disadvantage school-district, educational justice, teaching theories and methods, classroom management, etc. It is very difficult to cover all the educational issues in one pre-service teacher course. Therefore, the PBL method seems one of the possible choices for teacher to design a course to cover all these issues. In addition, hoping the PBL can also increase the students' learning motivation. Moreover, the students can lean by themselves and find the interesting issues by themselves. Hence, this study applies the PBL method to design an educational special topics course for pre-service teacher in teacher education curriculum.

Nowadays, the technologies, for example, laptop, iPad, mobile phone, are very popular in our lives. It is possible to use these technologies in the class during the students' discussing period.

Based on these reason, this study adopts PBL in normal scale class in higher education to discuss many educational issues with technologies. The other difference between the PBL and adopting PBL in this study is that the PBL uses the real scenario but the adopting PBL in this study uses movie as intermediary for writing scenario. The purpose of this study is to evaluate the effects of using adopting PBL in educational special topic course design since the PBL method is the first time to be tried on in this course. Although many studies talk about the advantages and disadvantages, different setting may have different results. The evaluation is the students' feedbacks when they finished this course. This study looks for not only the students' opinions but also the chance to improve the course activities for the next time. The data analysis is the text mining with KeyGraph for students' feedbacks. In other words, this study using adopting PBL strategies, find the import and rare-and-important factors for the educational special topics course in teacher education program for pre-service teachers.

2. RELATED LITERATURE

The aim of this study is to evaluate the effects in using adopting PBL in educational special topics course in order to find the important and rare-and-important factors. The evaluation is to know how the students feel about the course as well as to find a chance to help the instructor to design the course for the future. Therefore, the PBL and text mining with KeyGrpah technology are described here.

2.1 Problem Based Learning

Problem based learning (PBL) was found in McMaster medical school in Canada. Neufeld and Barrows (1974) proposed a "McMaster philosophy" term for interpretation the PBL. In Benson (2012) study, he reviewed the literature which was some for PBL and some against PBL. He gave his experience in using PBL in university and concluded that there were no academic or logistical grounds that support the use of PBL, but that it might still be regarded as a worthwhile exercise.

2.1.1 PBL in Curriculum Design

Since the PBL was implemented in medical school, many other courses were tried on to design for their own courses. Carrera, Tellez, and D'Ottavio (2003) implemented the PBL in medical course and indicated that schools in developing countries should consider whether a PBL curriculum is even appropriate for them. Also, considering the available research on curricular innovations such as PBL and the particular situations of their countries may help schools anywhere avoid wrong decisions about what curricula to implement. Etherington (2011) used PBL as a new pedagogy in an intermediate composition course. He indicated that PBL made the course easier to implement the social and collaborative aspects of writing as well as PBL allowed students to apply what they were learning in the classroom to contexts beyond the classroom in an immediate and relevant way. Kumar and Refaei (2013) used PBL as a new pedagogy in an intermediate composition course. They suggested that knowledge was co-created through social interactions that students learned important lessons through interactions with their peers.

2.1.2 PBL Assessment

We notice that PBL are implemented in various courses from literature review. Some studies are interested in assessment in PBL courses. Sockalingam, Rotgans, & Schmidt (2012) tried to build up a questionnaire for assessment the quality of PBL effects. Razzak (2012) focused on the effect of PBL strategies in class and used the observation, monitoring of students' performance, and students' personal reflections and group presentations were utilized as the main assessment instruments. Tosun and Taskesenligil (2013) designed the quasi experimental study that was carried out through non-equivalent control and comparison group pre-post-test design to examine the effect in PBL course. McDonald (2013) used two questionnaires to evaluate the faculty training course and found out that participants expressed satisfaction in a number of areas like clear delivery by workshop facilitator; capturing their interest; gaining knowledge; and obtaining useful handouts.

This study verified the PBL strategies in educational special topics course and use students' feedbacks as the assessment instrument.

2.2 Text Mining with KeyGraphy Technology

Weiss, Induskhya, Zhang, and Damerau (2010) indicated that data mining technology would find out the pattern in a structured data base but not in non-structured or semi-structured data base. Relatedly, Hearst (1999) pointed out that data mining would not satisfy the human needs of pursuing information and knowledge. Fortunately, text mining was created to apply language and statistics to analyze text data in order to attain new information as described by Grimes (2005). Therefore, text mining became one of the important issues.

Ohsawa, Benson, and Yachida (1998) proposed the KeyGraph technology as a kind of data visualization tool in order to discover chances. The KeyGraph technology brought the text mining research into a new era. Montero and Araki (2005) showed that a text could be divided into some different subgroups and that there was an association to each subgroup. Some phases would be connected to each other but some were not. At the same time, Sakakithara and Ohsawa (2005) sorted out different subgroups and used the KeyGraph format to present these subgroups. They also defined the high frequency element as a "black node", and the number of baskets which contain two elements and the high frequency co-occurrence as a "black link". In this model, the KeyGraph technology becomes a very powerful tool in many areas. Oshawa (2002) pointed out the value of KeyGraph technology as an extractor of causalities from an event - sequence, and as a words abstractor from a document. Moreover, the main point of the KeyGraph technology provided some chances which would reverse the bad situation into a better one, especially in a feeble industry.

Wang, Hong, Sung, and Hsu (2006) applied this method to explore the validity of KeyGraph. This paper discussed the detailed algorithm for the KeyGraph used in ARCS which was a well-designed questionnaire. The processing were constructing a weighted (directed graph) and identifying the rare but structurally important nodes according to the support rate, confident rate, and correction. In addition, this paper examined the results with ANOVA for each part of ARCS. The results indicated that although the statistics data showed no significant difference, the KeyGraph technology provided more information. Hsu and other educators also applied the KeyGraph technology in education settings. The results pointed out that the learners' scenario maps would tell more information than the traditional statistics results. Hsu, Hong, Wang, Chiu, and Chang (2009), also applied the KeyGraph technology to exploring the learners' thinking and tried to find the chances in instructional activities.

What are chances? According to chance discovery theory, the definition of chances is the rare but important events or factors (McBurney & Ohsawa, 2003; Ohsawa & Tsumoto, 2006). However, Watts (1999) emphasizes the importance of linking. Hsu (2005) has been applying chance discovery model to education especially in class activities. The findings were novel and would provide teachers with chances to design the activities from different points of view. The model we proposed would help instructional designers evaluate the course development as well as find chances to improve the quality of e-learning courses (Hsu, 2011). The data were analyzed in text format and represented in a chance building map.

In this study we took students' feedbacks as an instrument to evaluate the adopting PBL course effect. The KeyGraph was the tool to find the indicators to improve the course for the future design course.

3. METHOD

The aim of this study is to evaluate the effect of the adopting PBL implementation in educational special topics course for pre-service teacher in teacher education program. In order to assessment the PBL effect, the text mining with KeyGrapy technology is used. The research setting, participants, and procedure are described bellows.

3.1 Setting

The educational special topics course is not a require course in teacher education program. Therefore, forty two pre-service teachers took this course. This is a normal scale class (around 40-70) in the university. This course opens only in autumn semester for two credits which means two hours per week for class. Only one instructor runs this course, no teaching assistant. This course is expected to cover the educational issues as many as possible. The objective of this course is to understand the education issues in educational system for the fresh pre-service teachers. This course is open for the pre-service teachers only.

3.2 Participants

The pre-service teachers who are the students in the university and they have to pass three examines in order to get in the program. Therefore, the students who are in teacher education program are diversity from undergraduate students and graduate students, and contain from different department students, such as, Chinese school, Social Science school, Science school, and Foreign Language school, etc. Forty two pre-service teachers took this course. They all attended the adopting PBL activities. However, there were only thirty seven students who wrote their feedbacks after the courses in time. Therefore, only thirty seven feedbacks were collected. So, the participants in this study were thirty seven pre-service teachers although forty two students were registered. Ten participants were male and twenty seven were female. Sixteen participants were from Chinese School, seven were from Social Science School, Six were from Science School, and eight were from Foreign Language School. The distribution of the participants is described in table 1.

Table 1. The distribution of participants

Gander	Number
male	10
Female	27
Total	37
School	Number
Chinese	16
Social Science	7
Science	6
Foreign Language	8
Total	37

3.3 Procedure

The study adopt the PBL in normal scale class, the procedure is in figure 1.

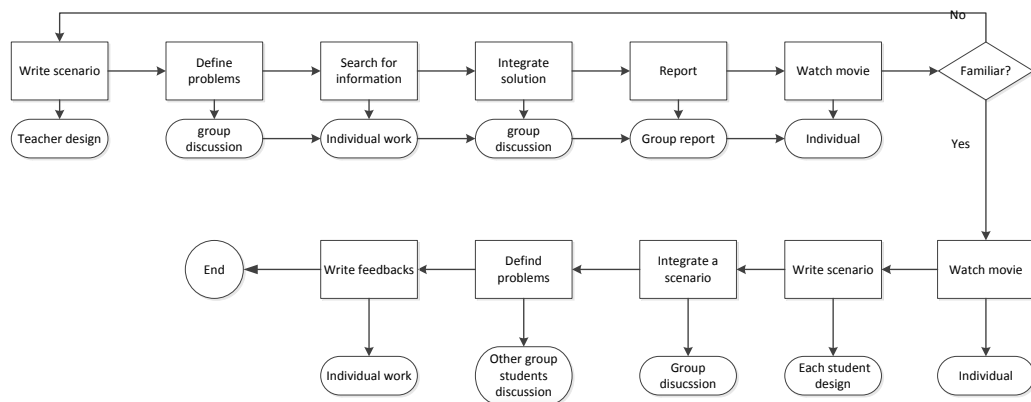


Figure 1. The research procedure

- Write scenario

First, the instructor wrote a scenario from a movie, school of life, for the pre-service teachers to discuss.

- Define problems

The pre-service teachers were divided into four groups. During the class discussing time, each group used iPad, laptop, and mobile phone in order to define the problems. At the end of class, each group had to select four problems which were they all agreed and interested.

- Search for information

The assignment for the pre-service teachers was to search for information for the possible answer.

- Integrate solution

Then, the second class period, the students also used the technologies (iPad, laptop, mobile phone) with their possible answers to discuss what would be the appropriate answer for the problems. They needed to integrate the answers in order to prepare for their group report.

- Report

Then at the third class period, each group reported their results.

- Watch movie

After the students finished the adopting PBL activities, the instructor showed the movie for them to watch. The PBL processing took four periods of classes.

- Second cycle of PBL strategies

In order to let the students familiar with the PBL processing, the second PBL cycle was taken again. The instructor wrote another scenario from a movie, no on less, for the pre-service teachers to discuss.

- Revise the PBL strategies

Finishing the second cycle of PBL processing, the instructor made different processing of PBL for students. Since the students were pre-service teachers, they needed to be trained to write scenario for their students in the future.

- Watch movie

Therefore, at the first step of the PBL processing, the instructor showed the movie, the free writer, for students to watch.

- Write scenario

The assignment was asked each student to write a scenario according to the educational issues. The reason is to train they know how to write scenario to guide their students in the future.

- Integrate a scenario

In the second class period, students brought their scenarios for discussion in the group and decided one appropriated scenario to put in the discussion board at the open cyber classroom platform.

- Define problems

Then, the other group read the scenario to produce four problems as they did before.

- Write feedbacks

At the end of these two kinds of PBL processing, students were asked to write feedbacks and upload to the open cyber classroom.

The scenarios and problems for each group in discussion board show in figure 2.



Figure 2. The scenarios and problems in open cyber classroom platform.

3.4 Data Analysis

This study used the text mining with KeyGraph technology to analyze students’ feedbacks. First step was to clean data that was to reduce the students’ feedbacks unnecessary words. Then, the N_Gram was done by the researcher. The frequency of the terms was produced. Then, using the intersection, the thresholds were determined. Finally, the KeyGraph was produced.

4. RESULTS

The aim of this study is to evaluate how the pre-service teachers feel about the PBL strategies by actually doing it and practicing it. The results indicated that the most feeling was discussing and the chance was the movie. Figure 3 showed the results.

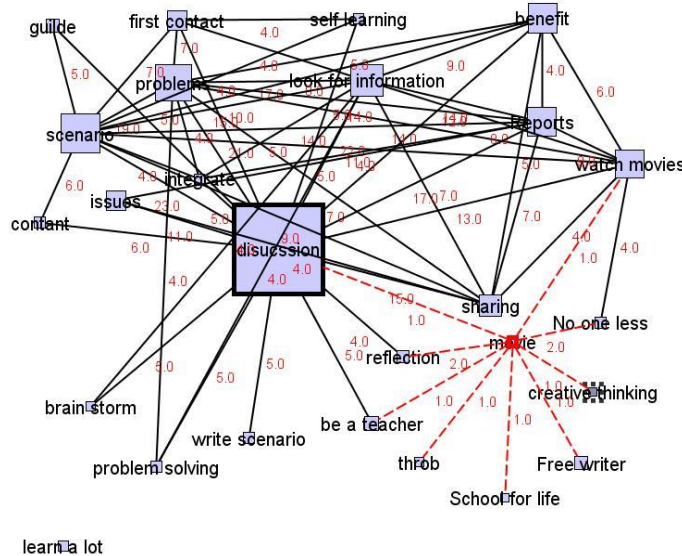


Figure 3. The KeyGrpahy as the results of the evaluate the PBL processing.

In the figure 2, the adopting PBL processing, that is, reading scenario, defining problems, looking for the answer, presenting the reports, and watching movies is shown. Each step contacts with discussion process. From the discussion process (the black point), that indicates that the pre-service teachers writing scenario, reflecting, sharing, brainstorming, and solving problems. The red point is movie which indicates that the chance for the adopting PBL processing. Because of the movie, the PBL activities would concentrate on discussing. The movies made them move and have creative thinking. The red point indicates that the chance for the adopting PBL activities. In other words, how to choose the right movies will make the course better. Movie is the rare and important factor in this adopting PBL course.

5. CONCLUSION AND SUGGESTION

This study is adopting PBL in normal scale class by using group discussion. The scenario is not from real case but movies. The purposes of this study are to understand how the pre-service teachers feel about the PBL strategies and to find out the chance that will make the PBL course better. The methodology is text mining with KeyGraph technology. The results indicate that the “discussion” is the core activity for PBL and that the “movie” is the rare and important factor to make the PBL course better. There are two main factors we need pay attention to, one is the important factor (black point) “discussion” and the other is rare and important factor (red point) “movie”.

From the feedbacks (the KeyGraph map), it indicated that the PBL strategies were the first time experience for students. They felt that PBL was self-learning and they benefit a lot from this course.

5.1 Suggestion

According to the results, some suggestions are provided:

- For instructors who are going to practicing the PBL course, the discussion is very important to design within the course.
- For instructional designers, the rare and important factor, such as “movie” in this case, is the effective factor to put in the course, In general, the intermediary needs to be considered carefully for PBL course design.
- For pre-service teachers, the abilities for management of discussion are very important.
- For teacher educators, the teaching methods of discussion and collaborated learning are important.
- For education administrator, the adopting PBL is possible in normal scale class in higher education.
- More research for evaluate the PBL are needed.

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STUDENT LEARNING THROUGH HANDS-ON INDUSTRY PROJECTS

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ABSTRACT

Learning is most effective when accompanied by doing. If someone desires to become a baseball player, being told how to play the game, watching others play and even understanding the rules of the game are mostly ineffective if the individual never “swings the bat”. This paper outlines the implementation of this method (swinging the bat) in Computer Science courses being taught at Indiana University Purdue University Indianapolis (IUPUI). Previously lecture-based courses were vastly improved by introducing real-world industry projects that allowed students to fully engage in the learning process. Partnering students with non-profit, educational and civic entities requiring professional deliverables mimics real-world business scenarios that require real-world professionalism. Typical industry projects encompass a wide array of skill sets, everything from time management and team collaboration to oral and presentation skills as well as the technology and processes required. While the success of these project-based courses has been overwhelming, this type of teaching pedagogy is not void of pitfalls and challenges. While outlining the process implemented in structuring these Computer Science courses to be project-based, this paper also addresses the challenges to be considered when choosing to adopt this teaching methodology.

KEYWORDS

Collaboration, Project-based, Industry-based, Engagement

1. INTRODUCTION

Learning by doing is proven to be an effective teaching methodology. Experiential Learning Theory (ELT) provides a holistic model of the learning process and a multilinear model of adult development, both of which are consistent with what we know about how people learn, grow, and develop. The theory is called “Experiential Learning” to emphasize the central role that experience plays in the learning process, an emphasis that distinguishes ELT from other learning theories. The term “experiential” is used therefore to differentiate ELT both from cognitive learning theories, which tend to emphasize cognition over affect, and behavioral learning theories that deny any role for subjective experience in the learning process.

Another reason the theory is called “experiential” is its intellectual origins in the experiential works of Dewey, Lewin, and Piaget. Taken together, Dewey’s philosophical pragmatism, Lewin’s social psychology, and Piaget’s cognitive-developmental genetic epistemology form a unique perspective on learning and development.¹

IUPUI has been aggressively promoting ELT and other proven alternative teaching pedagogies. To this end, IUPUI adopted an innovative educational model called RISE2. Research (undergraduate), International Study Abroad, Service and Experiential learning are the components of this educational initiative.

Experiential learning could also be considered Problem-Based Learning. Problem-Based Learning (PBL) is an instructional approach that makes the student the focus of the learning process, seeking to empower them such that they take responsibility themselves for their own learning. This differs from the traditional approach where the lecturer or instructor, acting as a transmitter of knowledge, drives the learning process. PBL is grounded in the philosophy of John Dewey, who believed that learning is based on discovery and that it is guided by mentoring rather than the transmission of knowledge. In this way the curiosity of the learner is aroused, resulting in them questioning, critically thinking about problems, and, hopefully, creatively solving problems³.

Two Computer Science courses; CSCI-N342 (Server Side Programming) and CSCI-N431 (E-Commerce with ASP.net) were transitioned from a lecture-based teaching methodology to a project-based interactive teaching and learning methodology. By immersing these students in real-world scenarios driven by real clients and real projects, a direct correlation is made between the content of the course and its application to industry.

2. PROJECT OVERVIEW

The project started by completely redesigning an approach that not only teaches all the topics of the courses to ensure that the learning objectives and outcomes are achieved, but also incorporates a project-based learning environment using real-world projects.

2.1 During the Design Stage, Intervention Included

1. Finding projects from non-profit organizations, IUPUI entities and local communities - This involved sending out flyers, going to networking events, attending community meetings, talking to friends and colleagues, etc. A screening process was conducted upon receiving emails of interest. After candidates were identified, meetings were scheduled with each entity to ensure that their projects were appropriate. A point worth mentioning here is that although some of the project requests were not a right fit for this class, other resources were suggested to help the clients achieve their goals, e.g. finding individual students who could meet their needs, establishing internships, or pointing them to the IUPUI Solution Center⁴. Many of the non-profit organizations involved did not realize that these resources existed. Even if they had budgets to pay for an internship, not all of them realized that they could contact IUPUI departments directly for student resources. Reaching out to them gave them a channel to connect to students and other resources which helped them achieve success with their particular needs.

2. Meeting with clients to finalize the projects - After the initial meeting, the clients were asked to provide additional documentation and detailed information such as paper forms used, existing databases (if they have any), future improvements, etc. A thorough understanding of the projects was crucial for the students' success because a project assignment that is inappropriate to the learning objective would highly affect the learning effectiveness. Clients were given ample time to collect this additional information. Clients with complex projects required multiple meetings before their project could be finalized. During the meetings, other than talking about the project itself, the following items were emphasized:

A. The risk of developing applications as a course project - Most students in the class do not have working experience. Even if the goal is to get the application into production, it cannot be guaranteed that all the projects will be up to the professional level. It is possible that future refinement will be needed such as bug removal or security enhancement. Additionally, a student may drop the class. In this case, adjustments within the class will be implemented to continue with the project, but there could be unforeseeable elements that will prevent the project from being completed by the end of the semester.

B. Do not give students access to their production server - If a project is to develop an improved version of the existing application, it will be convenient for the students to have access to the client's production server to get a thorough view of the current version. However, it is highly recommended that the client not do so because students may accidentally make some mistakes due to lack of experience. Suggestions of safe alternatives are offered to address this issue.

C. The client should consider the future project maintenance in advance - Some clients may not realize that a web/database application will need constant maintenance after it goes into production, e.g. renting or purchasing hosting spaces, software updates, bug removal or changes to the application. Clients are informed that students are not responsible for any future maintenance of the projects and they should have a plan on future maintenance issues before they start the development so that it will not be a surprise for them.

D. Class enrollment - The planning stage happens before the semester starts and how many projects the class can take depends on the size of the class which generally will not stabilize until one week into the semester. Thus a client needs to know that even if a project is chosen as a good candidate, there is still a possibility that it cannot be done in that semester.

3. Designing materials to be used during the implementation stage - New materials need to be developed such as evaluation forms, grading rubrics, slides, new syllabus, and background survey forms.

4. Finding a teaching assistant - Because the students are doing real projects, they may encounter problems that normally do not occur in a standard classroom setting. This requires the teaching assistant having not only strong technical background, but also leadership skills, project management skills and high problem solving abilities.

2.2 After the Course Started, Intervention Included

1. Helping form student teams - A background survey was conducted at the beginning of the semester to assess the students' skill level on the three most important areas integral to a successful completion of the class – web design, database and programming. Student teams were formed based on the principle that each team should have at least one member who possesses strong skills in each of the three areas. Students who chose to work in a team setting could pick their own team members. A student could also choose to work on a project on his/her own if he/she was strong in all three fields. Facilitating the team forming process made sure that each team had a well-balanced skill set. Another important step at this stage is to pick an initial team leader who is willing to serve and who exhibits good communication and leadership skills. The team leader's role is to 1) Act as a point of contact between the team and the client to handle communication with the client; 2) Facilitate group meetings; 3) Balance work load among team members; 4) Submit team project assignments. Team members could take turns to serve as the team leader so that more students would have a chance to practice their project management skills.

2. Helping with project assignments for different teams - Project descriptions were posted about one month after the semester started. At that stage, the students had learned most of the core concepts and had several lab assignments to practice on the important topics that they needed to know before they started the project. Instructor intervention at this stage was critical to ensure that each team was assigned a project that was the best fit. In the class, it was explained in great detail what each project was about, the goal of each project, who the client was, what skills were needed to do the project, how complex a project was and the potential challenges that they might encounter at a later stage. Students would pick a project that they were interested in and that fit into the team's skill level.

3. Organizing initial student/client meetings - As soon as the projects were assigned, a first meeting was scheduled to introduce the students and clients to each other. Since each project needs to have its own individual meeting and the client/students all had different schedules, this task required full engagement to find meeting locations and appropriate meeting times. Other than meet-and-greet in the first meeting, the client would talk in detail about the project expectations and requirements. Clients were notified in advance as to what they were expected to do in the first meeting so that the students could start the project immediately after the meeting.

4. Supervising the projects' progress - The students had about three months to finish their projects, and the development process was divided into a cycle of four stages - design, implementation, testing and delivery. Ensuring that they carry on their projects smoothly and complete their goals at each stage required close supervision for each project. A project presentation assignment was required at the end of each stage, and a carefully designed grading rubric was developed for each stage. Feedback was provided on the spot and the students were graded cumulatively, i.e. any weaknesses from the previous stage must be fixed at the next stage. No matter how hard students were willing to try, lack of industry experience prevented them from realizing some critical issues, thus real case scenarios were constantly brought in to help them understand how problems are solved in an actual working environment. The Computer Science (CS) department

provided hosting server space for the class, thus the students' applications were live on the internet at all times. This enabled test runs of the applications at any time which provided just-in-time feedback.

5. *Coordinating between clients and students* – Ideally, after the initial meeting when students and clients are introduced, the instructor should not have to serve as a go-between. However, there were multiple times when intervention was required, e.g. when a client did not reply to students emails after several days or vice versa. In general, students could come to the instructor for any questions they had when working with their client. This gave them a sense of comfort knowing that their instructor was there to help them with any issues they might encounter so they would not be intimidated by working on a real project without any real working experience.

6. *Handling Complications* - Some additional features can be implemented if the students are willing to do some self-studying. When this happened, student learning resources were pointed out such as lynda.com⁵, websites, tutorials, books etc. Students were also offered tutoring outside of the classroom. Some students were very excited and proud to present the work that they produced after walking the extra mile.

7. *Collecting Feedback* - Constant and prompt feedback is important in the student learning process. Several survey forms were developed to get feedback from multiple dimensions, including students to their peers, students to the instructor, students to the client, client to the students, client to the instructor. Some feedback was to be collected and dispersed immediately, and some were to be summarized at the end of semester for future improvements.

2.3 Technologies Used

Due to the nature of the real-world projects and team-based learning environment, students used various technologies such as IU Box⁵ for file sharing, video conferencing tools such as Skype for group meetings, project management software, videos on lynda.com⁶, and GitHub⁷ for source code management, etc. Numerous advanced technologies that are not part of the teaching objectives of the course were suggested by the clients and used by the students as well, such as mobile friendly platforms, data searching and sorting technologies, etc.

2.4 Pedagogies Adopted

Two typical pedagogies adopted in this class are project-based learning and peer-lead learning methods. Project-based learning enables the students to immediately apply the concepts learned in the classroom, and what's more, the learning process does not stop in the classroom. To finish a task, students often do research on their own using the library, internet resources, or any other means to find possible or best solutions. This not only increased their knowledge but also their critical thinking and problem solving abilities. Students also learned from their peers using collaborative group techniques, also known as conceptual learning.

Conceptual learning is the primary goal behind the use of collaborative group techniques. Research in the field of education shows that collaborative group work can facilitate learning. The instructor plays a key role in this process, by preparing students for quality interactions, structuring tasks to involve all group members, forming groups to maximize high-level discourse among group members, prompting groups to engage in quality interactions during group work, and structuring debriefing sessions to link group work to learning objectives. Importantly, each of the aforementioned variables affects learning to the extent that it promotes or hinders high-level verbal interaction during group work as well as during the subsequent debriefing with the instructor⁸.

Since each project was different, students learned a wide variety of techniques from others. It happened often that when a student or group implemented a neat feature, other students showed great interest in learning how this was done and asked for resources to learn about it. In a team setting, students helped each other and advanced together. If the team leader was technically strong, the leader would play a great role in help other members. Each project would require skills in three areas (web, database and programming); a student strong in one area would help other students to improve in this area. It is the goal of the class that students will be well versed in all three areas at the end of the semester, even if they were not at the

beginning. Many concepts obtained by the students in these courses were a result of “Active learning”, a well-documented method of preparing students to become lifelong learners.

Active learning in the college classroom has long been promoted as more effective than traditional lecture. Many studies measuring the impact of active learning determine that active learning strategies lead to better student attitudes, thinking abilities, and writing skills. Increased adoption of these instructional practices is recommended in several prominent national reports [NRC2011, 2012; PCAST 2012]. The National Science Foundation recently announced a program to encourage institutions to expand the use of evidence-based instructional practices with an emphasis on active learning [NSF 2013]. Practices are demonstrated effective through empirical studies. A variety of measures are used to demonstrate effectiveness including: student performance, successful completion of a course, retention in the major, and self-efficacy within the discipline⁹.

2.5 Principal Strengths

1) The opportunity for students to dive into a real software development environment that can help them develop skills in team working, project management, time management, presentations and business communications. These skills are vital in the real world but missing in a lecture-based classroom setting. Possessing these skills greatly helps them get their feet in the door of industry and benefits them in their future career advancement.

2) The pressure of the clients’ expectations of putting the projects into production, which transpired into students’ high motivation. Lots of students wanted to create something that could be put into their professional portfolio and something that they could talk about with pride. Generally speaking, the students did not have to be pushed to come up with their best work.

3) Impact to the community is one of the criteria in selecting projects for the class. Many of the projects completed will have a substantial positive impact to the community and in the long run, the impact could be invaluable and monumental. Some examples include:

- A healthy food guide (www.indylocalfood.org) that enables the general public to search for farmers markets, organic farms or other local food markets.
- An application for Drug Free Marion County (www.druggreemc.org) to allow general public and the administrators from the organization to search for license violations from local restaurants.
- An application for the Peers Project (www.peerproject.org) increases the productivity of the organization in tracking the teens involved in their education programs, which so far have reached 1 million students in Indiana.
- An application for the Health Industry Forum (www.ihif.org) to archive and access organizations or companies in the health industry and allow the members of the forum to search member information.

Some graphical examples of student projects are shown in figure 1.



Figure 1. Examples of student projects

4) Visibility of the CS department. The direct connection between the CS department and the outside organizations help spread the word to the community. At the end of each semester, a final presentation and reception session was held in the department. All current clients, colleagues, future clients, and industry partners were invited. This gave the students a chance to show case their projects. Students’ good work speaks for itself and requests keep coming in for future projects. This class has become a window that advertises the CS department as well as IUPUI.

2.6 Challenges Encountered

The biggest challenge lies in the unforeseeable circumstances that require immediate intervention and plan adjustment from the instructor. E.g. one student was not able to keep up with the pace of the team, so the student was pulled out of the team and given individual assignments to compensate for the course requirements; one student dropped the class due to health issues, so the other students on the team had to take on the additional work.

One surprise finding was that in some groups, the students were more motivated than the clients. There were times the clients were slow in responding to students, or the client couldn't come to the student presentations to check out their progress.

Another challenge encountered was that a project didn't seem to be difficult at the beginning, yet turned out to have a high level of complexity after the client devoted more thought to it and requested additional features later. How to achieve more for the client without causing too much stress to the students involves understanding and collaboration on both ends. An encouraging finding is that the clients were usually understanding and accommodating and the students were willing to do their best to accomplish as much as possible.

2.7 Student Learning Effectiveness

The learning effectiveness was greatly enhanced when the students saw the linkages between the concepts learned in the classroom and the application of them into a real project. As each project had its own requirements, students had to digest their clients' requests and determine what technique to use and how to use it. Sometimes students had to dig deeper into a topic that couldn't be expanded in the classroom due to time limit. This timely application of the concepts learned highly stimulated their interest of learning. Knowing that their project would be used for production upon successful delivery, students were motivated to achieve the highest standard.

A complete software development cycle is achieved during the semester, from the project design, project implementation until project delivery. Throughout the semester, students need to collect requirements, design an implementation plan, and consider possible risks and obstacles, handle unforeseeable situations, manage collaborations among team members, and finally work with clients' technical personnel to deliver their projects. In the past students mainly focused on the implementation stage in an imaginary project scenario. Now they had to go through the entire cycle thus the project management skills were naturally developed in this class.

Starting from the first meeting with the clients, students had to communicate with their clients through face-to-face meetings, email communications, sometimes conference calls or text messaging services. They were expected to deliver messages via a professional manner and they were evaluated by the clients on the timeliness, respectfulness and professionalism. Sometimes they had to discuss with their clients when or if they could finish a particular task because their client may want a feature that could not be achieved in this class due to time limitations or topics covered. Several students mentioned that they had never had to talk with a real client before and this class helped them realize the importance of business communications.

When students implement an imaginary project, they were their own client. There was no listening, digesting, and interpretation skills involved. Lack of real world experience prevented them from knowing the expectations of real users or how to best deliver information to the users. Clients know what they want, and some of the projects in the semester were the improved version of their existing database, thus they knew the weakness of the existing database and had a lot of specific requirements for the new project. Before the project design stage, students need to completely understand the project requirements, study the feasibility of each and determine on a reasonable scope of their project. The instructor's intervention is very important at this stage as not all the students could see the underlining difficulty behind a seemingly simple feature.

Four or five presentations were scheduled throughout each semester. Students were expected to treat each one as a professional endeavor. Presentation skills such as material preparation, concept delivery, voice level, body language, eye contact, timing etc. was part of the grading criteria.

At the end of the semester, each student group should deliver a project that not only works, but also meets the industry standards and achieves the highest possible professional level. Major concerns such as security

issues, efficiency, usability and mobile friendliness were all stressed in the class and tested by the users and by other students. Any problems found in the testing phase must be fixed before delivery.

Before the project, the learning outcome of the course was mainly on the knowledge and skills used to develop an advanced web/database application. This project tremendously helped students develop skills in the application of knowledge learned, critical thinking and research abilities, as well as team working spirit.

2.8 Evaluation

Assessment of course objectives was measured by several different means. Student surveys, client satisfaction surveys and course evaluations were administered throughout and at the end of each semester both before and after the project-based methodology were adopted.

From the student surveys, responses included:

“This class is one of my favorites. I had great fun working with teammates and testing others projects”.

“Great class. I knew nothing about php and database before taking the class, but I became quite advanced at the end. It was not an easy A but I learned a lot”.

“This class is a blast. I had so much fun making a web database for a real client. It is a lot of work, but the more time I put into it, the more I learned. Highly recommend this class to other students”.

From the client satisfaction surveys, feedback included:

"This has been a great experience and I'm pleased with the results. I have one more project in mind and hope to get a definition to you before the start of next semester”.

“I am eagerly awaiting production use of the web application. I am impressed with the finished app and the team’s work on it. I hope to participate in the service learning program in the future”.

“I really appreciated their attentiveness and effort, and was impressed by their drive to make sure they included all of our “needs” and as many of our “wants” as possible. Overall, very impressed! We are excited to begin using our new database”.

Cumulative client satisfaction surveys from both courses show an average satisfaction level 4.915 (out of 5).

Another indicator of the effectiveness of transitioning these courses from a lecture based format to a student-driven, client-centered project based format is summarized in figure 2. Final grades from both courses (CSCI-N342 & CSCI-N431) are given as evidence to show an overall improvement in student learning. Note: The grading rubrics remained the same both before and after the project-based method was implemented.

	Lecture-Based Course Structure			Project-Based		
	Spring 2011	Spring 2012	Fall 2012	Spring 2013	Fall 2013	Spring 2014
CSCI-N342		86.88	86.1	87.84	90.34	93.12
CSCI-N431	79.96	86.88		91.58		92.1

Figure 2. Final course grades before and after PBL implemented

3. CONCLUSION

These revised courses proved to be extremely successful and effective in instilling real-world, professional attributes into the students who were enrolled in these classes. By giving the students the opportunity to bridge the gap between the traditional learning environment and the professional setting, they clearly attained skill sets to not only bolster their confidence in their field of study, but to prepare them for industry

placement. One limitation to this pedagogy of teaching is the issue of sustainability. If another instructor is charged with teaching these same courses, they might not possess the motivation and drive (and extra effort) necessary to attain the same results. The applications of this type of teaching methodology are endless. From technical skills to advanced, critical thinking occupations, nothing can replace “swinging the bat”.

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A STUDY OF FACILITATING COGNITIVE PROCESSES WITH AUTHENTIC SUPPORT

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ABSTRACT

This study designed learning activity to enhance students' cognitive processes. Students could learn in class and then apply and analyze new knowledge to solve daily life problems by taking pictures of learning objects in familiar authentic context, describing them, and sharing their homework with peers. This study carried out an experiment and it aimed to assess the effectiveness of learning activities supported by a mobile learning system on students' cognitive processes. Furthermore, this study explored what learning strategies experimental students use during learning and how frequently. This paper discusses results, research findings, and implications along with conclusions and several suggestions for future development and research.

KEYWORDS

Cognitive process; Mobile learning; Learning strategy.

1. INTRODUCTION

Cognitive processes are the mental processes by which knowledge is acquired and understood through thought, experience, and the senses. Cognitive processes can be simple or complex. The Taxonomy for Learning, Teaching, and Assessing (Anderson & Krathwohl, 2001) was proposed to monitor, assess, and understand complex cognitive processes. This taxonomy includes six levels which increase in complexity as the learner moves up through the levels, from simple cognitive processes to complex cognitive processes: (1) Remember - Retrieve relevant knowledge from long-term memory; (2) Understand - Construct meaning from instructional messages, including oral, written, and graphic communication; (3) Apply - Carry out or use a procedure in a given situation; (4) Analyze - Break material into its constituent parts and determine how the parts relate to one another and to an overall structure or purpose; (5) Evaluate - Make judgments based on criteria and standards; and (6) Create - Put elements together to form a novel, coherent whole or to make an original product.

One important issue to consider in the learning process is to engage students not only in simple cognitive processes but also in more complex cognitive processes (Hwang & Shadiev, 2014). However, in the traditional context (i.e. paper and pencil), learning takes place but new knowledge is not applied and analyzed (Hwang & Shadiev, 2014; Hwang et al., 2014). To change this, (1) the instruction should focus not only on learning the basic knowledge and concepts or preparing for the exams, but also on their practical application, and analysis of knowledge; (2) students need to learn both at school and outside by applying and analyzing new knowledge in a wide range of daily life situations; (3) knowledge application and analysis should be linked to outside of school situational and authentic environments (Scardamalia & Bereiter, 1994).

One major drawback of previous research is that not much attention was paid in related studies on cognitive processes during learning. Particularly, little is known about how to promote students' cognitive processes from simple to complex. This study attempted to address this limitation. First, this study designed storytelling learning activity with the focus on both, knowledge acquisition and its practical application and analysis. In this study, students learned in class first and then they applied and analyzed new knowledge in a wide range of daily life situations in authentic learning environment with familiar context. Second, a mobile learning system was developed that enabled students to participate in learning activity.

Students could learn and apply new knowledge by taking pictures of learning objects, describing them, and sharing their homework with peers. This study aimed to test the effectiveness of learning activity supported by the system to enhance students' high level cognitive processes. What learning strategies students use during learning and how frequently were also investigated.

2. LITERATURE REVIEW

Practice involves repeatedly and regularly using skills in order to improve and to master them (Guha et al., 2007). Storytelling is an instructional approach that has a potential to facilitate language practice (Nilson, 2010). Storytelling was defined as a highly-effective instructional method that has students surrounded with the target language and enables them to communicate intentionally by using narrative sentences (Guha et al., 2007). According to Nilson (2010), storytelling promotes verbal skills and supports literacy development (Harmer, 2007); students interact, associate with each other, negotiate meanings, learn from each other, and share experiences through storytelling.

Cognitive processes can be greatly promoted if language learning takes place in an authentic environment with familiar context (Hwang & Chen, 2013; Shadiev, Hwang, & Huang, in press). Such environment features the following critical characteristics. First, it provides authentic contexts that reflect the way the knowledge will be used in real life. Second, it provides authentic activities that have real-world relevance, and which present complex tasks to be completed over a sustained period of time. Third, it creates an opportunity for the sharing learning experiences and accessing to learners in various levels of expertise. Finally, it promotes reflection and offers authentic assessment of learning within the tasks (Nilson, 2010). In such environment, students are more inclined to learn and they apply new knowledge to solve daily life problems (Hwang et al., 2011) as they can expose themselves to the familiar context that surrounds them more frequently.

Mobile technology provides rich resources for students to learn and creates an authentic learning environment with familiar context (Kim & Kim, 2012). For example, mobile assisted learning offers seamless learning experience, i.e. anytime and anywhere (Hwang & Chen, 2013). According to Huang et al. (2011), mobile technology aids both, formal learning in the classrooms and informal learning outside classes. This increases access to learning activities and engagement in learning tasks in and outside classroom. With mobile multimedia tools, students can create learning material in authentic environment. The utilization of multimedia aids, such as pictures and audio, for learning tasks makes learning more interactive, information richer, and more engaging (Huang et al., 2011). Furthermore, multimedia objects in learning stimulate students' imagination and helps in giving meaningful output. Students in the study of Hwang et al. (2012) took pictures of learning objects in authentic contexts and then described them by using vocabulary and grammar learned in class. In the study of Hwang et al. (in press), students practiced the target language by speaking out learning material from the textbook, taking pictures of learning objects from daily life, and orally introducing them. Besides, all speeches were recorded by students. Hwang and Chen (2013) argued that, with multimedia aids students could practice the target language repeatedly and regularly and access diverse learning objects which increased the richness of their language experience. Harmer (2007) suggested that if students record their speech, they (and teacher) can listen to recordings, evaluate language performance, and see how much progress they have been making. Hwang et al. (2011) claimed that sharing homework with peers allows further reflection, discussion and collaboration. Besides, sharing homework increases practice opportunities and helps students engage in EFL contexts. For example, students can listen to others' audios with diversity of speeches (i.e. accent, fluency, and level of learning performance) after sharing. Students in study of Hwang et al. (in press) listened to files recorded by peers and pre-recorded by the teacher pronunciation of learning material. Through sharing, students also exchanged meaningful comments (Hwang et al., in press). For example, students gave reflective comments and suggestions to a peer who did not complete homework correctly (Hwang et al., 2011). Students' comments were useful to revise or to improve homework.

3. METHODS

A total of 58 junior high school students (between 13 and 14 years of age) participated in this study. One class with 30 students served as the control group, and the other class with 28 students served as the experimental group. Most students in both groups were thirteen years old with four to six years' experience of using computers. Besides, most students had less than one to three years' experience to use tablet PCs.

A pre-test was conducted in the first class. Two groups had the same amount of hours of a course: one-hour lessons for three times a week, on a weekly basis for two and half months. After lessons, students participated in learning activity. Lessons and learning activity taught in the two classes were guided by the same instructor and shared the same learning content. However, the control group completed a learning activity with traditional textbooks while the experimental group with a learning system installed in the tablet PCs. Learning activities included three tasks; each of them was complete within two weeks. In the first class, every experimental student received tablet PC and students were explained how to use it and the system by the instructor. Experimental students were provided with an immediate assistance in troubleshooting technical problems during the experiment to reduce negative effect caused by technical problems. A post-test with all students and interviews with experimental students were carried out in the last class.

This study designed learning activity based on storytelling instructional method; students were asked to tell stories through introducing, describing and explaining learning objects found in an authentic environment with familiar context. Learning activity included three tasks:

1. *My meal and food critic.* In this task, every student was asked to take a photo of his /her three meals (i.e. breakfast, lunch, and dinner) during the last Saturday and Sunday. Students then were asked to introduce their meal. Finally, each student was asked to become a food critic and to express what he/she thinks of a partner's meal.

2. *Make my own salad!* Every student was asked to help their parent to do a food shopping, take a photo of and introduce what they bought. Students then made a salad from ingredients they bought, took a photo of a salad and introduced their recipe. Finally, each student was asked to write/tell how his/her salad is different from his/her partner's.

3. *Do you often clean your room?* In this task, students took a photo of their room before and after cleaning it up. Students then described what the difference in a room is before and after cleaning it up. Finally, students were asked to take a look at photos of their partners and make written and oral comparison with their own.

This study developed the learning system to support students to carry out the learning activity tasks. With the system, students could annotate important parts of learning material on tablet PCs. For example, students could write description of a learning object by creating a textual annotation. Besides, students could take photos of learning objects in familiar authentic environment and attach them to an annotation. When students spoke out descriptions of a learning object, they could record their own voice and play it afterwards. In this way the system enabled students to find their mistakes and improve content of audio recorded files. Besides, students could record the instructor's lectures and play some parts to recall important concepts. A Dictionary was also provided by the system. Students could find a list of new words with their meaning and translation. Finally, students could share their own annotations, photos, and audio recorded files with peers. This allowed students to study peers' annotations, to enhance their understanding of learning material, and to improve their own annotations.

Students' prior level of cognition was evaluated by a pre-test and students' post-experimental level of cognition was measured by a post-test. The content of the tests related to learning material covered during the experiment. Thirty items were included in each test. The items for both tests were similar in structure but different in content. This study adopted Anderson and Krathwohl's (2001) taxonomy to measure students' cognitive level. This study particularly focused on the first four levels, i.e. "Remember," "Understand," "Apply," and "Analyze." "Remember" level was measured by the first fourteen items of the tests. "Understand" level was measured by the next fifteen items, and "Apply" and "Analyze" levels were measured by the last item. A correct answer to an item from 1 to 29 in Table 1 was scored as "1," while incorrect one as "0." The item 30 is an open ended question; therefore, the content of students' answer to it was coded by using a sentence as a coding unit and scored on a 29-point scale (with 29 as the highest score). A score of "1" represented the lowest level of cognitive development, and a score of "29" represented the highest level.

Based on students' pre-test scores, this study formed two groups: low ability group (last eleven participants of the rank) and high ability group (first eleven participants of the rank).

This study developed a questionnaire (Huang et al., in press) to explore what learning strategies students used during learning and how frequently. Learning strategies are procedures that a student uses to succeed in a task that would be difficult without special effort (Shadie, Hwang, Huang, & Liu, in press). Strategies are associated with internal mental procedures (e.g., note-taking) and used by learners to aid the acquisition, storage, and retrieval of information (Oxford, 1990).

One-on-one semi-structured interviews (Huang et al., in press) were conducted with randomly selected ten experimental students (five students from low ability group and five students from high ability group). Interviews aimed to explore students' learning experiences and insights of their perceptions toward the system usefulness for learning. Each interview lasted for 20 minutes.

4. RESULTS AND DISCUSSION

First, the difference in the level of cognitive development between the control and experimental students on the post-test with the pre-test as covariate was investigated by employing analysis of covariance. The means and standard deviations of students' pretest and post-test scores are shown in Table 1. The experimental group outperformed the control group only on the post-test items related to "Remember 2", $F(1, 55)= 7.075$, $p=0.010$, partial eta-squared=0.114, "Understand 2," $F(1, 55)= 8.876$, $p=0.004$, partial eta-squared=0.139, and "Analyze," $F(1, 55)= 11.173$, $p=0.001$, partial eta-squared=0.169.

Table 1. Results of the pre-test and post-test and analysis of covariance.

Cognitive level	Groups	The pre-test		The post-test		F	Sig.	Partial eta squared
		M	SD	M	SD			
Remember 1	Control	7.67	0.88	7.67	1.29	1.504	.225	.027
	Experimental	7.04	1.60	7.93	0.38			
Remember 2	Control	4.83	1.60	5.10	1.49	7.075	.010	.114
	Experimental	4.29	1.67	5.68	0.55			
Understand 1	Control	6.97	2.02	7.93	2.20	1.588	.213	.028
	Experimental	6.32	2.07	8.32	1.60			
Understand 2	Control	4.96	3.00	5.83	2.26	8.876	.004	.139
	Experimental	4.61	3.41	6.93	2.37			
Analyze	Control	5.87	8.76	9.67	10.56	11.173	.001	.169
	Experimental	6.00	8.29	15.50	8.46			

Test items related to "Remember" and "Understand" levels were organized with two difficulty levels. In "Remember 1" items, students were asked to match English word with the correct Chinese meaning while in "Remember 2" items, students wrote down the Chinese meaning of English word. Similarly, in "Understand 1" items, students filled in the blank, while in "Understand 2" items, they wrote down a question based on a sentence, a negative sentence from given one, or translation of a sentence. Students in both groups obtained high scores in "Remember 1" and "Understand 1" because the items were very easy to complete and students already had some prior knowledge. However, as difficulty level of the items increased, control students' performance decreased compared to experimental students. This finding suggests that learning activities supported by the system significantly promoted the experimental students cognitive processes. The experimental students could learn and better remember and understand new vocabularies, sentence structure, and how to change it into question and negative form.

In the item of "Analyze," students were asked to write about themselves when they were at the first grade of the elementary school and at present time. Then students compared the difference. The experimental students completed this task significantly better compared to the control students. This finding may suggest that learning activities supported by the system could significantly facilitate students not only to learn and understand knowledge but also to apply and analyze it to solve daily life problems.

Some reasons to support these findings were revealed from interviews with experimental students. Students mentioned that learning activities could be completed more efficiently and students had more opportunities for practice if using the system, compared to traditional approach.

First, students took pictures of learning objects and recorded their own voice when describing learning objects. Students admitted that in a way they learn with tablet PCs, they could communicate in the target language with less anxiety of making mistakes (Hwang & Chen, 2013). Students also preferred to review pictures and to listen to their own recorded files. If content quality of photos and recorded files was not satisfactory (e.g. mistakes in pronouncing some words, the use of incorrect grammar or not fluent speech), students would want to improve it. According to students, such learning behavior led to more frequent language practice as well as to better quality of language output. Similar reasons to use multimedia tools for language practice were reported elsewhere. For example, students in the study of Hwang et al. (in press) and Hwang et al. (2011) took advantage of the technology in the same way to practice the target language repeatedly and regularly. In the study of Harmer (2007), after students recorded their speeches, they listened to recordings, evaluated language performance, and monitored how much progress made.

Second, students shared recorded files with peers. In this way, students could listen to peers' recorded files (i.e. usually to those who perform well) to get inspirational ideas to complete their own assignments, to study how peers accomplished assignments, and to improve their own homework. Students could exchange meaningful comments through sharing. That is, some students gave reflective comments and suggestions to a peer who did not complete homework correctly. Besides, students' comments were useful to revise or improve homework. Students highly thought of sharing mechanism of the system as they were able to learn from others, and then to locate and revise their own mistakes in homework. Hwang et al. (in press) and Hwang et al. (2011) argued that, with multimedia aids students access more diverse learning objects and this may increase the richness of their language experience. They further suggested that sharing multimedia learning content with others not only increases practice opportunities but engages students in EFL contexts and allows their deeper reflection on learning content, discussion and collaboration.

Third, students recorded lectures of the teacher. If students forgot some particular parts of a lecture or they needed to listen to the teacher's pronunciation of the learning material, they would play the recorded lecture on Tablet PC. This was particularly useful outside of classroom where students could not consult their teacher and ask questions (Hwang et al., in press).

Fourth, students reported that the system featured a dictionary which was very handy when they were outside of school or at home and needed to translate some unfamiliar vocabularies to complete assignments. In this case, a dictionary translated these words. Moreover, with a dictionary students could find multiple meaning of a word and how it can be used in different context. Hulstijn, Hollander, and Greidanus (1996) argued that the use of a dictionary positively affects vocabulary learning. Students look up target words in the dictionary during the reading session in order to find word meanings and to understand the main idea of texts. Those students who read texts using a dictionary can understand texts better and remember more word meanings.

These findings about benefits of the learning activities and multimedia support to learning are in line with other related studies (Harmer, 2007; Hwang et al., 2011; Hwang & Shadiev, in press). However, in contrast to other related research, this study designed the learning activity supported by the mobile learning system and it focused on enhancing students' cognitive processes, particularly application and analysis of new knowledge to solve daily life problems in authentic environment.

Next, this study investigated what learning strategies students use during learning and how frequently. Results showed that students employed thirty different learning strategies (Appendix). The most used cognitive strategies were: (1) take a photo of learning object (imagery), (2) write and (3) record speaking about learning object (summarizing), (4) use electronic dictionary (organization), and (5) improve and re-write about learning object (elaboration). That is, students took photos of learning objects (Strategy 1) and they wrote about learning objects (Strategy 2) and recorded audio (Strategy 3) description. Besides, students used electronic dictionary (Strategy 4). Finally, students improved and re-wrote their own writing about learning object (Strategy 6). Top metacognitive strategies in this study were: (1) prepare and rehears speaking about learning object (planning), (2) read my own and (3) partner's writing, (4) review partner's photo, and (5) listen to partner's recorded audio (monitoring). Students prepared and rehearsed their speaking about learning object (Strategy 9). That is, after completing homework, students read their own (Strategy 10) and partners' (Strategy 11) writing about learning objects, they listened to partners' recorded audio (Strategy 16), and reviewed partners' photos (Strategy 13). All these strategies were consistently and frequently used in three lessons. However, the number of strategies usage decreased in Lesson 3. It was the end of the semester when students studied Lesson 3; they were busy preparing for the final exams.

Therefore, the instructor asked students to complete only one part of the task (i.e. describe their own room only and do not compare it with partner's). As a result, students did less and the number of strategies they used also decreased. According to the result, this study suggests that abovementioned strategies are important for learning. Cognitive strategies helped students to complete their homework and metacognitive strategies assisted to make content of homework better. According to the result, no evaluation metacognitive strategies were used by students. In the interview, the instructor mentioned that some students knew some strategies but some did not. Therefore, this study suggests that the instructors need to teach students learning strategies, emphasize their importance, and encourage using strategies frequently.

Finally, this study explored the relationship between learning strategy usage and students' learning achievement by employing a Pearson product-moment correlation coefficient. No significant correlation was revealed between learning strategy usage and students' learning achievement, $r=0.155$, $p=0.480$. However, when considering strategy usage by students of different ability, significant correlation was found between strategy usage by low ability students and their post-test results, $r=0.758$, $p=0.007$. The difference in the post-test between low and high ability students with the pre-test as covariate was also investigated by employing analysis of covariance. According to the result, there was no significant difference between low ($M=37.09$, $SD=7.69$) and high ($M=43.09$, $SD=6.89$) ability students, $F(1,19)=0.549$, $p=0.468$, partial eta-squared= 0.028 . Therefore, this study carried out independent-samples test to compare the difference in learning gain between low and high ability students. According to the result, learning gain of low ability students ($M=19.64$, $SD=10.68$) was significantly higher than that of high ability students ($M=1.45$, $SD=10.33$), $t=4.059$, $p=0.001$. Based on these results, this study suggests that participants of low ability took better advantage of learning strategies while being engaged in learning. In the interviews, low ability students mentioned that they preferred to write and to speak out about learning objects (Strategies 3 and 4) first, and then to read peer's writing and to listen to peer's recorded files (Strategies 11 and 16). This helped them to improve and to re-write their own writing and to re-record their own audio files (Strategies 7 and 9). The results of Pearson correlation confirmed this finding; a significant correlation was found between strategies usage and post-test results for low ability students. Therefore, this study concludes that deeper engagement of low ability students in using learning strategies resulted into significant learning gain. This study also suggests that students should be taught to understand existing learning strategies and how to take better advantage of them.

5. CONCLUSION

Based on the results, this study proposes some recommendations for teaching and research community of the field. This study suggests to design and to implement appropriate learning activities supported by the mobile learning system in order to help students' application and analysis of new knowledge in a wide range of daily life situations. Particularly, this study would like to emphasize the importance of preparing, creating, and sharing, multimedia learning content as well as consulting learning content created by peers during learning activities to enhance high level cognitive processes. This study also suggests extending proposed novel approach and applying it to other domains. That is, apart from the domain of foreign language learning, similar learning activities can be applied to other domains, like natural science (e.g. Biology) or Mathematics to promote complex cognitive processes. Within extended approach, students may acquire conceptual knowledge in class and then apply and analyze it outside of school, in authentic learning environment with familiar context.

There are two limitations to the study that need to be considered. The first limitation concerns the relatively small sample size; for this reason, these findings cannot be generalized to the broader community based on this study alone. The second limitation relates to the technology; students complained that the size of tablet PC was too big to carry out and take pictures in authentic environment. These limitations will be addressed in a future study. Besides, the future study will attempt to facilitate other higher level of cognitive processes, i.e. "Evaluate" and "Create," by introducing some scaffolding mechanisms into learning activities.

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APPENDIX

#	Learning strategy	Lesson1	Lesson2	Lesson3
	Cognitive strategies			
	<i>Imagery</i>	<i>Imagery</i>	<i>Imagery</i>	<i>Imagery</i>
1.	Take a photo of my learning object	91(8)*	81 (3)*	64 (1)*
	<i>Summarizing</i>			
2.	Write about my/partner's learning object	126 (2)*	90 (2)*	21 (6)*
3.	Record my speaking about my/partner's learning object	96 (7)*	77 (6)*	18 (8)*
	<i>Organization</i>			
4.	Use electronic dictionary to complete my writing/speaking	107 (5)*	66 (9)*	17 (9)*
5.	Others: Use google to get additional information	40	30	11
	<i>Elaboration</i>			
6.	Improve and re-write my writing about (my/partner's) learning object	86 (10)*	65 (10)*	27 (3)*
7.	Improve and re-take photo of my learning object	34	36	12
8.	Improve and re-record the audio about (my/partner's) learning object	85	44	12
	Metacognitive strategies			
	<i>Planning</i>			
9.	Rehears speaking about my/partner's learning object	88 (9)*	69 (7)*	15 (10)*
	<i>Monitoring</i>			
10.	Read my introduction/critique to my/partner's learning object	86 (10)*	69 (8)*	32 (2)*
11.	Read partner's introduction/critique to his/her/my learning object	146 (1)*	106 (1)*	25 (4)*
12.	Read others' introduction/critique to their/others learning object	98 (6)*	60	8
13.	Review photo of partner's learning object	112 (3)*	80 (5)*	20 (7)*
14.	Review photo of others' learning object	47	26	9
15.	Listen to the audio recorded by me	80	42	6
16.	Listen to the audio recorded by my partner	108 (4)*	81 (4)*	22 (5)*
17.	Listen to the audio recorded by others	84	40	4
	<i>Evaluation</i>			
18.	Compare my writing with my partner's	61	39	3
19.	Compare my writing with others'	71	30	4
20.	Compare my photo with partner's	35	20	10
21.	Compare my photo with others'	28	14	10
22.	Compare my audio with partner's	40	22	1
23.	Compare my audio with others'	43	26	0
24.	Use electronic dictionary for reading/listening and comparing partner's/others' learning object	62	25	2
25.	Find mistakes in my writing about (my/partner's) learning object	78	64	12
26.	Find new ideas from writing of my partner	40	34	8
27.	Find new ideas from writing of others	30	31	10
28.	Find mistakes in the audio recorded by me	51	55	7
29.	Find new ideas from the audio recorded by my partner	40	22	4
30.	Find new ideas from the audio recorded by others	41	21	3

*Top ten frequently used strategies (the number in the rank).

MOBILE-ASSISTED SECOND LANGUAGE LEARNING: DEVELOPING A LEARNER-CENTERED FRAMEWORK

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ABSTRACT

The Mobile Assisted Language Learning concept has offered infinite language learning opportunities since its inception 20 years ago. Second Language Acquisition however embraces a considerably different body of knowledge from first language learning. While technological advances have optimized the psycholinguistic environment for language learning, this study narrows the discussion into developing a conceptual framework for Mobile Assisted Second Language Learning (MASLL). It is a logical and analytical concept developed from empirical theories and principles for Second Language mobile learning environments. Second Language Acquisition Theories, Model of Working Memory and Dual Coding Theory are the underlying learning theories for second language acquisition; Cognitive Theory of Multimedia Learning and FRAME Model on the other hand guide the design principles for mobile learning environments. Interest in MASLL derived from the preliminary investigation which highlighted low performance in oral communicative skills among learners of Chinese as a foreign language due to the lack of interactive environments. As such, a mobile chat room which follows this framework is briefly discussed to better inform the concept of MASLL.

KEYWORDS

Oral Communicative Skills, Second Language Acquisition, Mobile Learning, Mobile-Assisted Language Learning.

1. INTRODUCTION

The idea of mobile assisted language learning has permeated through the people for its mobility in accessing information and knowledge across time and space. Having known the numerous technological language learning options available, researchers (Beatty, 2003; Copaet, 2004; Doughty & Long, 2003) emphasized creating a learning environment which focuses on learners, concerning pedagogy that drives learning to happen before deciding the use of mobile technologies for instructional purpose.

To create an optimal psycholinguistic second language (L2) learning environment, Doughty and Long (2003) defined 10 methodological principles and pedagogical procedures to inform choices that can be made among the technological options available. This study however highlighted Mayer's Cognitive Theory of Multimedia Learning (2009) which focuses on learner-centered approaches to understand human information-processing system when designing multimedia instructional messages.

The fundamental issue being explored was the unsatisfactory learning outcomes in Second Language Acquisition (SLA), particularly the oral communicative skills for secondary school learners. Expanded from Doughty and Long (2003), Leow, Wan & Zarina (2014) suggested that oral communicative skills can be fostered by creating an acquisition system for subconscious learning, and to impose obligatory intakes in the second language learning environment.

The preliminary investigation from Leow, et al (2014) identified the learning dilemma encountered by learners of Chinese as a second language in Malaysian International Schools. Teachers claimed that environment is the core factor that result in poor performance in oral communicative skills. This is primarily due to learners not using the target language in their interactions; apart from the language complexity factors by nature. In short, the lack of a language-practice environment needs to be addressed, by undertaking the potentially powerful learning technology with multimedia representations, particularly learning with handheld mobile devices.

Just as the oral communicative skills are important assessment components in assessing a person's language proficiency in professional English tests such as Test of English as Foreign Language Internet-Based Test (TOEFLiBT) (Frost et al. 2011) as well as in the TOEFL and TESOL, the same can be said for speaking tests in the Cambridge Chinese as a Foreign Language examination, which sees the importance of overall utterance performance in role plays, presentations and general conversation components. These stress the need to equip second language learners with fluent oral communicative skills.

In accordance with the findings, a mobile chat room environment which integrates mobile technology to synchronously and asynchronously transfer the "speech" in their daily interactions using the target language, is believed to be able to foster oral communicative skills for second language learning. It is believed that Mobile Chat Room can provide an alternative platform for extended learning after formal lessons in school; and to promote independent language learning without time and space constraints. In other words, taken the advantages mobile phones can offer, second language acquisition is much easier if a language environment can be created that can help students perform in the examination and through the real life task-based learning, as well as to reduce teachers' workload and worrying.

Mobile Assisted Second Language Learning (MASLL) acts as the underlying premise when designing the multimedia instructional messages to promise meaningful second language learning with mobile phone devices. To initiate this, an experimental research will be conducted to generate the validity and reliability of this framework. Six research questions were generated to assist the findings with moderating variables for individual differences limited to learners' reactive behavioural patterns.

Further studies are called to investigate the effectiveness of MASLL in other second language learnings, especially for school-based blended learning as well as for distance learning.

2. LITERATURE REVIEW

Learning a second language / foreign language can secure a better future in life, as indicated by The European Survey on Language Competence, ESLC (2012). Hence more than 80 % of students expressed the view that the purpose of learning a foreign language is for future work and getting a good job. In this study, second language and foreign language are treated as the same. Because the aim of this study, is to create a meaningful mobile learning environment for second language learners whose mother tongue is not the target language, therefore to differentiate between them becomes meaningless.

Krashen (2002) explained humans acquire a second language through the natural communication approach. In his "acquisition-learning" hypothesis, he highlighted the terms "acquire" and "natural" which refer to oral communication. This study therefore focuses on oral communicative skills. As Yang (2009) explained, oral communication is the most direct and frequent type of verbal communication in social activities; and it is vital for learning as learners are actively clarifying their thinking and reflecting on their learning (Focus on Literacy: Talking and Listening, 2003).

Therefore when referring to oral communicative skills acquisition, as concluded by Krashen (2002), the first language (L1) may "substitute" for the acquired second language (L2) as an utterance initiator when the performer has to produce in the target language but has not acquired enough of the L2 to do this. This explains the impact of L1 on L2 is significant, particularly for L2 beginners. Hence when teachers or instructional designers are designing a mobile assisted second language learning, a discussion of the role of L1 is crucial.

The advantages of Mobile-Assisted Language Learning (MALL) are tremendous (Chinnery, 2006; Gromik, 2012; Sarica & Cavus, 2009; Schier, Mulvany, & Shaw, 2010; Sharples et al. 2007) yet no efforts towards research have been done in Malaysia, neither on Chinese as Second Language learning, nor on secondary schools' population. From the meta-analysis, there are only studies on mobile learning (m-learning) readiness amongst higher education institutions' learners (Jacob & Issac, 2008; Supyan, Mohd Radzi, Zaini, & Pramela, 2012; Abas, Chng, & Norziati, 2009).

The interest of establishing a Mobile Assisted Second Language Learning (MASLL) in this study is derived from the effort to promote human cognition with the aids of technology, instead of focusing on the power that technology can offer to education. Cuban (2001) revealed that a technology-centered approach fails to lead to lasting improvement in education, therefore we shall learn from these disappointing results in the realm of multimedia technology, by taking the learners-centered approach (Mayer, 2009).

To understand how we can adapt multimedia to enhance human learning, we shall not neglect the readiness and acceptance for using mobile technology in learning. As indicated by Ainol (2009); Jacob & Issac (2008); Supyan, et al. (2012); Abas, et. al., (2009), Malaysian college and university learners show a high acceptance and readiness rate in mobile learning. Statistics from Malaysian Handphone Users (2012) indicate that school learners in the 15-19 age group form the second highest number of mobile phone users in Malaysia, recorded at 11.4% in the year 2012. These reflect the possibility of implementing mobile learning amongst secondary learners in Malaysia. Again however, the focus is on helping learners to enhance L2 learning through the aid of mobile technology.

From the above analysis, an understanding of the underpinning learning theories and principles of MASLL conceptual framework are crucial in order to provide a strong and solid fundamental ground in developing a second language learning environment using mobile phone devices. An experiment using a mobile chat room, in this study, will be used to validate the framework establishment.

3. LEARNING THEORIES

Learning to speak a second language (L2) has often become a challenge, although studies realized that learning a L2 can benefit academic progress in other subjects (Regarding Word Language Education, 2007). To date, studies have predominantly focused on writing assessment (Cumming et al., 2006, Ohkubo, 2009; Plakans, 2009, (Fros Elder, & Wigglesworth, 2011) and reading assessment (Yu, 2009). As pointed out by McCandlish (2012), oral communicative skills have an important social function; in the context of education, it is also well documented that oral language has an important role in the development of literacy skills (Scarborough, 1998). This study, has therefore developed a Mobile Assisted Second Language Learning (MASLL) conceptual framework to assist L2 teachers and learners in identifying the fundamental cognitive process in learning L2 through the aid of multimedia in mobile phones, or more precisely smart phones with internet access.

The theories and principles that explain the limitations in learning capacity and the human information processing system such as Model of Working Memory, Dual Coding theory, and Second Language Acquisition theory give implications when designing a framework for L2 learning; Cognitive Theory of Multimedia Learning explains how the human brain processes information in the multimedia learning environment; FRAME model of mobile learning added the social aspect into discussion. From single review to collective analyses of theories and principles, this MASLL conceptual framework is needed for creating an environment to facilitate L2 learning. This research refers to Chinese as a Second Language (CSL), with oral communicative skills as the research objective to be achieved.

3.1 Second Language Acquisition Learning Theory

The Acquisition – Learning Hypothesis (Krashen 2002) is also known as the natural approach which clearly defines two distinct concepts; both acquisition and learning need to be understood when learning a L2. To acquire a L2 does not need tedious drills but rather involves real meaningful interactions between people in the target language and culture, where the learner is an active player.

Conscious learning such as learning language grammar and structured formal instructions can hardly equip the L2 learners to master the language knowledge in the conversation (Krashen, 1988). Therefore, learning acts as a monitor for corrective process.

The significant impact of L1 on L2 is undeniable hence it becomes a premise underlying in developing conceptual framework of MASLL.

3.2 Working Memory

Baddeley's Model of Working Memory (1986) illustrates the importance of rehearsing verbal information; this is supported by Gathercole and Baddeley (1993) who explain the information that we hear in phonological form fades away in seconds, therefore the subvocal rehearsal process – by repeating the sound of the words and phrases silently or out loud, can help to retain the verbal information in the phonological loop.

Hence equipping L2 learners with oral communicative skills, which involve cognitive fluency, utterance fluency and perceived fluency, is a complicated process because it requires the learners to be able to speak the

language in a manner where listeners can understand. This process therefore needs higher working memory capacity in order to free up capacity for other information (Yoshimura & Macwhinney, 2007).

As in this study, the development of automaticity in using the L2 is important in enhancing oral communicative skills (Gathercole & Baddeley, 1993; Just & Carpenter, 1992). Technology in mobile learning environments allows development of oral communicative skills with its recording and playback functions for rehearsing, retaining and the transferring of verbal information in the voice-messaging technology. In other words to enhance L2 acquisition, technology embedded in mobile phones can assist in promoting human cognition, at a faster pace and more efficient order.

3.3 Paivio’s Dual Coding Theory (DCT)

Paivio’s Dual Coding Theory maps to the Baddeley & Hitch’s Model of Working Memory for the information processing systems (auditory channel & verbal channel), but highlights the mental representations from the same stimulus, which is called “the cross-channels representations” (Mayer, 2009) as shown in Figure 1.

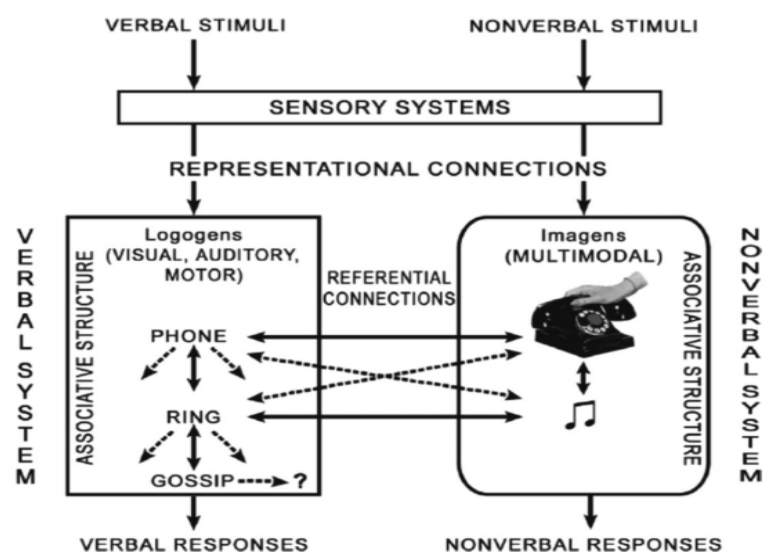


Figure 1. Paivio (2010) Dual Coding Theory and Mental Lexicon

The cross-channel representations which Mayer (2009) highlighted explain Paivio’s hypothesis on the formation of mental images (or specifically called the mental codes) that could aid in learning (Reed, 2010). Sternberg (2003) describes the importance of both verbal and visual codes in mental images for recalling purposes. This study therefore employs Paivio’s Dual Coding Theory in the “learning” strategy, but differs in terms of “acquisition” strategy, to acquire automaticity in oral communicative skills.

3.4 Cognitive Theory of Multimedia Learning

Mayer’s Cognitive Theory of Multimedia Learning (2009) provides a base to instructional design on how humans process information in a multimedia environment. The central concept of this theory taps into the human cognitive processing system which comprises of processes from selecting, to organizing, to integrating information using verbal and auditory channels, as well as the cognitive load principles in designing multimedia learning materials for effective learning, by eliminating the excessive *noise* due to limitation in working memory capacity.

Twelve principles of multimedia instructional design were identified to reduce the cognitive load which consists of extraneous, essential, and generative cognitive processing. Where the MASLL conceptual framework is concerned this theory is essential, yet it requires proper planning when dealing with cognitive load which is likely to happen when dealing with different learning goals and targets, or for particular target skills learning.

3.5 Mobile Learning (Koole's FRAME Model)

Koole's FRAME Model (Koole, 2009) in Figure 2, which is best suited to the purpose of language learning, converges three distinct perspectives: device (mobile technologies), learner (human learning capacities) and social (social interaction) aspects. As Koole mentioned, mobile learning can be implemented effectively in both formal and informal learning from the intersection of these aspects.

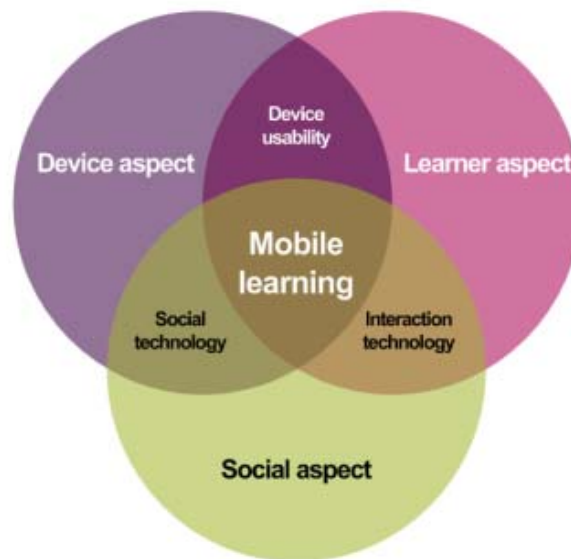


Figure 2. Koole's (2009) Framework for Rational Analysis of Mobile Education (FRAME)

The characteristics of mobile learning run in parallel with second language acquisition pedagogies, therefore the framework creates situated learning for "social and cultural practices" where people bring to the uses of tools (in this study, mobile phone) they share (Russell, 2002).

4. CONCEPTUAL FRAMEWORK

For the purpose of developing oral communicative skills in L2 learning, in particular, the analyses on literature reviews, theories and principles lead to the formulation of the Mobile-Assisted Second Language Learning (MASLL) conceptual framework in this study. The proposed MASLL framework, in Figure 3, believed to be able to improve the oral communicative skills in L2 learning, which will then be used in developing a mobile chat room environment for L2 learning, complements the comprehensive intake environment and communication strategies suggested in the following Table 1.

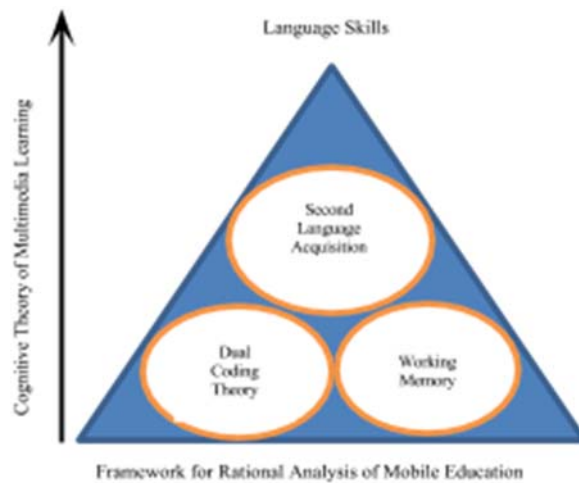


Figure 3. Conceptual Framework for Mobile-Assisted Second Language Learning (MASLL)

This MASLL framework is suggested for second language learning, after realizing the unresolved learning phenomena in classroom-based learning which were constrained by factors such as, among others, teaching and learning time, language learning environment, L1 effects, and target language complexity. This study follows Krashen's Second Language Acquisition theory, for understanding its fundamental acquisition principles in second language learning.

From the macro analysis, Baddeley's Model of Working Memory and Paivio's Dual Coding Theory explain that the human processing information system shall be the main domain for analysis when designing learning pedagogy. Taking this study in particular, we shall therefore investigate how humans process oral information when learning a L2, and to eliminate the overloaded information which could hamper the development of oral communicative skills acquisition, it will use the verbal channel and *pinyin* phonetic symbol for learning.

Adding to that, the micro analysis explains the integration of multimedia into mobile learning, which brought in Koole's FRAME mobile learning and Mayer's Cognitive Theory of Multimedia Learning into discussion. The process of selecting, organising and integrating in Cognitive Theory of Multimedia Learning distinguishes the reactions steps of learners when learning with multimedia as well as providing a stronger understanding of cognitive load theory and working memory model, whereby learners are autonomous in their own learning, but limited to their working memory capacity. Therefore researchers, educators and instructional designers are urged to investigate the fundamental learning theories and principles, for effective learning to take place.

MASLL is believed to be able to provide a more precise analysis into learning a second language, in a mobile learning environment. This MASLL framework will be used in this study to develop a mobile (cellphone) chat room for learning Chinese as a Second Language.

5. CHARACTERISTICS OF MOBILE CHAT ROOM FOR ORAL COMMUNICATIVE SKILLS ACQUISITION

As postulated by Krashen (2002), the major function of a L2 language classroom is to provide intake for acquisition in the learning environment. Apart from the mobile technology that be offered, the intake obligatory and fluency programs shall be designed for L2 acquisition. Grounded with the theories and conceptual framework, the following Table 1 explains the similar aspects and components which a mobile chat room (MCR) should offer when learning a FL.

Table 1. L2 acquisition in mobile chat room, adapted from Krashen (2002) acquisition system, Koole's (2009) FRAME Model, cited from Leow, et. al., (2014b)

	Acquisition: Intake (Obligatory)	Mobile Learning	Mobile-Chat-Room (MCR)
1	Meaningful / Communicative exercises	Social aspect & Interaction technology	Peers learning through informal chat group, extended learning after school (syllabus-based)
2	Extensive reading	Learner aspect	Attachment, hyperlink: Text, pictures
3	Natural method	Social aspect & Interaction technology	Oral and written communication, hand-held, accessible
4	Intercambio	Social aspect / learner aspect	Grouping with native speaker
5	Total Physical Response	Device usability	Video / Audio recording
Acquisition: Fluency			
1	Communication strategies	Device usability / social technology	Syllabus-based, multimedia (audio, videos, pictures)
2	Routines / patterns (short term)	Device usability / social technology	Synchronous & Asynchronous
3	Role-playing, games, etc.	Social technology & Interaction technology	Apps, games and etc.
4	Writing	Device aspect	Hand - writing / Typing

5. CONCLUSION

This paper analyses the development of mobile assisted language learning, particularly for second language acquisition, with oral communicative skills being one of the experiment components to further validate the usability of this Mobile Assisted Second Language Learning (MASLL) conceptual framework. Despite the fact that many studies have discussed the use of mobile learning in the MALL concepts, a conceptual framework in which to review the learning of a second language is yet to be found.

The development of MASLL conceptual framework is important and is in need of further investigation and validation in other second language learning research, as it is designed to address mobile learning pedagogies for second language acquisition.

In short, it is feasible that mobile phones could be useful learning tools for learning, provided the setting of the learning environment can be defined for its purpose; and can be confined into a cohesive MASLL environment which supports and motivates learning as a whole.

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SOCIAL INTERACTION DEVELOPMENT THROUGH IMMERSIVE VIRTUAL ENVIRONMENTS

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ABSTRACT

The purpose of this pilot study was to determine if participants could improve their social interaction skills by participating in a virtual immersive environment. The participants used a developing virtual reality head-mounted display to engage themselves in a fully-immersive environment. While in the environment, participants had an opportunity to explore and interact in a variety of scenarios that were designed to help develop their social interaction skills. The study observed and interviewed participants with Autism Spectrum Disorders (ASD) to determine the effectiveness of virtual environments and examine how they can be used to develop and improve social interaction skills.

KEYWORDS

Autism, Social Interaction Skills, Virtual Reality

1. INTRODUCTION

Understanding the context of a joke, sarcasm, and knowing when someone is bullying are all experiences that typical people take for granted each day. Students with Autism Spectrum Disorders often struggle to understand the subtle nuances of everyday social interactions. Autism Spectrum Disorder (ASD) is a term that encompasses a variety of neurodevelopmental disorders. In May 2013, The American Psychiatric Association's Diagnostic and Statistical Manual of Mental Disorders 5th edition (DSM-5), redefined the autism spectrum to include diagnoses of Asperger syndrome, Rett Syndrome, childhood disintegrative disorder, and pervasive developmental disorder not otherwise specified (PDD-NOS) (Kupfer & Regier, 2013). The reclassification allows researchers to help spread awareness of these disorders to the general public and still target neurodevelopmental disorders on a case-by-case basis.

As researchers learn more about neurodevelopmental disorders, they have to leverage new technologies to help students develop their social interaction skills. One type of technology that shows promise is immersive virtual environments (IVE). IVEs have been utilized for many years in a variety of settings including entertainment, military training, and corporate applications. Unfortunately, these environments are costly to build and are typically designed around a specific scenario or activity. The nature of these virtual environments was usually centered on a specific product, which made it difficult to develop a flexible environment that could be adapted and modified for educational purposes.

In 2003, Linden Research, Inc. released Second Life, a three-dimensional modeling program designed to let users design and develop virtual environments. The creators of Second Life wanted to create a virtual world where users could freely create and interact. Second Life differs from other three-dimensional games in general because there are no tasks users have to complete, and users are able to create content for any purpose. Researchers have been studying how Second Life can be used in educational settings. Ke & Tami (2013) examined social interaction in a virtual reality environment (Second Life) for students with high functioning autism. Researchers collected data through behavior observation and analysis, interviews, and questionnaires. The participants showed increased performance across a variety of social interactions including responding, initiation, greeting, and social competence. Unfortunately, researchers have not been able to create and fully implement a completely immersive experience to practice social interaction skills.

Autism researchers, while looking for ways to address social learning concerns, have united with technology researchers to develop a focused specialty area body of work. Technology integration, in terms of social interactions, has been discussed both positively (Rajendran, et al., 2005; Goodwin, 2008) and negatively (Howlin, 1998; Latash, 1998). As with many research endeavors, early results can vary widely until the body of knowledge is more thoroughly established. For example, Porayska-Pomsta et al., (2012) concluded that working with technology increases opportunities for communication between adults and children. The primary difference in this study's focus is the development of interaction related to Immersive Virtual Environments (IVE). Slater (2009) contends that the best IVE experiences provide visual, auditory, and haptic input. Traditional virtual environments do not have the same sense of "really being there". Wallace et al (2010) was one of the first to explore the way children with autism perceive IVE compared to typical children. Jarrold et al. (2011) investigated children's scanning patterns in IVE classroom environments and found that children with autism were less focused on distant virtual peers than the central character in the digital classroom. Rajendran (2013) points out that future research in IVE arguably holds greater promise (than traditional virtual reality) because of its incorporation of both sensory motor and social cognition qualities.

The purpose of this study was to examine if students could alter their social interaction skills by practicing them in an IVE. The researchers also examined if the students were able to transfer the skills they learned in the IVE to similar situations in the real-world environment. Unlike previous studies, this study utilized a head-mounted unit that provided a full visual sensory experience for the user. Students were completely immersed in the environment and were able to look and move in all directions unimpeded. The results of this study will add to the research body of knowledge related to social learning, IVEs, and the interaction between these two fields.

2. THE STUDY

The pilot study was designed to determine if high functioning students with ASD were able to improve their social interaction skills by participating in scenarios designed in an IVE. The researchers partnered with a special education coordinator from a regional school system to select students that were willing to participate in the study. The participants were selected from a pool of students who attended a yearly summer camp that invites students in grades K-12 from different parts of the state to practice their social skills in a variety of settings and activities. Two students were selected based on their age, stage of life, social ability level, and self-awareness. The study was conducted in conjunction with the summer camp that lasted for two weeks. The participants would spend three hours at the camp, followed by two hours in the IVE at the university.

Participant One was a fifteen-year-old Caucasian who at the time of the study just finished his freshman year in high school. He had participated in the summer camp for three years. He overheard the teachers discussing the project and asked if he could participate. He had heard of the technology, and wanted to see what it looked like. Participant One was adept at computers and enjoyed building in Minecraft and hosting Minecraft servers. The teachers at the camp chose to focus on his inability to recognize the cues of when a friendly conversation began moving towards an aggressive situation. The first scenario was designed around him looking at a classic truck owned by an aggressive senior in high school. The second scenario was designed in a public library where he was studying with a small group and they were annoyed by the way he acted. The third scenario was focused on his ability to leave a situation where he was being bullied.

Participant Two was an eighteen-year-old Caucasian who recently graduated from high school. Participant Two struggled maintaining eye contact during typical conversation. He had attended the summer camp since it began six years ago. The director of the camp selected him to participate, and when told about the project, he was excited to participate. The teachers designed his scenarios around situations where he needed to maintain eye contact. The first scenario focused on him walking up to a person sitting on a park bench and asking for directions. The second scenario was designed around him applying for a job at a local hospital. The third scenario took place in a library where he needed to ask a librarian for help finding a book.

The researchers worked in conjunction with the camp leaders to build social interaction scripts. The scripts were designed around each student's identified social interaction weakness. Once the scripts were completed, each participant's special education teacher vetted them for accuracy and quality. After approval, the scripts were then given to the researchers to design the events in a virtual space.

The researchers used Second Life to design the virtual environments. Second Life is a virtual world developed by Linden Research, Inc. According to the Linden Research (Linden Labs, 2013), Second Life has about 1 million regular monthly users that actively interact and build 3D based content. The researchers utilized existing content that was already created in the virtual space. The researchers and participants interacted in a variety of areas that replicated real-life environments that matched the scripts.

2.1 Research Questions

This study addressed two research questions:

- 1.) Can students with ASD transfer and maintain skills learned in a virtual scenario and to a real-life scenario?
- 2.) Can students with ASD alter their social interaction skills by practicing them in a virtual immersive environment?

2.2 Conceptual Framework

The researchers used the following frameworks and concepts to understand the intricacies of technology application, social interaction and awareness, and human performance: The Technological, Pedagogical, and Content Knowledge framework (Koehler & Mishra, 2008), Social Skill Menu for age 14 through Adulthood (Baker, 2007), Performance Improvement/HPT Model (Van Tiem, D. et al., 2012). The frameworks and concepts were used to help guide the researchers when coding and interpreting the data. They guided the researchers in understanding how technology can be used to develop and deliver meaningful curricula that could be enabled through immersive virtual environments. The frameworks also provided a reference point for social skill development. This helped the researchers understand which targeted tasks needed to be mastered in the virtual environment, and then reexamined in the natural environment. Finally, the HPT model was used to examine gap analysis to determine the difference between desired performance and actual performance.

2.3 Research Design

The researchers incorporated a case study approach using an ethnographic perspective (Hymes, 1982; Gee & Green, 1998). An ethnographic perspective, in contrast to ethnography, does not focus on understanding an entire culture but instead focuses on the actions of smaller groups (Hymes, 1982; Bloome, 1989). This approach is also used when studying practice-oriented theories in smaller group settings (Ortner, 1984). The case study was guided by the case study structure created by Lincoln and Guba (1985) that starts with the overall problem (how can students improve their social interaction skills), the context (using IVEs that replicate real-life situations), the issues (can the students relate to the virtual world as well as the real-world), and lessons learned (develop skills in the virtual space and transfer them to real-world settings).

2.4 Data Verification

To ensure the credibility of the data, the researcher incorporated a variety of validation strategies. Qualitative researchers utilize a variety of validation strategies to make their studies are credible and rigorous (Creswell, 2007). Credibility and validity for this study were achieved through the validation strategies of triangulation, thick rich description, researcher reflexivity, and peer debriefing. Triangulation was achieved through the collection of interviews, reflective journals, and field notes. The researcher also incorporated Stake's (1995) "critique checklist" to analyze the case study quality.

2.5 Data Analysis

Before the researchers analyzed the data, the interviews, reflective journals, and field notes were transcribed. The process of transcribing allowed the researchers to become acquainted with the data (Riessman, 1993).

All coded data was reviewed through the lens of prevalent theories already mentioned to build logical explanations and add to the internal validity through the use of comparative analysis with rival theories (Yin, 2003). The emerging themes were discovered through the process of in vivo coding (Strauss & Corbin, 1998). The researchers followed the step-by-step guidelines provided by Braun and Clarke (2006) for thematic analysis. Themes that were prominent across both cases were documented as well as those that were extremely different. The guidelines provided rigor, but still allowed for flexibility that is often needed in qualitative data analysis. The guidelines were: (1) familiarize yourself with the data, (2) generate initial codes, (3) the researcher reads each transcript to immerse himself in the data, (4) analyze the themes, (5) define and name the themes, (6) produce the results.

2.6 Results

Due to the nature and length of qualitative analysis, this section reflects only a small portion of the documented information from the full study. Table 1. provides the themes and categories that were prevalent within the data. The results of the study are presented with each corresponding research question.

2.7 Themes, Categories, and Definitions Identified in the Data

Table 1

Themes	Definition	Categories
Social Awareness	Participants' awareness of their inability to engage and maintain conversation with their peers. Developing and enhancing their social interaction skills was a task they worked on daily.	Apprehension Being Normal
Sensory Engagement	Participants' experience in the simulator and use of the head-mounted device.	Realistic Scenarios Authentic Engagement

Two themes and four categories were prevalent in the data. Social Awareness was the first theme to emerge, and it yielded the categories of Apprehension and Being Normal. The second theme was Sensory Engagement, and it yielded Realistic Scenarios and Authentic Engagement. The answers to the research questions are embedded in the themes and categories that relate to the research questions. The researchers chose to use as many excerpts from the transcribed data as possible in an attempt to allow the reader to understand the participants' experience in the virtual environment.

2.8 Findings

Can students with ASD transfer and maintain skills learned in a virtual scenario and to a real-life scenario? The theme of Sensory Engagement answered the first research question. Both participants did describe the virtual world as realistic and they felt that they were part of the actual environment. Participant One explained, "The places were life-like. You could walk into a building and go through doors. There was even a person sitting behind the desk waiting to talk to me." Participant Two enjoyed the freedom to move and the ability to engage with a variety of objects. He explained, "I walked into the hospital and looked around. I was able to run, walk, and sit down. I liked exploring the building and finding my way on the roof. When I jumped off, it felt like I was falling for real, it was cool." When the participants were introduced to the environment, they both were amazed at how they could look around. Participant One explained, "When I put on the Oculus Rift, I heard someone talking behind me. I thought someone had walked into the room behind me. Then he (researcher) told me that he was in the simulator."

When asked if the scenarios seemed real, Participant One said, “The library scenario was the most realistic. I could see the library books, the desk and the other students looking back at me. I knew they were not real people but it seemed pretty realistic.” Participant Two also agreed. He said, “ I like the scenario where I went to the hospital and asked about a job. The guy behind the desk looked at me, then looked down like he was going to type on his computer, then he did!” Participant One experienced a glitch during one of his scenarios. His reaction reinforced the notion that the virtual experiences can be engaging. During his scenario the character he was talking with closed his eyes and fell asleep. He stopped and said, “Why are you asleep? Are you ok?” When asked if he would have responded in the same way in the real world. He replied, “Yes. I would ask if they are ok.”

Both participants were authentically engaged during the scenarios. The researchers decided to have the students travel to the location of the scenario instead of starting the scenario at its location. Both participants responded that traveling to the scenario helped them become more acquainted with the environment and made it feel more realistic. Participant Two explained, “ I had to walk on the sidewalk to the library. I even had to open the door before I was able to go in.” Participant one also felt that traveling to the scenario made the experience more realistic. He explained, “I couldn’t fly to the location. I had to walk. When I was walking I was able to see more of the town and the truck. Walking made it more realistic.”

The teachers at the summer camp reenacted the scenarios in a real-life environment. The researchers noticed that the participants were less nervous during the scenarios. Both participants agreed that they felt less stress when interacting in the real-life scenario after participating in the virtual scenario. Participant One described his experience. He explained, “ I kinda knew what the teachers were going to ask me. So that helped. I knew the teachers so it helped me not feel as nervous.” Participant Two also acknowledged that knowing the teacher made the scenario easier. He explained, “I know the teacher so I knew she was acting. I liked the scenario. I know the teacher doesn’t work at a hospital (referring to the scenario at the hospital).”

Each time the participants engaged in the real-life scenario it was altered to make sure they were not scripting their responses. The researchers noticed several changes in how the participants responded during the scenarios. The teachers also commented that both participants were more responsive and less rigid. A teacher commented, “ I was surprised when he (Participant One) didn’t keep talking about his Minecraft server. After realizing that the person liked his truck, he complimented him on the truck and said he liked it and walked away. He normally would have tried to talk about computers and fixate on his interest. He started noticing “cues” and responded accordingly.” One teacher commented on Participant Two’s ability to maintain eye contact. She said, “I saw a big difference in his use of eye contact. This is something that we have been working on for several years. This year, after spending time in the simulator, I noticed that he would look up more and engage in eye contact. This is a big stride for him.”

Can students with ASD alter their social interaction skills by practicing them in a virtual immersive environment? The researchers found that both participants were able to alter their social skills by participating in scenarios in the virtual environment. The teachers at the summer camp noticed and documented that both participants were making gains in their social interaction skills. When the participants were at the summer camp, they were more outgoing and excited to talk and discuss their experiences with the project. Participant Two showed noticeable gains in maintaining eye contact during conversations. When asked if he felt that his eye contact has improved, he said, “Yes. I don’t look down as much. I’m not as nervous when I’m talking to people.”

Participant One also showed gains in handling conversations that would start out civil and lead to bullying. He explained, “The guy really liked his truck. When I was asking him about it I could tell he liked it. I don’t know a lot about trucks so I asked him about computers. He thought computers were for nerds. So I told him that I liked his truck and walked away.” When asked if he would have handled the situation differently not practicing in a virtual space, he said, “Yeah, I would have started telling him about my server and Minecraft. I would have wanted him to like me so I would keep talking about things I like.” Participant Two also showed improvement in his ability to engage in conversation. A teacher commented, “ I have known him (Participant Two) for three years and this is the first time that I have seen him participate in group conversation without being asked to participate.”

Both participants were apprehensive when engaging and maintaining conversation. When asked how they felt about talking to their peers, they both explained that they did not want to mess up and they were always anxious. Participant One explained, “I try to control what I say and stuff and make sure nothing bad happens or goes wrong. I feel worried, mainly around students and friends. I have to tell myself to act normal. I have to tell myself not to worry about it. Don’t be anxious about it.” Participant Two also felt anxious about

maintaining conversation. He explained, “I have trouble talking to girls. With boys I don’t have problems because I talk about boy stuff. With girls I don’t know what to talk about.” When asked if had more confidence when engaging in conversation, he said, “Yes. I feel more confident now that I have practiced. I am not as anxious because I had do it before and I was ok when I did it in then (in the simulator).”

3. CONCLUSION

By developing engaging scenarios and presenting them in an IVE, both participants were able to show moderate gains in their areas of weakness. Participant One was able to maintain conversation without redirecting it to his specific interests. He also demonstrated his ability to detach himself from the conversation when he realized the conversation was turning negative. Participant Two maintained eye contact throughout the scenarios consistently, and also increased eye contact in his real-life scenarios. Both participants said they felt less stress when engaging in conversation after practicing in the simulator.

The participants indicated that using the immersive head unit made them feel like they were actually in the environment. They were impressed with how life-like the avatars were, and felt that the characters’ head movements and eye blinking added to the virtual scenario. The IVE was real enough for the students to transfer some of their skills from the virtual scenarios to the real-world scenarios. Both participants wanted to continue the project with more social environments that could help them practice their social skills.

While the researchers felt that the study was successful, there were some limitations that impacted the results. The researchers only had three scenarios for each participant to practice. This limited the amount of flexibility that resulted in the development of the conversation. Another limitation was that the participant, and not the researchers, was the only one immersed in the virtual world using the device. The other avatars were controlled with a mouse and keyboard. This limited how much head movement and gesturing was made during the conversation. The final limitation was the lack of time the students had in the virtual world. They spent two weeks engaged with the simulator. The researchers feel that if they had more time in the virtual world, the impact on their social skills would have been greater.

The findings from this study will add to the body of literature on Autism and social skill development. The researchers feel that additional time spent with participants will increase the validity of the findings and give additional insight to broader applications. Beyond the special education applications, students of all ages could benefit from scenarios explored and practiced in an IVE. As software and hardware continue to become more affordable and obtainable, the corporate, military, entertainment, and home applications will become much more involved and expanded.

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TEACHING AND LEARNING IN THE DIGITAL ERA: A CASE STUDY OF VIDEO-CONFERENCE LECTURES FROM JAPAN TO AUSTRALIA

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ABSTRACT

‘Blended learning’ has been attracting academic interest catalysed by the advance of mixed-media technology and has significance for the global educational community and evolutionary development of pedagogical approaches to optimise student learning. This paper examines one aspect of blended teaching of Japanese language and culture in the Australian classroom. The study encompasses the Japan-to-Australia component of a bi-lateral teaching and learning program established in 2002 between the Faculty of Arts, the University of Sydney, Australia and the Faculty of Education, Gifu University, Japan. The significance of the program was affirmed by the National Institute of Multimedia Education (NIME), a Japanese government agency dedicated to research and development in e-learning/distance education in the tertiary sector, who confirmed in 2006 that the programme was the only one of its kind. Lectures provided by Gifu University, are in real time, the mode of delivery is via web-based video conference. The international exchange of lectures is one component of a rich teaching strategy created for the multicultural environment of the Australian classroom. Findings draw on student learning outcomes and views on motivation as the criterion of the efficacy of the program. The study confirms, within the defined parameters, that video-conferencing from Japan to Australia is an effective tool, as an adjunct to current teaching methods within the classroom, to enhance learning and motivate students learning Japanese culture?

KEYWORDS

Blended learning, Technology, Motivation, International education, Video conference, Asia-Pacific.

1. INTRODUCTION

This paper explores application and findings from an example of web-based video conferencing in the context of blended learning on teaching and student reception of aspects of Japanese culture in Australia. The project entails an international distance-learning relationship between The University of Sydney, Australia and Gifu University in Japan with the exchange of real time lectures using the technology of web-based video-conferencing. Lectures on Japanese language and culture are transmitted from Gifu University and incorporated as discrete modules into Japanese studies courses for The University of Sydney students at the third year level. Conversely lectures in Australian studies are transmitted from Sydney to Gifu University and incorporated into existing courses in cross-cultural communication and English as a foreign language. The lectures delivered from Australia to Japan are mentioned but the prime purpose of this study is to ascertain the extent of student engagement in Australia with lectures from Gifu University to the University of Sydney. The outcome of lectures from Gifu University in 2012 have been analysed. The intent of the analysis is to gauge the extent of student learning patterns and the extent of their motivation derived from the video-conference lectures. The content of the paper is part of a continuing study which includes learning outcomes in both Japan and Australia.

Section 1 of this paper introduces the background of the international distance learning project from the Australian perspective. Section 2 details aspects of the project in respect to lectures presented in Japan for students in Australia. Section 3 is the theoretical framework towards addressing the research question arising from the project and the applied methodology. The findings from the project are in section 4 and conclusions in section 5.

The collective experience derived from the project of teaching using video-conferencing is delineated, focussing upon the cultural and linguistic issues which have arisen. Through this some implications of the digital revolution on teaching and learning in the Asia-Pacific region and the influences on student learning and motivation are explored.

2. BACKGROUND

In Australia we are witnessing an expansion of curriculum driven by an increasingly multi-cultural society. Established forms of international exchange between universities normally require students to travel abroad for a significant period of time. There is enthusiasm for Australian based students to visit Japan but the process is costly and, from a grants viewpoint, competitive. Typically only three to five students, less than one percent of the overall enrolment in The University of Sydney's Japanese Department visit Japan in any one year. International distance learning utilizing video-conferencing offers the opportunity, particularly for students who have not visited Japan, to have a uniquely authentic Japanese learning experience. In this sense, distance learning can impart a global educational experience at a local level and create a different form of student mobility.

The lecture exchange program between Gifu and Sydney universities is a teaching and learning initiative between Australia and Japan was a pioneer project. 'The National Institute of Multimedia Education (NIME), a Japanese government agency dedicated to research and development in e-learning/distance education in the tertiary sector, has reported that the current relationship between Gifu and Sydney universities is the only institution-to-institution program of distance learning between a Japanese and an overseas university' (Mycak et al., 2011) The seeds and conceptualization for the project was initiated in Japan. The project has generated considerable media interest, particularly in Japan (Mycak and Yasumoto, 2010). The inaugural trial lecture transmission from Gifu University to the University of Sydney was reported in the national newspaper, the *Australian* (Giglio, 2002). The formal signing of an agreement between the two universities was reported in Japanese television news broadcasts Japan Broadcasting Corporation (NHK) Gifu and Gifu BC, and in four Japanese newspapers: *Asahi* and *Yomiuri* (nation-wide), *Chunichi News* (regional), and *Gifu News* (local). The lectures transmitted from the University of Sydney have received press coverage in Japan, on television (*Rabu Waigo Today* [11/1/05]) and in newspapers: *Gifu News* (2002b); *Chunichi News* (2002a) ; *Chunichi News*(2005b); *Gifu News* (2005a); and *Yomiuri* (2006).

The break through and opportunity for cost effective international learning came when the enabling technology became available. The University of Sydney was well placed to embark on international distance learning as some years prior to the project The University of Sydney had used the technique with its Faculty of Medicine. Gifu University and The University of Sydney initially trialled international distance learning with ISDN (Integrated Services Digital Network) dial-up circuits, this approach was costly and subject to the vagaries of dial up connections at that time. Nishizawa points out the issue of costs in using ISDN (Mycak et al., 2011). Japan in 1997 had a transmission rate of 384 kbps which was adequate and provided almost television picture quality, the early 2000s saw development continuing with video-conferencing expanding from its early days in the late 1990s *CNA Report Japan* (2012).

A major step forward from both a cost base and quality of technology was taken advantage of when IP (Internet Protocol) links became available. Digital technology continues to progress where domestic or international exchanges can fall into the desk top type for small groups of students and group type for large screen presentations. Currently development of video-conference equipment provides for the transmission and reception of high definition three dimensional images. The University of Sydney uses the group type with a large presentation screen in two dimensional picture format.

One prospective and significant problem with the video-conference format is that it is preferred that the presenter requires a degree of technical skills associated with a video-conferencing system that is used in international distance learning. Any prospective fault with the equipment need to be addressed prior to the video-conference as an equipment failure during a lecture, which is in real time, can impair the quality of presentation and in turn reception of the content and in the worst case may need the lecture to be terminated. It is recommended that as further insurance towards the efficacy of an audio-visual conference that the presenter has on hand technical support available to during a lecture to ensure that the lecture continues to plan and that any technical glitches not anticipated are resolved with expediency.

It is an imperative that the lecturer in Japan and the lecturer and class receiving the lecture in Australia are not encumbered with technical problems during the transmission and reception period.

It is postulated that while both the style and the content of international distance learning could, and perhaps should, embrace a set of at least two discrete elements, that is a matrix of video-conferencing from an overseas source integrated into local course content locally presented in a seamless and consistent presentation. Technology is not a panacea for poor course content and structure. It is affirmed that there is a need to be aware that much depends upon the progress and innovations in the field of technology. Technical advances in global communication are a continuum and the transmission of images and verbal communication is synchronized in real time with minimal time lag between transmission and reception only serves to enhance course quality. The advent of higher speed digital highways will continue to improve the quality of video-conferencing enabling students in one location to receive a lecture from another location in real time with progressively improved interactive speech and vision. Importantly the differentiation of cultural and linguist competencies between transmitter of lectures and receptor students cannot be over emphasised. One advantage with video-conferencing, rather than audio-conferencing which compensates for prospective mismatches is that with visual images supporting the verbal content the presenter can be alert to body language clues. The visual images enable adjustment to presentation timing and possibly some cultural sensitivity with content.

Mycak has reported various forms of multimedia have been employed, using a high visual component (video, photographs, and images). The use of real-time transmissions with the added benefit of the small time difference (maximum two hours) between Japan and the Eastern Australia has maximized immediacy. There are opportunities ongoing to complement real time video-conferencing with e-learning and stored lecture content enabling on-demand studies for student distance learning. Improved student to student and student lecturer interactivity is also receiving ongoing attention (Mycak et al., 2011).

The sustainability of video-conferencing also depends upon institutional support and a willingness to continue to invest in new technology to enhance system topology. This requires a corresponding commitment to the retention and training of technical support staff. Gifu University and Sydney University have made these commitments to date with the costs of high definition presentation equipment presenting a mutual a budgeting challenge. Video-conferencing systems should ideally be mirror imaged.

3. VIDEO-CONFERENCE LECTURES FROM JAPAN TO AUSTRALIA

3.1 Purpose, Content and Participation

This segment of the project is to advance the reception of Japanese lectures from Gifu University to the benefit of The University of Sydney students through video-conferencing; video-conferencing has been integrated into two of The University of Sydney courses. Firstly the option course 'Media and Popular Culture' the students participating in this option have an intermediate level of Japanese language. Very few of these students have been to Japan. This course aims to discourse the new Japan and its youth culture and to guide The University of Sydney students to understand and broaden their knowledge of inherent and changing aspects of Japanese society and culture. The course content includes newspaper reading, video analysis, discussion and research presentation, and video-conferencing. Themes to be covered are from Japanese traditions through to contemporary popular culture, students explore Japan utilising six modules. They are 1) Positioning and status of people in the Japanese society, changing values. 2) Popular Culture in Japan; J-pop music, J-Anime, J-Manga and its reception in East Asia 3) Japanese print and television media, sociological and cultural impacts 4) Evolution of traditional Japanese traditions and external influences. 5) Discourse J-pop language relating social issues 6) 'Soft Power' and Youth Culture. Secondly 'Japanese advanced level', these students have advanced level of Japanese language and a number have language and cultural experience gained from studying in Japan. These lectures, which include video-conferencing, place emphasis on acquiring basic research skills as well as presentation and discussion skills in Japanese, this unit of study links with honours courses. Classes are in the Japanese language and the themes include 6 modules: 1) text discourse, 2) Contemporary literature, 3) Academic essays, 4) Critiques, 5) Media text: film and 6) Media text: TV drama.

The motivation theories of scholars, Dörnyei, Gardner and Schmidt (Gardner, 2001, Schmidt et al., 1996) have been applied when relevant to design the overall content of the courses where video-conference lectures form part of the syllabi. Each video-conference session is planned and themed prior to the individual video conferences taking place, ensuring that the content and context is relevant to the overall course objectives. The reception of lecture modules from Japan is part of The University of Sydney's commitment to teaching excellence aiming for teaching best practice utilising existing and evolving technologies. To create immediacy, it is argued that creating an effective multifaceted learning environment in the Australian classroom stimulates student motivation in the learning process with enhanced learning outcomes. The use of video-conferencing in real time is an important element in the overall teaching strategy for the student to learn about Japan within the boundaries of the course content. Video conferences can embrace a multitude of topics but must have content relevant to student needs within course objectives.

3.2 Lecture Content

Lectures, which students are required to critique, have been delivered from 2005 to 2012: Include 1) 'Edo Hayashi' a traditional Japanese music performance often played in festivals and in Noh plays (Hayashi or Bayashi is a term used to describe an instrumental ensemble consisting of a flute, a drum, and various percussion instruments such as a gong, a scraper and a clapper, Noh is a major form of classical Japanese music drama that has been performed since the 14th century). 2) 'Kireru Jidou' (Emotional Outburst) Current social issues among children 10-15 years old, harming other children physically and psychologically. 3) 'Futokou to Hikikomori' (Social Withdrawal). One of the critical social problems among junior high school and senior high school students in Japan who are withdrawn from life for more than three to four years. 4). Edo Popular culture 'Writing ability amongst Japanese children', 5) Morino Youchien (Kindergarten in the forests).

Two lectures were delivered in 2012. The first lecture was about socially withdrawn Japanese youth and this included an outline of the topic from a theoretical perspective. This was presented to both intermediate and advanced level students. The second lecture was on writing ability amongst Japanese children presented intermediate level students. During each video-conference students were required to make notes summarizing the main lecture points, participate in ensuing group discussions and finally submit an assignment: The assignment guidelines require the students to isolate major issues from each video conference, critically analyse the content and express in writing their views and opinions.

4. THEORETICAL FRAMEWORK

The theoretical framework is derived to determine the extent of learning and student motivation as a result of distance learning utilising video-conferencing. It draws on findings from research on language teaching and in particular student motivation. Student motivation has been extensively researched. I am not aware of research on student motivation derived from the learning outcomes arising from the use of the video-conference module exchange as part of an overall teaching structure. Kato, Yasumoto and Van Aaken have conducted comparative studies and examined motivation of university students in Australia and the USA over a three year period within the confines of traditional face to face teaching. (Kato et al., 2007). Motivation is the 'driving force in any situation'(Gardner, 2001). Motivation is a prominent element in pursuing anything in our lives. 'The truly motivated individual displays effort, desire, and affect'(Gardner, 2001) Many second/foreign language (L2) researchers in the past have reported that motivation is a key factor determining the rate and success of L2 acquisition (Dörnyei, 2001, Oxford and Shearin, 1996). People are generally highly motivated at the outset when they decide to accomplish some tasks. However, because of obstacles encountered on the way or for various other reasons, they often give up. It can be argued that it is indeed difficult to continue to persevere with learning the same thing over a long period until the student masters the essence of what learning is and has the desire and enthusiasm to continue with it.

A few decades after Gardner and Lambert established their motivation theory in the 1950s, Dörnyei (2001) claimed 'L2 motivation research is currently flourishing' (p. 52). However, research into the motivation of learners of Japanese is still less reported in the L2 acquisition research field than for learners of the European languages.

Also, the effect of where the L2 is taught appears to be neglected: little is published on studies comparing the degree of motivation among different tertiary institutions. Japanese is regarded as one of the priority foreign languages for teaching and learning at all levels in Australia. These observations in respect to Japan and Australia in respect to distance learning are also relevant by example for history and culture. Video-conferencing in real time provides an opportunity beyond language teaching for students learning experience including the silent language (Hall, 1990) to be enriched and motivation reinforced.

Teaching is both a challenge and opportunity for teacher and student. In the contemporary University environment in Australia we are faced with cost and budgeting restraints which require corresponding actions to search for better and more cost effective methods of content delivery and pupil stimulus directed to improve student learning outcomes. Three aspects are paramount in this scenario, firstly face to face contact time, secondly student motivation and thirdly utilisation of technology to enhance the efficacy of student learning. Of these, arguably, student motivation is paramount to learning outcomes and them staying the distance in the learning journey. A quotation attributed to Confucius some two thousand five-hundred years ago resonates with the twenty first century classroom 'I hear and I forget. I see and I remember. I do and I understand' (Blotnick, 2009). More pointedly to student motivation *Suki koso mono no joozu nare* (what you like you will do well in) (Kato et al., 2007). This Japanese saying clearly points out that motivation is the 'driving force in any situation' (Gardner, 2001). Motivation is a prominent element in pursuing anything in our lives. 'The truly motivated individual displays effort, desire, and affect' (Gardner, 2001).

When students commence learning for example a language, their instructors hope that they will reach the top level and go on to master the language. However several studies show that L2 learners have a high attrition rate, especially when their native or first language (L1) is English and they are learning Japanese/or Chinese as L2 (Kato, 2001, Saito and Samimy, 1996, Aacken, 2003, Watt, 1997). Yet, if the initial enthusiasm for learning, i.e. high motivation, could be retained throughout a course of learning, students would be more likely to achieve their language goals. It would be beneficial then for instructors to know whether advanced students are more enthusiastic and satisfied with their learning experience or whether they are more worried and uncomfortable in comparison with beginning or intermediate students. It was decided to explore how and whether video-conference as tool can positively affect learner's motivation. This study also examined whether the established theory, i.e. that learners' motivation was the best determinant of students' success is also true with distance learning utilising video-conferencing. 'Motivation is one of the main determinations of foreign language learning achievement' (Dornyei, 1994). 'Learning a second language requires the adaption of word sounds, pronunciations, words orders and other behavioural and cognitive features that are part of another culture. re' (Masgoret and Gardner, 2003). These views it is argued are also equally relevant to teaching culture.

This paper introduces a teaching methodology, as a component in an overall teaching strategy, for teaching Japanese language and culture utilising bi-lateral video-conferencing between Japan and Australia. This approach utilising available technology is designed to enhance student motivation and distance learning outcomes in both countries by 'hearing, seeing and doing' in a pro-active cyberspace classroom. Many researchers have focussed on anxiety as an important component of student motivation and as a predictor of success in language teaching (MacIntyre and Gardner, 1991, Walt and Dreyer, 1997, Saito and Samimy, 1996, Kato, 2002). This study is focussed on video-conferencing methodology and student learning outcomes and has not considered student anxiety or gender with the emphasis on the means used for, and content of, the educational transfers and reception. The research findings are based upon feedback from three The University of Sydney student tranches from two video conferences against six parameters comprising: Understanding the Theme; Understanding the Context; Understanding the Issues; Writing ability; Expression of opinions and motivation.

4.1 Research Question

Is video-conferencing between Japan and Australia an effective tool, as an adjunct to current teaching methods within the classroom, to enhance comprehension of Japanese culture and motivate students' learning Japanese culture?

4.2 Methodology

The focus of this paper is outcomes from web-based video-conferences Japan to Australia in 2012 forming a component of an overall teaching strategy. The methodology applied is extracted from a broader based research project which includes bi-lateral learning outcomes from blended teaching in Japan and Australia over a three year period. In the expanded study the outcomes are critiqued against publication on the application of digital technology to pedagogy. Research for this paper was carried out in Australia on The University of Sydney students who had received two video-conference lectures transmitted from Gifu University in Japan. The student understanding of the content of each video-conference within the study was ascertained against six criteria. Analysis was conducted on the quality of their post conference written assignments. Measurement was against each of the six criteria and numbered from one to five. The minimum mark is one and the maximum mark 5. A Likert type scale is commonly used in questionnaires and is the most widely used scale in survey research; it is a form of rating scale. The scale enables qualitative data to be ascribed quantitative values. The criteria selected were directed to ascertain the efficacy of the video-conference from Japan to Australia on student comprehension of lecture content and their thinking in respect to their personal motivation.

Table 1. The measurement criteria.

Criteria	none	little	moderate	high	very high
Understanding the Context (Topic)	1	2	3	4	5
Understanding the Theme (Content)	1	2	3	4	5
Understanding the Issues (Issues)	1	2	3	4	5
Expression of opinions (Opinion)	1	2	3	4	5
Writing ability (Writing)	1	2	3	4	5
Motivation to learn (Motivation)	1	2	3	4	5

5. FINDINGS

Table 2 shows the average results from the Likert analysis of the intermediate level (32 students) and advanced level (18 students) derived from the video-conference topic: Social withdrawal.

Table 2.

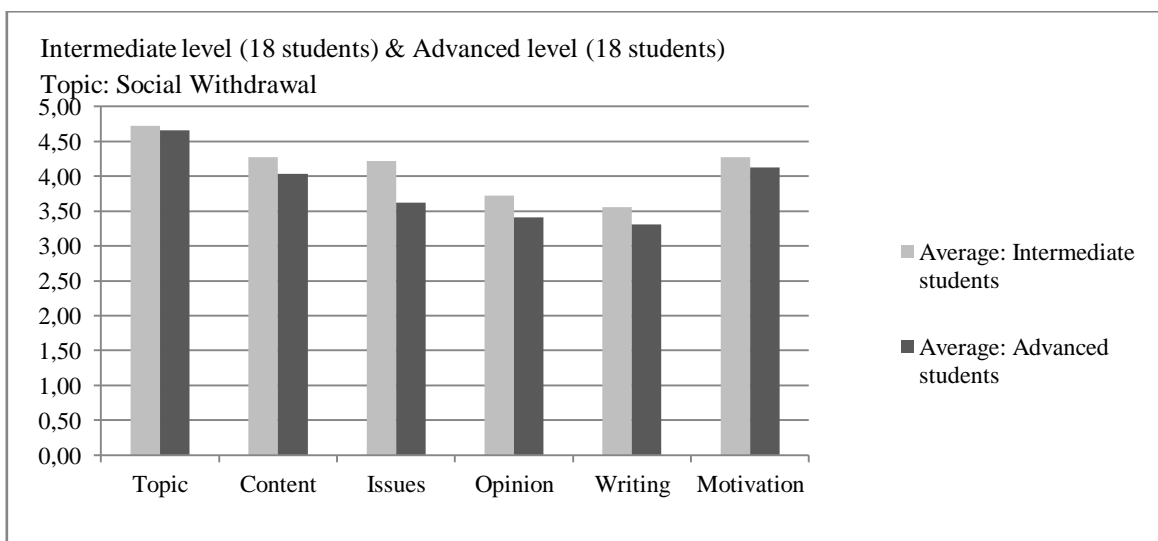
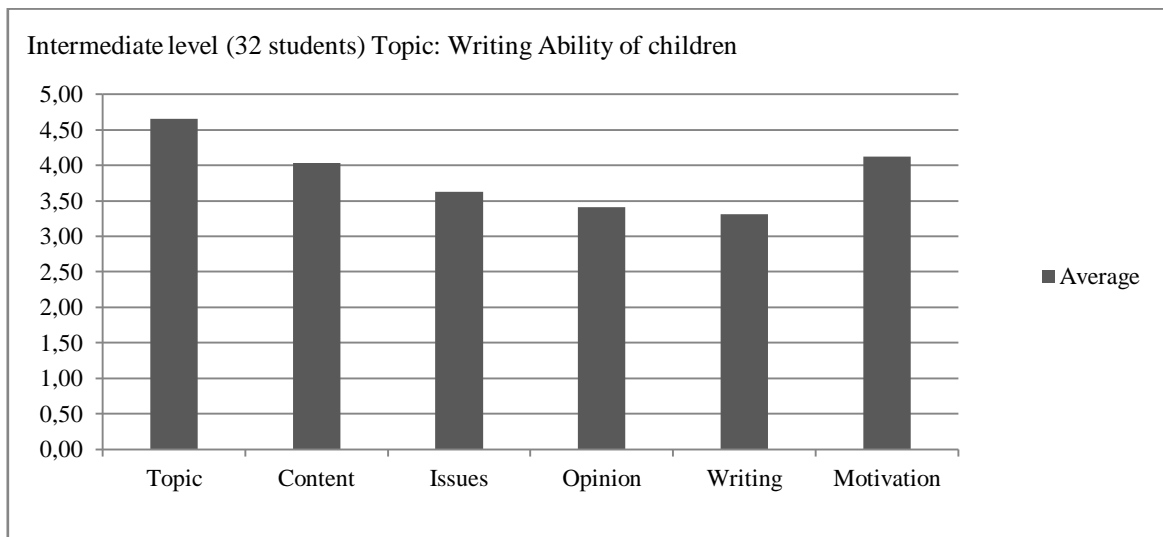


Table 3 shows the average results from the Likert analysis of the intermediate level (32 students) derived from the video conference. Topic: Writing Ability of children.

Table 3.



As deduced from the findings the video-conference concept and reception is a very important component in the courses falling within this study. The trends across the spectrum of topic, content, issues, opinions, writing and motivation between the two video conferences and the three groups of receptor students have been shown. The comparative average of each measured component of the respective Likert scales across the three groups is similar.

Some deviations in outcomes can be observed between the performance of intermediate level and advanced level students who participated in the video-conference Social withdrawal. The findings show that in every respect the reception and subsequent writing quality and understanding of the issues was marginally better with the intermediate level students than the advanced level students. These findings were counter-intuitive to my expectations. Intermediate level students have a language proficiency which is just suitable for them to receive and comprehend lectures in presented in Japanese whereas the advanced level students have adequate language competency. The advanced students were more actively engaged during and in the post conference discussion but relatively underperforming in the write up. Most encouraging across the range of the survey was the high level of student motivation. Riessman developed narrative theory and narrative accounts in Social Sciences and Humanities research by using dialogic analysis of interviewing (Riessman, 1999).

The feedback from the students towards video-conferencing utilising dialogic analysis has been very positive ‘hard to listen to, difficult, but challenging’ ‘interesting, and want more’, ‘Never had an opportunities learning through video-conferencing’, ‘give us more time for an assessment tasks’ and etc. Teaching good practice and creating an effective learning environment is challenging and an ongoing and evolving task. Video-conferencing gives students opportunities for direct contact in real time to learn about selective aspects of Japan.

6. CONCLUSION

The blended teaching strategy was well received by students and importantly all students were sufficiently motivated to complete their respective courses. Video-conferencing has a theoretical and practical part to play in the teaching and learning process, it lifts the classroom from local to international. The interactivity of the video-conference helps to dissolve real or imagined barriers to the learning process and is also edifying for the video-conferencing lecturers.

The use of six selected parameters relevant to the two video conferences and measurement utilizing a Likert scale has been confirmed as an appropriate measure of student engagement with the selected topics. It is acknowledged that the research sample is small and the expanded study will provide additional data for analysis and a more comprehensive understanding of students' learning derived from video conferencing content.

Cultural and linguistic issues do arise in both Japan and Australia, particularly at the intermediate student level with video-conferencing compounded by the immediacy of the distance teaching methodology. Notwithstanding this form of teaching has been confirmed as very fulfilling by the lecture presenters and students. Reaching new audiences who would not otherwise have the exposure to any form international education is important. Real-time transmission of content, which video-conferencing provides, achieves that end. The project findings have confirmed what international distance learning is capable of achieving. The project has extended the horizon of existing courses in Japan and Australia by inviting from abroad specialist lecturers who can talk on a connected topic but who could bring an entirely new vista to the series of preceding lectures. Thus, by presenting lectures from Japan, there is an enriching of existing curricula in Australia.

The Sydney-Gifu universities collaborative program provides an ongoing opportunity for video-conferencing as a supplement to the boundaries of the classroom, to the educational and social benefit of both Japanese and Australian students. Video-conferencing gives Australian students opportunities for direct contact in real time cyber space with Japan and opportunity is presented to students to learn about selective aspects of Japan. This tool is an important part of the evolving teaching aids and helps to create an effective learning environment. For Australian universities broadening the student learning experience has become an important aim, as has the need to raise awareness of Australia's place within the Asia-Pacific region.

The broadest aims of international educational exchange can be served through international distance learning, by allowing students a readily accessible but truly global educational experience. My findings confirm that the collaborative work with video-conferencing between Gifu University and the University of Sydney is playing an important role in the development of education across geographical boundaries in the emerging global village. The model established by Gifu and Sydney universities is a benchmark for future international distance learning. Video-conferencing is playing a significant role in bringing Japan into the Australian classroom. The audio-visual transfers in real time challenge, stimulate and motivate the students. The process is interactive and moves the students forward from perceived stereotypes in Australia to current realities including some of the rapid social changes happening in Japanese society.

The findings confirm that video conferences from Japan to Australia have an important part to play in the teaching and learning process. Video-conferencing helps students to consolidate learning with ensuing group discussion and assignment preparation. Through this process they develop critical thinking and analytical skills. The findings also confirm student motivation and well-founded information retention confirmed by written assignments. The progress to date will be the subject of ongoing research to determine the motivation factors for students of Gifu University beyond the preliminary findings and also to carry out evaluations in the future in respect to student motivation and compare these with findings to date.

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LESSONS LEARNT FROM AND SUSTAINABILITY OF ADOPTING A PERSONAL LEARNING ENVIRONMENT & NETWORK (PLE&N)

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ABSTRACT

This paper describes the feedback from the configuration and deployment of a Personal Learning Environment & Network (PLE&N) tool to support peer-based social learning for university students and graduates. An extension of an earlier project in which a generic PLE&N was deployed for all learners, the current PLE&N is a cloud-based learning system that has been customized for groups of learners and support them with active and continuous learning in a blended environment. Major stereotypes of learners were identified based on learners' background, the academic program they enrolled in, and interviews, which together help to identify the learning and career needs of the individuals. Based on the collected information, stereotypes of learners are identified based on common learning and career needs and personal aspirations. Appropriate sets of tools providing support for communications, collaborations, file storage, information alerts etc. are provided to the various types of learners. Trials have been conducted over 3 academic semesters and key factors for enticing participations, contributions and sustained usage of the PLE&N beyond the passing of a semester are also discussed.

KEYWORDS

Personal Learning Environment, Knowledge Management, Social Networking, Social Learning

1. INTRODUCTION

Advancements in the knowledge society has led to massive connections among people, machines and information. Access to the Internet/Cloud is pervasive and ubiquitous. Users are increasingly being empowered with a plethora of tools to conduct knowledge processes e.g, search, store, retrieve, classify, share etc. In the context of learning, individual learners can now configure their own customized set of learning tools and platforms to support their learning activities in a robust way. Therefore, identifying the major stereotypes of learners has a vital rule in delivering the appropriate yet highly personalized content (Cheong & Tsui, 2010). Once such stereotypes are identified, by locating the appropriate tools, data sources and suitable learning content, the fulfillment of the learning requirements and career needs for each type of learners can be properly determined (Drachler, Hummel, & Koper, 2008; Fiedler & Våljataga, 2011). For example, in general undergraduate students with limited working experience may need a greater support for their learning experience while the part-time post-graduate students may observe such learning needs in the form of career enhancement.

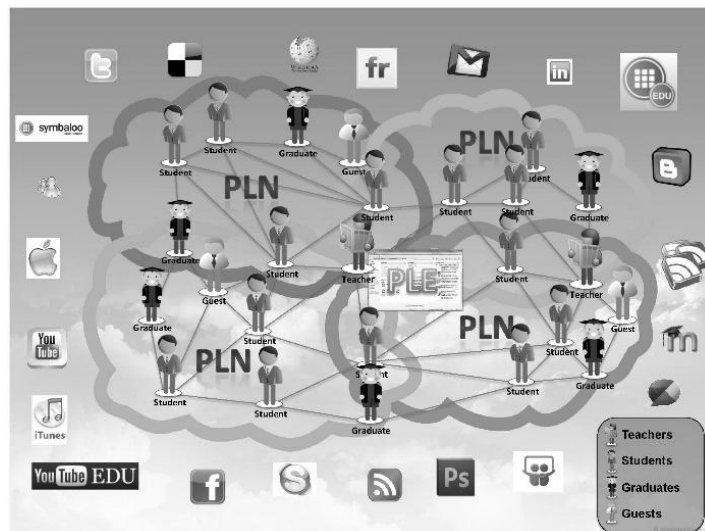


Figure 1. Personal Learning Environment and Networking (PLE&N)

Figure 1. shows a typical PLE&N environment. In this Personal Learning Environment and Networking (PLE&N) project, by determining the student stereotypes through observations and conducting a series of interviews, a prototype system has been developed. This prototype system consists of series of collaborative tools in the cloud environment that enables the students to identify knowledge resources outside of the classroom, annotate and share them with other learners whom include classmates, teacher(s), graduates and other invited professionals (Tsui, Cheong, & Sabetzadeh, 2011). Such external knowledge resources has been used by the students as a validation source for ideas discussed in classes in order to tackle the real world problems based on the taught concepts (Hwang & Chang, 2011; Wang & Wu, 2008; Zimmerman, 2008). Ultimately, in order to evaluate the effectiveness of this prototype system for supporting personal active learning, student feedback has been collected throughout three consecutive semesters (one academic year including summer)(Chou & Liu, 2005; Dabbagh & Kitsantas, 2012; Lee, Cheung, Tsui, & Kwok, 2007). As early as 2011, an earlier but “generic” version of the PLE&N had been deployed to learners by one of the co-authors to his students and substantial feedback and experience have been gained hence leading to this current project which focusses on an advanced version of the PLE&N with “customized pre-configuration” to suit major types of learners.

The PLE&N offers students a personal learning space which they can control. Students can participate and contribute to the PLE&N anytime by posting (with annotations) new articles that they have found, reviewing and commenting on other students’ posts, responding to the teacher’s requests, and recommending appropriate feeds for a topic of common interest, etc. Furthermore, the PLE&N is customisable and extendable to suit individual students depending on their needs and preferences. As long as a student uses the core set of tools, he/she can supplement his/her PLE&N with additional tools and feeds (see the figure above). This possibility of personalising the learning environment *enables and encourages students to manage their own learning as an independent and inquisitive learner*. The experience of exploring and adopting alternative learning processes (a peer-based, network-based, social connectionist approach to learning) *transforms their mindset* and also *develops their capabilities for life-long learning*.

While much remains to be learnt and fine-tuned, an early evaluation is that this revolutionary approach to learning has been a positive educational experience for students. It is very rewarding to see that the PLE&N has helped students *transcend the boundary of traditional classroom settings* into one that has no physical boundary, offers ubiquitous access, and operates dynamically with networked learners, and at the same time it has helped *transform my students into more independent and inquisitive learners*.

2. METHODOLOGY

Initially, before setting up the PLE&N prototype, a series of interviews were conducted to identify the user's groups and their respective needs. Such preliminary assessment of the students' needs have helped the prototype PLE&N to be fine-tuned (Mupinga, Nora, & Yaw, 2006; Robertson, Line, Jones, & Thomas, 2000). Table 1 shows the interview questions and the purpose of posing the question.

Table 1. The PLE&N Preliminary Survey

Interview Question	Explanation	Interview Question	Explanation
1. What's your background? (Full Time/Part Time Undergraduate or Postgraduate)	Identifying the student type and background	8. If not, why? What other features you would like to have that can help do your group work?	Designed to let students imagine what features in LMS will be useful to their group work.
2. What are your key goals? (e.g. continue to study at a university, switch job, etc.)	The key goals determine the learner's learning and career needs.	9. What tools do you commonly use to complete a group work?	This question is designed to ask students the tools they are currently using to complete a group work
3. Is the university-provided Learning Management system (LMS) adequate for your learning?	This question is designed in order to collect feedback on the university-provided LMS	10. What other tools or features you like to have in a personal learning environment?	To further stretch student imagination for ideal features and tools in PLE&N environment.
4. If not, why? And what else you also like to receive/know/read?	To know what information and knowledge they would like to get from LMS	11. How your desired personal learning environment can take you to your key goals in a better way?	To make students think on their own feet why their ideal personal learning environment can take them to their key.
5. What other tools you commonly used to support your study?	This question asks the interviewee if they are currently using any tools to support their study.	12. In addition to achieving your key goals, what other benefits will your desired PLE&N?	To ask students about other benefits in addition to those that help them to achieve their key goals.
6. Apart from learning the subject, what else do you also need to know/learn?	To obtain information on students' learning needs beyond the curriculum	13. What are your goals of lifelong learning?	To understand how students aim to stay current and competitive.
7. Based on your experience, is the university-provided LMS helpful to your group work?	To know more about students' using university LMS to assist their group work. Follow-up questions are raised	14. If you are aiming for a lifelong learning tool, what sort of systems and/or features do you need?	Designed to let students think more long-term and imagine the systems and/or features that can be used long-term to cater for their learning needs

A total of 15 students were interviewed which include 4 undergraduate students, 5 part-time MSc students, 4 research students and 2 Doctor of Engineering students. The duration of each interview was around 40 minutes. One interview was conducted by phone.

On the basis of this preliminary interview, a series of popular tools was also recommended to students as shown in Table 2.

Table 2. Suggested Collaboration Tools in the Prototype PLE&N

Tool	Corresponding Need(s)	Tool	Corresponding Need(s)
Google+	<ul style="list-style-type: none"> ✓ Cloud-based & Multimedia-oriented ✓ Free and Massive Connectivity 	Youtube	<ul style="list-style-type: none"> ✓ Cloud-based & Multimedia-oriented ✓ Sourcing and rating of learning content
Google Docs	<ul style="list-style-type: none"> ✓ Storage Capacity ✓ Creation and use of collaboration tools 	Dropbox	<ul style="list-style-type: none"> ✓ Storage Capacity
Whatsapp and other Mobile communication tools	<ul style="list-style-type: none"> ✓ Locate Expertise ✓ Orchestrate easily and flexibly 	Linkedin	<ul style="list-style-type: none"> ✓ Locate Expertise ✓ Free and Massive Professional Connectivity
Facebook	<ul style="list-style-type: none"> ✓ Cloud-based & Multimedia-oriented ✓ Free and Massive Connectivity 	Ning	<ul style="list-style-type: none"> ✓ Cloud-based & Multimedia-oriented ✓ Creation of learning communities for on-going and ad-hoc discussion and resolution of issues and problems
Skype	<ul style="list-style-type: none"> ✓ Creation of learning communities for on-going and ad-hoc discussion and resolution of issues and problems 	Feedly	<ul style="list-style-type: none"> ✓ Sourcing and rating of content relevant to learning and personal interest

The following criteria (together with design rationale) were considered when deciding whether to include a tool in each of the PLE&Ns for a student stereotype:

1. Does it support discussion? (This is the primary requirement for the PLE&N)
2. Does it have a RSS feeds function? (The PLE&N is indeed a semi-automatic bulletin board so it is crucial for it to receive RSS feeds for users to filter, read, tag, annotate and share)
3. Does it have various security settings? (Different learning communities are being created by allocating learners to respective group(s) in the PLE&N; learners are motivated to learn and share if they are surrounded by others with common goals and interest)
4. Does it enable collaboration? (Many functions are needed e.g. instant messaging, file sharing, video conferencing etc.)
5. Is it guided by profiles? (Profiles help to consolidate information about each learner and can act as a central point of information about a person)
6. What can this tool do that assists learning? (Review and project the total learning experience of a learner by using the combined set of tools)
7. What this tool cannot do? (Review any major shortfall of the platform)
8. What's the cost of this tool? (Obviously, a free tool would pose a much lower entrance barrier for a learner to install and adopt it)

With these criteria, after completion of each semester, a feedback questionnaires has been circulated among the participating students to assess the effectiveness of the prototyped PLE&N environment.

3. FINDINGS

3.1 Statistical Findings

Based on the feedback questionnaires collected from the students at the end of three semesters, a series of statistical analysis has been made for assessment of each criteria in each student category. Figure 2 shows the feedback from both undergraduate and postgraduate students.

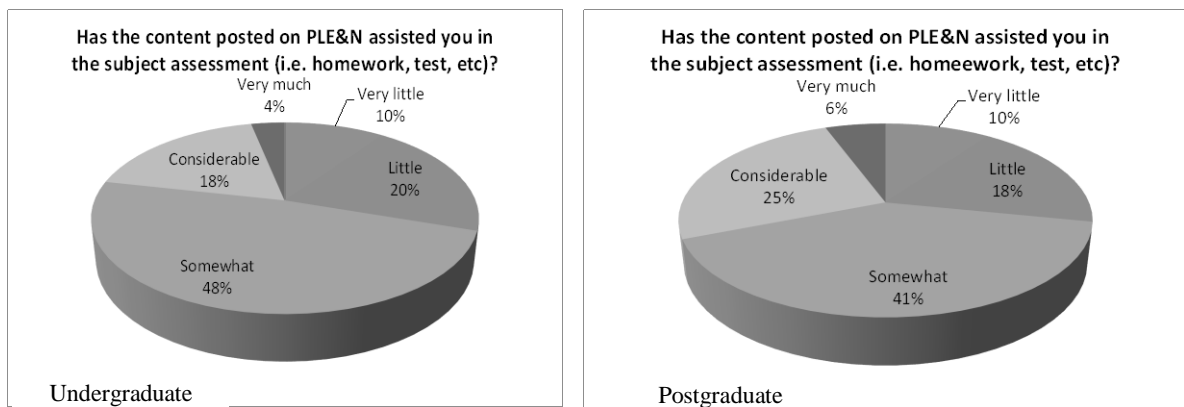


Figure 2. Feedback From Postgraduate And Undergraduate Students

As Figure 2 suggests, majority of the students find the PLE&N environment a supporting learning tool in their learning experience. During the trial period, all materials relevant to the enrolled subjects by the students are shared via the PLE&N. Obviously not all the shared material are directly related to those topics and issues that are being assessed (as what's being assessed is typically a fraction of what's covered in the lectures and the directed readings.) A better litmus test for students' appreciation of the PLE&N indeed is that more than 90% of the learners express they wish to remain in the PLE&N after a semester is over. Anecdotally, some 10-15% continue to post and comment in the PLE&N even after they have graduated from the university.

3.2 Interview Findings

3.2.1 Undergraduate Students

As for undergraduate stereotype, their key goals of learning are to earn good grades, spot their area of development and prepare their career. Their critical learning & career needs are to explore interests to find the desired pursuit of development areas, learn from senior people on the field and build up skillsets such as problem-solving skill. Though they share commonalities, individual differences do exist within the group. For example, local Hong Kong students are more proactive and mature in terms of planning their careers, while Chinese mainland students are more focused on university study to improve their knowledge and skills. In another comparison, male students are still in the stage of absorbing more knowledge and exploring more interest while female students have begun focusing on career planning.

3.2.2 Part-Time Postgraduate Students

For the part-time MSc stereotype, their key goals of learning are to learn knowledge from a broad range of areas and from others, to apply the knowledge learned at work, and to have career advancement.

Their critical learning & career needs are to organize knowledge better, have better communication and collaboration with others, and have more connections. Though they share commonalities, individual differences do exist within the group such as attitude towards life-long learning, what else is expected apart from learning the subject, etc. As an example, while one interviewee views life-long learning as part of natural life, another views it as steps for career advancement, and some others have not thought of it and just want to focus on the job-related learning now. These differences are observed to be due to characteristics such as age, position, area of working, etc.

3.2.3 Research Student

For research stereotype, their key goal of learning is to complete the degree and find a related job. Their critical learning & career needs are to have a communication and discussion platform with recommendations for their reference, have a platform for obtaining and organizing different sources of knowledge, and have a file-sharing system. Though they share commonalities, individual differences do exist. For example, male

researchers more openly express their pursuit of personal achievements. It has been also observed, that their focus and proactivity on their research area also varies significantly. These differences are due to their interests and other considerations such as funding.

3.2.4 Doctor of Engineering Student

For Doctor of Engineering stereotype, their key goal is to obtain a doctoral degree. Their critical learning & career needs are about obtaining relevant course materials anywhere anytime; for example, they expect to have access to a web-based system with online lectures. They also expect to get expert support, in addition to extending their network. Again, though they share commonalities, individual differences do exist. For example, some are focused on obtaining a doctoral degree while some others is interested in getting teaching and training opportunities through university education.

4. ADOPTION & SUSTAINABILITY OF THE PLE&N

In this section, we briefly discuss the motivation for learners to adopt the PLE&N and more importantly, factors that influence the continuing usage of the PLE&N. Based on feedback from learners (from surveys and interviews) and teachers' own reflection, the following factors play a key roles in influencing a learner to adopt and continue to use the PLE&N:

- Do-It-Yourself (DIY) – Installation, configuration and operation of the PLE&N need to be effortless. In our experience, students from both technical and business schools can install the PLE&N without any problem, often in less than half an hour. As the core components of the PLE&N are made up of Google tools in the public domain (i.e. they are in a Public Cloud), scalability and reliability of the PLE&N are guaranteed. We had had no interruption to accessing the PLE&N for years and there was also no need to contact the university's IT department as the Google cloud provides scalable and instantaneous support to all users. The tools are also free and together these circumstantial elements lead to rapid and massive adoption of the PLE&N by all users.
- Alignment with the learners' goals – As mentioned above, the needs and aspirations of the various types of users were prior ascertained, followed by the pre-configuration of an array of tools for each group of users to start using their "customized" PLE&N. These prior efforts and a pre-configured PLE&N have contributed to learner's adoption as the deployed PLE&N has already embedded a set of tools which are aligned to support the users' needs and objectives. Although each user can further customize his/her own PLE&N, providing a pre-configured PLE&N surely saves time and effort and users appreciate this arrangement more than just being provided with a "vanilla" (i.e. generic) PLE&N irrespective of their needs and background.
- Mobile Access – Nowadays most people access social systems via their tablets and smart phones. As a tool to support ubiquitous peer-based social learning, the PLE&N is no exception. In this regard, no extra work is needed as the Google and many of the deployed tools are already operating in a cloud environment hence usability issues have already been addressed. Mobile access to the PLE&N is therefore readily available and content are properly formatted for presentation.
- Value-Add – The PLE&N actually generally more benefits than merely acting as learning platform with a collection of tools for fostering communications and collaborations. In fact, over the years, all participants appreciate that there are value-add capabilities generated by the PLE&N. For example, teachers can, based on level of students' participation/contributions in various topics, ascertain the absorptive capacity of learners on specific topics thereby leading to alternative or additional learning paradigms to be explored, teachers can also treat the PLE&N as a "living repository" to harness learners' behavioral reactions to peer input, over time the "active contributors" of a PLE&N can be considered as core members of a learning community, and the content in the PLE&N, which often includes documents, links to web pages and webinars, can serve as prior reading or revision materials for Flipped Classrooms to be conducted.
- Rewards/Incentives – To all of the students, PLE&N is a revolutionary new concept. Never ever they have heard of nor encountered such a tool before. Hence, some incentives are needed to entice them to adopt and contribute to the PLE&N. This "incentive" comes in the form of, in most of the subjects that operate with the PLE&N, a 10% assessment of the subject for constructive and consistent contributions

throughout the semester. This level of assessment percentage was arbitrary set based on teachers' intuition and experience after taking into consideration that the PLE&N is new, students need time to adapt to this new learning environment and, especially for Asian, many students have the misconception that their postings may not meet the expectation or may even be ridiculed by the teacher. There is also a clear divide between the attitude of the undergraduate and postgraduate students in this regard. Overall speaking, from teachers' observation and feedback from the students, undergraduate students care a lot more about the marks allocated to the PLE&N whereas postgraduate students generally realize the power and benefits of the PLE&N and they care more about their learning than the marks being awarded by the teacher. Recently, there are encouraging signs as the latest round of feedback from the postgraduate students is that they want the marks for the PLE&N to be reduced or even abolished. Overall speaking, the 10% assessment mark for the PLE&N is felt to be appropriate to attract students to adopt and try out the PLE&N as a new and supplementary learning tool.

5. CONCLUSION

Result from the PLE&N project shows that the students' learning experience can improve by deploying some common (and mostly free) available tools. While Learning Management Platforms (LMS) provide students with an organized content and course materials plus the necessary collaborative tools, the PLE&N environment has indeed extend beyond the limited boundaries of the course syllabus, allowing students to read or disseminate knowledge on the Internet with their peers. The PLE&N also enables each and every learner to further customize the learning environment in terms of content, the layout and tools that they need or prefer and is not merely limited to the user interface customization in the LMS.

By identifying the learner stereotypes and needs, the PLE&N stereotypes experiment has been a good demonstration to show that, while it may not fully satisfy some students (e.g. those unfamiliar with the social networking tools), it can cover and satisfy many different student stereotypes to a great extent.

Currently, Some 10 subjects are operating with this prototype PLE&N by more than 4 teachers at Hong Kong polytechnic University with over 1000 participating students. As mentioned before in this paper, the collected feedback over three consecutive semesters shows that, over 90% of the participating students choose to continue operating their PLE&N platform after their graduation. This commitment by students is clearly aligned with the initial objective of this project which is to showcase how tools like the PLE&N can support life-long learning.

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STUDYING CHALLENGES IN INTEGRATING TECHNOLOGY IN SECONDARY MATHEMATICS WITH TECHNOLOGICAL PEDAGOGICAL AND CONTENT KNOWLEDGE (TPACK)

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ABSTRACT

This paper describes challenges encountered by two secondary mathematics teachers when they try to integrate ICT devices in their classes. These findings are based on using the Technological Pedagogical and Content Knowledge (TPACK) context, the four dimension framework developed by Niess: 1) overarching conceptions of integrating ICT, 2) knowledge of instructional strategies and representations for teaching, 3) knowledge of students' knowledge of technology; and 4) knowledge of curriculum and curriculum materials that integrate technology with learning. By using this analysis, we explore the challenges that teachers face and suggest ways of improving strategies of integrating ICT instruction.

KEYWORDS

Computer Technology in Classrooms; The Technological Pedagogical And Content Knowledge (TPACK), Mathematics And Technology, Teacher Education, Mathematics Secondary.

1. INTRODUCTION

ICT devices have been praised for offering support for performing differentiated instruction, opportunities for collaboration, and ways to engage multiple intelligences for teaching and learning (Kelly & Tangney, 2006; Stoilescu, 2005). More specifically, in the case of mathematics education, integrating ICT in mathematics education was often emphasized as providing a major support for teachers and students. Overall, ICT might have positive benefits for classrooms, if educators do not view the use of technology as a panacea and if they are knowledgeably and flexibly adapting ICT to the specific school settings (Kimmel & Deek, 1995; Ringstaff & Kelley, 2002).

Although researchers pointed out that computers might be used in education to improve learning outcomes (Roschelle, Pea, Hoadley, Gordin & Means, 2000), this is not easy to accomplish in practice. One of the reasons is that keeping up with the latest technological trends is very difficult for educators. For instance, educators such as Anderson (1992), Kaput (1992) and McRory (2006) have cautioned about the risk of ICT devices becoming obsolete in short time. In addition, because of the high cost of periodically purchasing software, there is a growing pressure for educators to produce better student learning outcomes.

In studying preservice teachers in mathematics, Niess (2005) recommends that the

TPACK framework should take into account four important aspects:

1. An overarching conception of what it means to teach a particular subject, integrating technology in the learning process;
2. Knowledge of instructional strategies and representations for teaching particular topics with technology;
3. Knowledge of students' understandings, thinking, and learning with technology; and
4. Knowledge of curriculum and curriculum materials that integrate technology with learning.

This article is based on Niess design framework and explores difficulties encountered by teachers when they attempt to use ICT in secondary school mathematics classrooms. As well, the research describe the challenges mathematics teachers have in their efforts to integrate technology in teaching mathematics.

The goals of this research are: to understand existent pedagogical development ideas and pedagogical models of knowledge in the context of integration of technology into mathematics education by experienced teachers; and to document and analyze secondary school mathematics teachers' choices in integrating technology. The main research questions explored here was: What difficulties do teachers have when they try to integrate technology into mathematics classrooms.

2. BODY OF PAPER

2.1 Literature Review

Plair (2008) noticed that teachers that have been long time in the field and were not trained to integrate technology, did not use ICT devices in their classroom. As well, Li (2007), noticed that ICT integration in classrooms would not be positively received by many teachers as they view ICT as chore activity that is not directed with their core teaching goals.

Sugar, Crawley and Fine (2004) recognized that teachers need to have personal reasons of integrating technology. Consequently, when they were satisfied with their results, they did not have any incentives to integrate ICT in their classrooms.

In particular for the mathematics classroom, Healy and Hoyles (2001) noticed that technology posed particular challenges as using ICT was not a guarantee of successful instruction.

2.2 Methodology

This research is a qualitative study based on case studies (Creswell, 1998). I selected a large secondary urban school from Toronto. The school has a large majority of new immigrant students most of them coming from East Asia and East Asia. Data was collected from interviews, class observations and document analysis. Three experienced mathematics teachers with over 15- year experience participated in this study. Due to space limits, in this paper I will present only two teachers. The author discussed with the mathematics teachers different modalities entailed by the integration of computer technology in mathematics curriculum. Teachers' practices varied according to settings. Therefore, he spent a considerable amount of time reading different curricular and educational research literature for the purpose of understanding various solutions designed for these classrooms. Also, I was required to reflect on teaching acts and be able to critically evaluate interactions between teacher, students and group activities in order to understand the role of ICT in the mathematics instruction. In these stages, building, openness and the sense of sharing were essential. The challenges that appeared were classified in the four main categories developed by Niess (2005): a) overall conceptions; b) teacher instructional difficulties; c) student difficulties; and d) technological and curricular issues.

2.3 Findings

2.3.1 Overall Conceptions

Lawrence noticed that some mathematics teachers might be fearful of technology. Especially when the technical support is limited, the teachers should be able to work with technology on their own. Therefore, in order to overcome these difficulties, rigorous preparation is required for any teacher willing to implement computer technologies in classrooms. He said that teachers helped each other:

If people are comfortable with it, they might use it... Secure enough to go to the classroom! Otherwise, they might look stupid and they might not know how to use it... We help each other; we try to help other people but teachers are on their own. They have to learn by themselves, practice by themselves, and learn how to do by themselves. This takes time and effort. You have to learn the technology, how to set it up and how to work it out.

Mark gave the example of Lawrence who, being supported to integrate technology in his classroom, was able to adjust it for his classes, although Lawrence's desire to master every minute detail might delay his plans of integrating new technologies into classrooms:

When I tried to convince him to use computer technology in classroom, he was saying 'No, I have to learn it first.' But he did make an effort, a few years ago, when I asked him to use Fathom in data management classes. He made the effort but he did it in his way. He learned it first and then he studied it in class. But he realized that I was right in the first place. That he really did not know it as an expert... He needs to know something, a little bit; how to turn it on and how to run the program. That's about it. Now he is doing it. He does not need to be an expert in that specific technology. Nobody needs to be an expert but everyone has to take the risk.

2.3.2 Teacher Instructional Difficulties

While I observed Mark teaching, I noticed that the abstract part of mathematics does benefit from technology. For instance, he used a lot of technology when he taught geometry in the course Calculus and Vectors. He taught using Fathom and the Geometer's Sketchpad software. He was committed to integrating technology and to keeping the most difficult parts of mathematics in the course: abstract math, math as an art, and living as a mathematician. I asked for details about specific ways of teaching, what his goals are, and how he is trying to get these objectives accepted:

I would like to have the whole picture. I want to know what the school is... Where the main efforts are going. ... What the ministry is trying to do. I am trying to be aware of these changes in the curriculum, and changes to approaches of delivering the curriculum. Sometimes, it is a struggle to discuss with parents because some [parents] have not been to school for years. There are also other challenges. To give you particular examples, about ten years ago, the ministry introduced the new assistant evaluation approaches. It was written into the curriculum how we are supposed to evaluate the students. Not just what the students are supposed to know at the end of each course, but how it is supposed to be delivered and how it is supposed to be evaluated. As I said, this was ten years ago and the debate is still on. There are schools where still this has not been accepted.

For Mark, the technology is not helpful when someone is trying to substitute the "beauty of thinking" on mathematics with computer technology. However, the technology might help in understanding even the most abstract aspects of mathematical thinking:

What the technology does not discuss is the art part of the mathematics where there is beauty of just thinking about the mathematics problem and sometimes we do not want the technology to spoil the thinking, and it is possible... all I am saying is that sometimes, there are areas of math where the technology cannot go, or it is not there yet. But the question is: do we need it there? I personally would not do it.

Lawrence and Mark acknowledged that cutting Grade 13 from the Ontario curriculum left students unprepared for university, in particular for mathematics. Mark described his concern:

The curriculum changes, so it may not be simple to compare the level of achievement but, when I started working in 1997, we still had that five-year program. The students were more mature. Then we had to change the programs. There are now visible changes in our school.

2.3.3 Student Difficulties

When Lawrence was asked about Grade 9 students, he mentioned that "they seem to understand concepts but they cannot do anything with them". He was aware of the process of selecting students in applied mathematics courses and believed that the current strategies of integrating technology are getting more effective for them:

Nine applied are never strong. But I think that [by integrating technology], they get to learn more. I cannot prove that. But I think that their EQAO scores are a little better, which means that the program is actually working. The classes are going now a little smoother and the students are less nasty, mean, or belligerent. They are more focused if they are going better.

When I asked Lawrence about his Grade 12 students who registered for the Advanced Functions course, he stated that being at this stage means that they will pursue higher education degrees. They were described as gifted and able to accomplish complex mathematical problems:

This is a different matter. I treat them like university students. I try to give them interesting problems. I try to challenge them. I try to give them problems that are not obvious. Something that requires a bit of thought so they can play around with it. So I like to make them puzzles. ... The textbook is pretty straightforward. I try to make them more open-ended.

2.3.4 Technical and Curricular Issues

Although integrating computer technology gave teachers some major advantages in mathematics instruction, these attempts were not without challenges. Teachers had some problems with technology and with instructing students with computers. In the first section, we will present each of these cases separately. In the second section, we will discuss the four-layer framework analysis with samples from all teachers together. When I asked him about different technologies that he might consider in teaching for the next semester, Lawrence mentioned Gizmos as an important tool for assessment and instruction fit for use in his classrooms. Not much in this moment. The only thing I see is using Gizmos, so they can set up to learn by using computer tutorials. Graphically, they visualize, they do problems. And there are a lot of problems, a lot of Gizmos. I used a few, but I think that this is going to be a thing in the future. Using these little programs called Gizmos. But that requires that the kids have individual computers. I can bring one computer only in a regular classroom, so I have to bring them to the lab. And to have everybody work on that it is a bit of a problem. There are not many labs. It's only one lab. You got to share.

3. CONCLUSION

3.1 Summary of Difficulties by Using the TPACK Four-Layer

3.1.1 Overall Conceptions

The teachers experienced some dissonance between their theoretical and practical conceptions. For instance, as they were recently trained in Web2.0, we expected to see them working on implementing Web 2.0 technologies in their classrooms. It appeared that these technologies required a new teaching paradigm that the teachers did not know how to implement easily. These teachers clearly wanted to use technology in their classrooms. For example, they thought that working with graphic calculators was important, although there was no general consensus on how it could be used. The issue of appropriate use of calculators was divided between keeping them as they are, bringing in a new generation of graphic calculators, or replacing them with personal computers.

3.1.2 Teacher Instructional Difficulties

In the TPACK framework, these challenges are located at the intersection between pedagogy, content, and context. Some of the teachers' challenges were caused by the change of software and hardware. When the software or hardware used by teachers change, then teachers need time to update their skills (Galbraith et al., 2001). For instance, the present version of Geometric Sketchpad is very different from the older versions on which these teachers were trained. The new version is more complex and has some different features. Because the geometry curriculum has been reduced drastically, the importance of Geometer's Sketchpad has decreased. Another discrepancy was noticed in the Advanced Functions course, where many problems from the current textbook were solved with Geometric Sketchpad, but Mark chose to solve these problems using Fathom software, which was not mentioned at all in the textbook. An adequate textbook for this course would make the Geometric Sketchpad software less necessary and would require the inclusion of the Fathom. Some curriculum areas were not covered with current software products. These made teachers feel uneasy. For instance, in the Calculus and Vectors course, there was no software to cover the second half of the course. Therefore, Mark had to use several software products for different lessons. This approach could not be followed by many teachers as becoming familiar with the content of this course was not covered by any workshop or seminar and was an individual effort.

3.1.3 Student Difficulties

Students had specific challenges in the process of integrating technology. Studies from Niess (2005) and Mishra and Koehler (2008) acknowledged a specific role for students. Although students were familiar, in general, with computer technology, the adaptation to specific mathematic tools should not be taken for granted (Drier, 2001; Ronau et al., 2008). For instance, in the Data Management Grade 12 course, the use of Excel, PowerPoint, and Word presented some challenges when students started to use them for the project. Sometimes, they had difficulties inserting mathematical formulae; sometimes they had difficulty integrating data in their project with previous texts, presentations, and game scenarios.

The Grade 9 Applied students had numerous challenges. On some occasions, the students from the Grade 9 Applied course were not able to use graphic calculators for assignments. Instead, they tried to avoid the use of graphic calculators and solve the problems on paper only. When they were brought into the computer lab, they attempted to use technology for things unrelated to learning mathematics. For instance, some of them preferred to look for games, videos, or music and the teacher had a hard time trying to convince them to keep their focus on working on the mathematical software. Some students were using the graphic calculators and computers carelessly. This triggered the teachers to ask them to be more responsible when they use technology. These experiences are different for different courses, students and teachers, and they represent important aspects that need to be considered when teachers attempt to integrate technology in the classroom.

3.1.4 Technical and Curricular Issues

In the TPACK framework, these challenges intersect between technology and context. Some limitations were due to challenges posed by the technology, either hardware or software problems. For instance, although the prices have dropped significantly for equipment and software, purchasing technology still remains challenging for public schools. In addition, the technology becomes outdated quickly (McCrorry, 2006) so other financial efforts are required to purchase new equipment. Teachers commented that financial aspects were seriously considered in purchasing computer technology as the price for some products were prohibitive. In addition, there were some issues with the manipulation of the technological devices. For instance, some students dropped the graphic calculators on the floor and this might reduce their functionality over time. Some graphic calculators ran out of batteries and some had deteriorated. The teachers used different versions of the software from that used in the examples in the textbooks. However, these were reasonable challenges and the teachers were able to fix or work with them.

A considerable problem was the lack of computer technology. If all of the teachers were determined to integrate technology in their classrooms, the school could not afford to have all of these technologies and use them simultaneously. Therefore, as noted in Maor's study (2003), the IT infrastructure represented a serious problem that teachers had to consider. The software generated an important number of challenges. The software was not always able to help students. Mark stated that some units did not offer many possibilities for using computer technology with the students. Each course had some areas where no actual computer technology could have any impact on student learning.

3.1.5 Summary of Challenges

The process of integrating technology in mathematics classrooms posed various types of challenges that were found on all four layers of analysis. Sometimes there were problems with the technology, sometimes the curriculum did not afford much support for learning by using software, and sometimes students or teachers themselves were challenged. Still, the teachers felt that the technology offers opportunities for supporting students' learning and technology is helpful for teaching and assessments. The two teachers displayed a strong understanding of challenges that might appear in the use of technology in mathematics instruction. In addition, their experience in using technology, in teaching mathematics, and in integrating technology in mathematics gave them confidence and supported their pedagogical efforts to integrate computer technologies in mathematics classrooms. This evidence was demonstrated in multiple forms: teaching activities, class assignments, interactions between teachers and students, and interviews and discussions about using technology in mathematics. The teachers mentioned that, despite these challenges, the role of technology was still engaging for their students and that computer technology is requested in their classrooms.

Similar to Harris's (2008) description of experienced teachers linking the integration of technology with spontaneity, Lawrence mentioned:

I always read my students. When I teach a class, if I know that they do not know anything about what I am talking about, I stop teaching that... Because you got to be flexible, you got to be adaptable. You got to read the situation, you got to read the people.

3.1.6 Discussions

Why are so few teachers currently integrating technology in secondary school classrooms (Cuban, 2001), particularly in mathematics classrooms? This study did not explore the root causes that make technology difficult to be integrated in mathematics curriculum. Rather, this research was focused on successful practices of integrating technology in mathematics, revealing both individual and institutional efforts that made these attempts possible.

Perhaps it might be argued that some software products such as Excel and PowerPoint are easy to use because teachers have been using them in other contexts before. Other software products such as SMART Boards or TI-Nspire Graphic Calculators might be new and require some training. For some specific software products for mathematics curriculum, such as Fathom or the Geometer's Sketchpad, an extensive period of training is required. These are cases when software requires an extensive period of learning, training, and assistance in teaching them in the classroom and therefore teachers should consider them attentively.

PD programs for mathematics teachers should provide more opportunities to help the teachers integrate technology in the classroom. Mark mentioned that the workshops and seminars only trigger an interest in a specific problem. Indeed this is the case for an experienced math teacher who has already taught using computer technologies in the classroom. But the problem is different for a teacher who has not yet tried to use computer technology in their teaching.

Technical support is very important. For teachers who have strong expertise in computers, it was fine to have technologists from outside the school to support them. However, for teachers who were new to technology, this could be frightening. Therefore, for new teachers, maybe the technological support should be embedded in the school in order to encourage them to efficiently use technology in classrooms.

Therefore, it is very important to establish mentorship relationships with teachers who are already comfortable with computers in teaching mathematics. It is essential to establish collaboration between technical support staff and teachers in order to solve various technological issues. The administration of the school should support efforts to integrate computer technologies in mathematics classrooms. Likewise, time should be allowed for designing and integrating technology in classrooms (McDougall, 1997). In addition, a more specific agenda for sharing ideas, skills, and computational resources should be considered.

As the teachers mentioned, they are left alone most of the time to teach. This might explain why other teachers did not succeed in implementing technology in the classroom. Therefore, in order to be able to integrate new technologies and use them efficiently in front of the class, teachers need to be helped to develop planning, collaboration, and determination. They should be able to reflect on strategies, representations, and visions that make purposeful use of a specific technology for their students.

A major problem is that, although the integration of technology in education has been recommended for almost three decades, in fact this process of integration is still not implemented on a large scale. The process of integrating technology has not penetrated every school as expected. This is due to different reasons. At the beginning, the main reason was the high costs required. Now, it seems to be that the main reason is that the integration of technology is still an option and therefore teachers can delay whenever they wish. Unfortunately, as Mark, this process of integrating technology in curriculum still remains at the stage of recommendation. This lack of specific deadlines might trigger a lack of planning and clarification for the specific use of computer technology. This might be because of lack of clear guidelines for integrating technology in mathematics classroom from teachers, administrators, or the school board.

Teaching is an iterative process (Koehler & Mishra, 2008) and, as the models of Rogers (1996) describe, the technology takes different stages of integration. Therefore, I see the process of integrating technology as an important and sustained leadership effort that needs to be carefully planned. More precisely, teachers and administrators should consider a long term perspective in plans to implement technologies into classroom.

The technology is changing fast and therefore it will always remain a challenge implementing in purposeful way in mathematics education. As Grandgenett (2008) recommends, in order to provide adequate training for inservice and preservice teachers, the goals of the instruction should flexibly target teachers to help foster their skills and attitudes in using technology in thoughtful ways.

As Mishra and Koehler (2007) note, "teachers construct curricula through an organic process of iterative design and refinement, negotiating among existing constraints, to create contingent conditions for learning"

(p. 2222). This was also noticed in this study as using technology produced major changes in teaching. For instance, the mode of teaching and the assignment procedures were totally changed from a traditional classroom where the teacher talks and writes on the blackboard. In addition, the technology changed the way students interacted. As a result, the roles of collaborative and cooperative strategies were redesigned.

The technology changed the control and the management of classrooms. For instance, by making digital resources available to students, the students had access to them to learn without any effort from teachers. In their turn, the teachers interacted with students only at critical points when they needed specific advice or coordination. These strategies are developing over time. As Koehler and Mishra (2008) suggest, the preparation of teachers should be a spiral process, starting first with technologies that are simple and familiar to them. They might extend afterward with products of increasing difficulty. Therefore, aspects of and strategies for time management, interaction, and collaboration should be carefully considered in integrating technology.

The major contribution in this study was to explore effective integration of computer technology in mathematics education. This study shows two different ways of integrating technology in classroom. The teacher participants in this research have different personal, pedagogical and technical backgrounds. In order to teach their students mathematics, they used different technologies or use the same computer device differently. Yet, they were able to show, in different ways, that their pedagogical approaches of integrating technology in mathematics classrooms remain successful.

This study makes three main contributions to the research in mathematics teaching:

1. To help teachers develop pedagogical skills and also a conceptual understanding in integrating technology in mathematic classrooms,
2. To learn more about TPACK and how it is designed as a theoretical and practical approach in assisting secondary school mathematics teachers better understand how to use technology tools in teaching mathematical concepts, and
3. To identify secondary school mathematics teachers' challenges with using educational technologies in classrooms, as they investigate pedagogical and technical issues and modalities designed to improve mathematical teaching and learning skills.

It is important to have teachers be skillful in mastering computer techniques and be able to show these to students. In this research, I found that it is important to have in a mathematics department a critical number of teachers who are interested in integrating technology in the classroom. Without fostering an adequate support group, teachers have various individual interests and would not be able to implement technology in classrooms. Teaching with technology requires interactions with colleagues and teamwork. As Gopalakrishnan (2006) states, "Individuals from both educational and technical orientations can support teachers with technology integration as long as they are able to 'translate' between the two domains and work with users of varying technical abilities" (p. 54). Therefore, it is very important to establish mentorship relationships with teachers who are already comfortable with computers in teaching mathematics. It is essential to establish collaboration between technical support staff and teachers in order to solve various technological issues. The administration of the school should support efforts to integrate computer technologies in mathematics classrooms. Likewise, time should be allowed for designing and integrating technology in classrooms (McDougall, 1997). In addition, a more specific agenda for sharing ideas, skills, and computational resources should be considered. As the teachers mentioned, they are left alone most of the time to teach. This might explain why other teachers did not succeed in implementing technology in the classroom. Therefore, in order to be able to integrate new technologies and use them efficiently in front of the class, teachers need to be helped to develop planning, collaboration, and determination. They should be able to reflect on strategies, representations, and visions that make purposeful use of a specific technology for their students.

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takes different stages of integration. Therefore, I see the process of integrating technology as an important and sustained leadership effort that needs to be carefully planned. More precisely, teachers and administrators should consider a long term perspective in plans to implement technologies into classroom. The technology is changing fast and therefore it will always remain a challenge implementing in purposeful way in mathematics education. As Grandgenett (2008) recommends, in order to provide adequate training for inservice and preservice teachers, the goals of the instruction should flexibly target teachers to help foster their skills and attitudes in using technology in thoughtful ways. As Mishra and Koehler (2007) note, “teachers construct curricula through an organic process of iterative design and refinement, negotiating among existing constraints, to create contingent conditions for learning” (p. 2222). This was also noticed in this study as using technology produced major changes in teaching. For instance, the mode of teaching and the assignment procedures were totally changed from a traditional classroom where the teacher talks and writes on the blackboard. In addition, the technology changed the way students interacted. As a result, the roles of collaborative and cooperative strategies were redesigned. The technology changed the control and the management of classrooms. For instance, by making digital resources available to students, the students had access to them to learn without any effort from teachers. In their turn, the teachers interacted with students only at critical points when they needed specific advice or coordination. These strategies are developing over time.

As Koehler and Mishra (2008) suggest, the preparation of teachers should be a spiral process, starting first with technologies that are simple and familiar to them. They might extend afterward with products of increasing difficulty. Therefore, aspects of and strategies for time management, interaction, and collaboration should be carefully considered in integrating technology. The major contribution in this study was to explore effective integration of computer technology in mathematics education. This study shows two different ways of integrating technology in classroom. The teacher participants in this research have different personal, pedagogical and technical backgrounds. In order to teach their students mathematics, they used different technologies or use the same computer device differently. Yet, they were able to show, in different ways, that their pedagogical approaches of integrating technology in mathematics classrooms remain successful. This study makes three main contributions to the research in mathematics teaching: 1. To help teachers develop pedagogical skills and also a conceptual understanding in integrating technology in mathematic classrooms, 2. To learn more about TPACK and how it is designed as a theoretical and practical approach in assisting secondary school mathematics teachers better understand how to use technology tools in teaching mathematical concepts, and 3. To identify secondary school mathematics teachers’ challenges with using educational technologies in classrooms, as they investigate pedagogical and technical issues and modalities designed to improve mathematical teaching and learning skills.

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BUILDING BETTER DISCIPLINE STRATEGIES FOR SCHOOLS BY FUZZY LOGICS

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ABSTRACT

This study aims to realize better discipline strategies for applying in high schools. We invited 400 teachers to participate the survey and collected their perceptions on the discipline strategies in terms of the acceptance of strategies and their effectiveness in schools. Based on the idea of fuzzy statistics, this study transformed the fuzzy interval data by way of fuzzy means, fuzzy centroids, and fuzzy distances to select better discipline strategies. The result reveals, in positive discipline domain, the high acceptable and effective strategies are “praise student in oral frequently”, following “integrated life events in classroom management”, “grant awards, small merit, and work incentives”, and “leading students to participate volunteering activities”; In general discipline domain, the high acceptable and effective strategies are “notify parents to associate to solve”, then “adjusting students’ seating”; In special discipline domain, there is no high acceptable and effective strategies available. The selected discipline strategies might be used to improve the current issues in high schools.

KEYWORDS

High schools, teacher perception, discipline strategies, positive discipline, fuzzy statistics, fuzzy distance

1. INTRODUCTION

In 2006, “Zero Corporal Punishment” Act had put into gear in Taiwan. The Act provides a new direction that teachers cannot use corporal punishment anymore in campus. Consequently, the traditional discipline, which teachers depended on for a long time, was withdrawal from schools. While the new discipline strategies did not well develop yet. Teachers always respond that the decline in families and social values made their task more difficult, and sometime impossible. According to the Ministry's report, 2011 statistics of school discipline events, the number of serious conflicts rose in campus from 78 in 2003 to 377 in 2010 (Ministry of Education, 2011). The conflict growth rate indicates up to 4.8 times in this period. Among the conflicts, 45% is in high school level (Yan, 2010). When the students’ problems become increasingly complex in schools, the teachers have no choice should face the music. How to find a better way to deal with the problem? How to lead teachers to face the discipline problems has cause public concerns. Schools may need more proper strategies for improving discipline problem, essentially, it need to get all staff, parents, and the community to involve the issue (Blandford, 2005). Nonetheless, what kind of discipline strategies are more acceptable by teachers? Which discipline strategies are more effective in schools? This study aims to detect the acceptance and effectiveness of discipline strategies.

2. LITERATURE REVIEW

Discipline has been defined as teachers for educational purposes, dealing with their students’ behaviors, which includes various advantages or disadvantages enacted by collective or individual treatments. From the behavior control’s view, the control influences can be classified as rewards and punishments. For example, rewards include bonuses, prizes, give praise, and excellent reviews; however, punishments contain blaming, warning,

impose a mental or physical suffering (Etzioni, 1975). Lindgren and Suter (1985) pointed that discipline is controlled through coercion, obedience, and punishment. Wolfgang (1995) thought discipline is when students' behaviors disrupt educational activities or violate general social norms or laws, school teachers or administrators take the necessary actions to treat them. Specifically, Charles' (1999) point of discipline refers to teachers help students to do well in school, the purpose is to prevent, terminate, and guide their misconducts. The ultimate goal is appropriated to help students control their behaviors and reduce teacher's intervention. Better discipline strategies may refer to teachers realize the right of education, the aims of education, students' proper behaviors. Charles (1999) suggested that the treatment system should be consolidated into the following three dimensions:

(1) Preventive discipline refers to providing interesting content in the classroom, when students engage in the designed activities, they have no time to undertake improper behaviors.

(2) Supportive discipline refers to helping students to back to their jobs, enabling them to achieve self-control. (3) Corrective discipline refers to termination of students' inappropriate behaviors, resetting their acceptable behaviors while retaining their dignity.

Previous studies have listed kinds of discipline strategies that teachers often adopted as Table 1 (Lin, 2004).

Table 1. Listing the teachers' discipline strategies listed in literature

No.	Discipline strategies	No.	Discipline strategies
1	Encourage good performance	10	Role play
2	Persuasion	11	Inform their parents
3	Individual talks	12	Referrals to other professional organizations of guidance
4	Boot behavior problems in class review	13	Penalty for repeatedly copying activities
5	Small group counseling	14	Increased labor loading
6	Temporarily ignoring their inappropriate behaviors	15	Deprivation of their physiological needs
7	Transfer their focus	16	Impose labor on their body
8	Use of community sanctions issues	17	Inflict pain on their body
9	Value clarification		

In 2006, the "Basic Education Act" amendment in the 8th and 15th related to "prohibition of corporal punishment" has clearly designated that government should protect students from corporal punishment in schools. Taiwan became the 109th nations that the legislative decision must implement zero corporal punishment in schools. The government has also initiated a "Positive Discipline Plan" for school teachers. But school teachers still worried about the related measures that announced by the Ministry of Education might be ineffective. Teachers always stand in the first line and face to their students. What are they really concern? Following the related "Acts", "Guidelines", and "Measures" for school discipline, we integrated the related strategies by their timing and fittest to students. Then, we classified the strategies into the following three domains: positive, general, and special discipline, see Table 2. In this study, we would like to know how the teachers' view on the related discipline strategies.

3. METHODS

3.1 Research Framework

Figure 1 demonstrates the framework of the teachers' perception on the discipline strategies under the fuzzy measurement. The strategy selection follows the fuzzy logics. By way of fuzzy questionnaires, this study corrected teachers' perceptions on acceptance and effectiveness of the strategies and transformed the data to select better discipline strategies for schools.

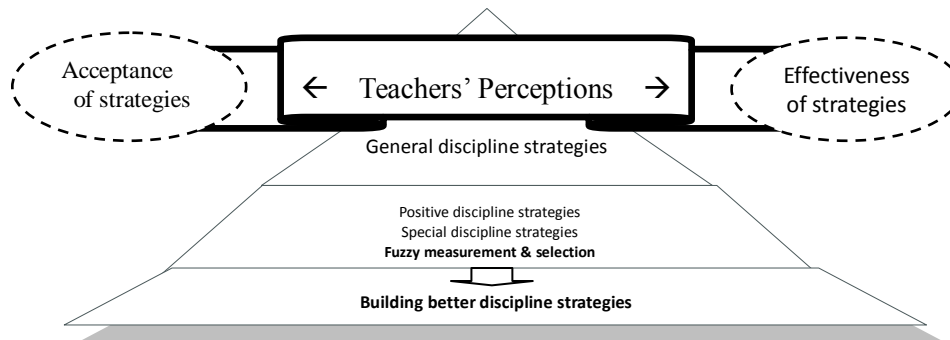


Figure 1. Logics of selecting the school discipline strategies

3.2 Instrument Design

In initial stage, we collected 29 related discipline strategies which based on the literature review. After inviting seven professors/experts to provide their comments, we follow their suggestions to delete improper strategies. Finally, the selected 20 discipline strategies were assigned to “positive discipline”, “general discipline”, or “special discipline” domain respectively, see Table 2.

Table 2. Classify the discipline strategies to related domain

Classification	Codes	Discipline strategies
Positive discipline	1-1	Integrated life events in classroom management
	1-2	Leading students to participate volunteering activities
	1-3	Praising students in oral frequently
General discipline	1-4	Grant awards, small merit, and work incentives
	2-1	Using student’s oral apology
	2-2	Using student’s written introspection
	2-3	Adjusting student’s seating
	2-4	Asking students to stand to reflect
	2-5	Increasing student’s proper job (such as penalty wrote)
	2-6	Asking students to participate public services (such as play a daily helper)
	2-7	Notify parents to associate to solve
	2-8	Deferring students to stay after school
	2-9	Depriving students class miss time
Special discipline	2-10	Giving a warning, a small or a big punishment
	3-1	Asking for assistance from the office of student affairs
	3-2	Asking for assistance from the office of student counseling
	3-3	Transfer students to other school
	3-4	Handed over their parent to implement bring-back-discipline for five days
	3-5	Offering high-risk-caring courses
	3-6	Asking for assistance from the police office

3.3 Fuzzy Questionnaire

The designed questionnaire includes 20 items which have been divided into the following three domains: positive, general, and special disciplines. The participants were asked to fill the questionnaire as our fuzzy format. The examples of completing the questionnaire are listed as follows:

Direction: The following questions are related to discipline strategies. We need your opinions on the acceptance and effectiveness of these discipline strategies. Please circle the number representing your opinion of acceptance and effectiveness of these discipline strategies. If you feel the possible acceptance of positive discipline strategy is 4–6 on the scale of 1–7, then please fill your numbers 4 and 6. If your selection of effectiveness of positive discipline strategy is from 6 to 7, it means your judgment of the possibility of the effectiveness is 6 to 7 on the scale. Figure 2 refers to your perceptions on the positive discipline strategy.

<u>Degree of Acceptance</u>							<u>Degree of Effectiveness</u>						
1	2	3	○, 4	5	○, 6	7	1	2	3	4	5	○, 6	○, 7

Figure 2. The examples of fuzzy questionnaire for selecting discipline strategies

This study randomized 16 high schools in New Taipei city and invited 400 high school teachers to participate this survey. Finally, there are 347 valid questionnaires available in this study.

3.4 Fuzzy Statistics

Fuzzy statistics is a useful tool for measuring ambiguous concepts in science and social science (Hsu & Wu 2010; Chang 2007; Samatsu, Tachikawa & Shi 2010). Fuzzy set concepts were proposed by Zadeh and applied to fuzzy measurement to contend with the dynamic environment which will provide a more reasonable description of numerous data transformation (Sun & Wu 2007; Zadeh 1968). The idea of membership function allows the studies transform their data and interpret from crisp to interval data. Following the concept, this study designed a fuzzy survey to deal with the issues of discipline strategy selection in high schools. This study applied fuzzy means, centroids of fuzzy numbers, and fuzzy distance to transform fuzzy interval data. The definitions and their calculations are listed as follows:

Definition 1. Fuzzy means (data with interval values) (Nguyen & Wu, 2006):

Let U be the universal set and $\{Fx_i = [a_i, b_i], a_i, b_i \in R, i = 1, \dots, n\}$ be a sequence of random fuzzy samples on U . The fuzzy sample mean is then defined as

$$F\bar{x} = \left[\frac{1}{n} \sum_{i=1}^n a_i, \frac{1}{n} \sum_{i=1}^n b_i \right]$$

Membership function can be used to explain the idea of the triangular fuzzy numbers. Let's display two triangular fuzzy numbers, one is [1,3,5] and the other is [4,5.5,7]. We can use the idea of membership function to determine their centroids. In the fuzzy measurement, the centroid represents 1.0 in terms of its membership function is 100% to fit. We can use the centroids to determine the weights of fuzzy means.

Definition 2. Distance between samples of interval-valued data (Chang, 2012):

Let U be the universe of discourse. Let $\{\chi_i = (a, b, c), i = 1, 2, 3\}$ be three samples from U , with the center

$$C_i = \frac{a_i + b_i + c_i}{3}, \quad h_i = 1, \quad \text{and area } A_i = \frac{(c_i - a_i) * h_i}{2}. \quad \text{The distance between the triangle samples } \chi_1 \text{ and } \chi_2$$

is defined as $\chi_1 \rightarrow [C_1, A_1]$, and $\chi_2 \rightarrow [C_2, A_2]$. Therefore,

$$d(\chi_1, \chi_2) = |C_i - C_j| + \left| \frac{\ln(1 + |A_i|)}{|A_i|} - \frac{\ln(1 + |A_j|)}{|A_j|} \right|$$

This study analyzed the acceptance and effectiveness of discipline strategies. We applied fuzzy means, centroids, and fuzzy distances to interpret the fuzzy interval data related to the discipline strategies.

Example 1. The fuzzy means: Let $x_1=[3,5]$, $x_2=[2,4]$, $x_3=[4,6]$, $x_4=[5,7]$, and $x_5=[5,7]$ be the perception of acceptance of discipline strategy by five teachers with fuzzy interval. Thus, the fuzzy mean for their perceptions estimated as

$$\overline{F\bar{x}} = \left[\frac{3+2+4+5+5}{5}, \frac{5+4+6+7+7}{5} \right] = [3.8, 5.8]$$

Example 2. How to calculate the fuzzy distance between acceptance and effectiveness? Let two sets of interval data be $\chi_1=[2,4,6]$ and $\chi_2=[4,5,5,7]$, then $\chi_1=[(2+4+6)/3, (6-2)/2]=[4,2]$, $\chi_2=[(4+5.5+7)/3, (7-4)/2]=[5.5;1.5]$. We can get the following fuzzy distance:

$$d(\chi_1, \chi_2) = |4 - 5.5| + \left| \frac{\ln(1+2)}{2} - \frac{\ln(1+1.5)}{1.5} \right| = 1.53$$

4. RESULTS

4.1 Acceptance of Discipline Strategies

After transforming the fuzzy data, we found teachers perceive that “praise students in oral frequently” (C=5.91) is the most acceptable strategy, following “integrated life events in classroom management” (C=5.81) and “leading students to participate volunteering activities” (C=5.61). The least one is “grant awards, small merit, and work incentives” (C=5.56) in positive discipline domain, see Table 3.

In general discipline domain, teachers think that “notify parents to associate to solve” (C=5.41) for most acceptable strategy, following are “adjusting students’ seating” (C=5.37), “asking students to participate public services (such as play a daily helper)” (C=5.31), “using student’s oral apology” (C=5.23), “using student’s written introspection” (C=5.17), “asking students to stand to reflect” (C=4.99), “increasing student’s proper job (such as penalty wrote)” (C=4.92), “giving a warning, a small or a big punishment” (C=4.76), “deferring students to stay after school” (C=4.74), and “depriving students class miss time” (C=4.65).

In special discipline domain, the teachers view “asking for assistance from the office of student affairs” (C=5.18) is the most acceptable strategy, then “asking for assistance from the office of student counseling” (C=5.06), “asking for assistance from the police office” (C=4.98), “offering high-risk-caring courses” (C=4.82), “handed over their parent to implement bring-back-discipline for five days” (C=4.69), and “transfer students to other school” (C=4.64).

Overall, the teachers view our selected discipline strategies at medial level or above in our fuzzy scale 1-7. The average of positive discipline domain (C=5.72) is higher than both general discipline (C=5.06) and special discipline domain (C=4.90).

4.2 Effectiveness of the Discipline Strategies

The result reveals that the most effective discipline strategy is “praising students in oral frequently” (C=5.44). The other effective discipline strategies are as follows: “integrated life events in classroom management” (C=5.33), “grant awards, small merit, and work incentives” (C=5.18), “asking students to participate public services (such as play a daily helper)” (C=5.08), “notify parents to associate to solve”, and “adjusting student’s seating” (C=5.01), see Table 3.

Table 3. Teachers' perceptions on acceptance and effectiveness of the discipline strategies

Classification	Codes	Fuzzy Means (Acceptance)	Centroids	Rank	Fuzzy means (Effectiveness)	Centroids	Rank
Positive discipline	1-1	[4.91,6.04]	5.81	2	[4.76,5.54]	5.33	2
	1-2	[4.74,5.82]	5.61	3	[4.18,5.31]	5.08	4
	1-3	[5.05,6.14]	5.91	1	[4.54,5.67]	5.44	1
	1-4	[4.68,5.79]	5.56	4	[4.31,5.40]	5.18	3
General discipline	2-1	[4.33,5.46]	5.23	4	[3.76,4.87]	4.64	7
	2-2	[4.27,5.40]	5.17	5	[3.78,4.89]	4.66	6
	2-3	[4.46,5.61]	5.37	2	[4.12,5.24]	5.01	1
	2-4	[4.06,5.24]	4.99	6	[3.71,4.84]	4.60	9
	2-5	[4.00,5.17]	4.92	7	[3.70,4.86]	4.61	8
	2-6	[4.39,5.55]	5.31	3	[3.95,5.11]	4.87	3
	2-7	[4.49,5.66]	5.41	1	[4.11,5.25]	5.01	1
	2-8	[3.82,4.98]	4.74	9	[3.91,5.03]	4.80	4
	2-9	[3.76,4.88]	4.65	10	[3.86,4.99]	4.76	5
	2-10	[3.86,5.00]	4.76	8	[3.65,4.81]	4.57	10
Special discipline	3-1	[4.27,5.42]	5.18	1	[3.93,5.05]	4.82	2
	3-2	[4.15,5.30]	5.06	2	[3.78,4.91]	4.67	3
	3-3	[3.76,4.87]	4.64	6	[3.62,4.70]	4.48	4
	3-4	[3.79,4.93]	4.69	5	[3.45,4.57]	4.34	6
	3-5	[3.91,5.06]	4.82	4	[3.58,4.69]	4.46	5
	3-6	[4.08,5.22]	4.98	3	[4.02,5.13]	4.91	1

4.3 Finding the Harmonizing between Acceptance and Effectiveness

This study applied fuzzy distances to determine better harmonizing between acceptance and effectiveness of the discipline strategies. Fuzzy distances were calculated by the formula in Definition 2. The fuzzy distance was defined by the center of acceptance minus the center of effectiveness which was calculated by its fuzzy measurement respectively. The results of fuzzy distance measurement show in the Table 4. Which one is the best strategy? The result reveals there are six strategies listed in the high acceptance and high effectiveness dimension, see the codes 1-1, 1-2, 1-3, 1-4, 2-3, and 2-7 in Table 5. Most of them belong to positive discipline strategies. We also found there are five discipline strategies belong to high acceptance and moderate effectiveness. These discipline strategies may suggest for high school teachers.

5. CONCLUSION

Discipline issues have disturbed most of teachers for a long time. Since the "Zero Corporal Punishment" Act put into gear, there is only one way to go building better discipline strategies for teachers. In this study, we applied fuzzy measurement to determine which discipline strategies fit to schools. The participants provide a lot of useful information for us to make a better decision to select discipline strategies. According to the fuzzy data transforming, we suggest six high acceptable and effective discipline strategies for teachers. The suggestion also goes to the further related studies to take advantage to deal with fuzzy measurement.

Table 4. The distance between acceptance and effectiveness of discipline strategies

Classification	Codes	Discipline strategies	Fuzzy Distance* $D=C_a-C_e$	Ranking in Domain	Ranking in Total
Positive discipline	1-1	Integrated life events in classroom management	0.48	2	16
	1-2	Leading students to participate volunteering activities	0.54	4	19
General discipline	1-3	Praising students in oral frequently	0.49	3	17
	1-4	Grant awards, small merit, and work incentives	0.38	1	11
	2-1	Using student's oral apology	0.59	10	20
	2-2	Using student's written introspection	0.51	9	18
	2-3	Adjusting student's seating	0.36	5	8
	2-4	Asking students to stand to reflect	0.38	6	11
	2-5	Increasing student's proper job (such as penalty wrote)	0.31	4	6
	2-6	Asking students to participate public services (such as play a daily helper)	0.44	8	15
	2-7	Notify parents to associate to solve	0.40	7	14
	2-8	Deferring students to stay after school	0.07	1	1
Special discipline	2-9	Depriving students class miss time	0.10	2	3
	2-10	Giving a warning, a small or a big punishment	0.20	3	5
	3-1	Asking for assistance from the office of student affairs	0.36	4	8
	3-2	Asking for assistance from the office of student counseling	0.38	6	11
	3-3	Transfer students to other school	0.16	2	4
	3-4	Handed over their parent to implement bring-back-discipline for five days	0.35	3	7
	3-5	Offering high-risk-caring courses	0.36	4	8
	3-6	Asking for assistance from the police office	0.07	1	1

*Note. $D=C_a-C_e$ in terms of the distance D equals to center of acceptance minus the center of effectiveness calculated by fuzzy measure.

Table 5. Suggested strategies for high school teachers

Classification	Codes	Discipline strategies	Moderate A&E	High A& Moderate E	High A&E
Positive discipline	1-1	Integrated life events in classroom management			✓
	1-2	Leading students to participate volunteering activities			✓
General discipline	1-3	Praising students in oral frequently			✓
	1-4	Grant awards, small merit, and work incentives			✓
	2-1	Using student's oral apology		✓	
	2-2	Using student's written introspection		✓	
	2-3	Adjusting student's seating			✓
	2-4	Asking students to stand to reflect	✓		
	2-5	Increasing student's proper job (such as penalty wrote)	✓		
	2-6	Asking students to participate public services (such as play a daily helper)		✓	
	2-7	Notify parents to associate to solve			✓
	2-8	Deferring students to stay after school	✓		
Special discipline	2-9	Depriving students class miss time	✓		
	2-10	Giving a warning, a small or a big punishment	✓		
	3-1	Asking for assistance from the office of student affairs		✓	
	3-2	Asking for assistance from the office of student counseling		✓	
	3-3	Transfer students to other school	✓		
	3-4	Handed over their parent to implement bring-back-discipline for five days	✓		
	3-5	Offering high-risk-caring courses	✓		
	3-6	Asking for assistance from the police office	✓		

Note. A=acceptance, E=effectiveness

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ASSESSING CRITICAL THINKING PERFORMANCE OF POSTGRADUATE STUDENTS IN THREADED DISCUSSIONS

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ABSTRACT

Critical thinking has increasingly been seen as one of the important attributes where human capital is concerned and in line with this recognition, the tertiary educational institutions worldwide are putting more effort into designing courses that produce university leavers who are critical thinkers. This study aims to investigate the critical thinking ability of the postgraduate students in threaded discussion. Participants of the threaded discussion were the postgraduate students of a faculty of a public university located in Klang Valley. Data was collected from the postgraduate courses' threaded discussion assignment mediated via a learning management. Overall, four threaded discussion transcripts were collected and used as the source of data of this study. The researcher assessed the four threaded discussion transcripts based Newman et.al (1995) content analysis framework. Results showed that the participants' postings mainly reflected their critical thinking ability in terms of being able to include relevant (R+ positive critical thinking indicator), clear (AC+ positive critical thinking indicator), novel (N+ positive critical thinking indicator) and justified (JS+ positive critical thinking indicator) input into the threaded discussion. It was found that in the postings, the participants integrated a lot of their personal experience into the discussion (O+ positive critical thinking indicator) and were able to link their ideas coherently (L+ positive critical thinking indicator). However, it was found that the participants generally lacked the ability to critically evaluate their peers' or their own postings.

KEYWORDS

Critical thinking, threaded discussion, computer mediated higher education instruction.

1. INTRODUCTION

Critical thinking has increasingly been seen as an important attribute in empowering human capital. For instance, as stated in 10th Malaysian Plan, "the success of the innovation agenda hinges on a Malaysian citizenry that values openness, embraces **critical thinking** and encourages risk taking and experimentation. This will require an education system that nurtures creative and analytical human capital" (Tenth Malaysia Plan, 2011-2015). Besides that, as quoted by Koo, Wong, Kemboja, Chang and Mohd Subakir (2011) in their study, Malaysia Ministry of Higher Education has established among others the National Higher Educational Plan which "aims squarely on holistic human capital development, to produce Malaysians who are intellectually active, creative, innovative, adapted and capable of **critical thinking**" in order to address the unemployment situation among public universities graduates. Thus, it is evident that higher educational institutions in Malaysia are encouraged to produce university leavers who possess the capability to think critically in order to help them to secure employment. This perception also prompts the tertiary education institutions worldwide to utilize means such as Computer Supported Collaborative Learning (CSCL) platform when designing teaching and learning activities that encourage critical thinking among the university students.

Since past studies had proven that CSCL can be useful in terms of nurturing critical thinking virtual communities (Li, 2010; Lim, Cheung, & Hew, 2011), threaded discussion which is known as one of the Computer Mediated Communication (CMC) tools have been employed by the instructors in carrying out CSCL activities with their students. To date, a number of studies have investigated the capabilities of asynchronous threaded discussion in cultivating critical thinking among learners (Leston-Bandeira, 2009; Irfan & Hazita, 2010).

In addition, there are numerous studies which investigated the linguistic features found in computer mediated communication transcripts. Despite that, there has been no direct study which investigates how the use of certain linguistic features reflects the critical thinking. In view of what was stated by Leston-Bandeira (2009), which indicated that there is potential in developing critical thinking skills among learners via threaded discussions, so it would be logical to assume the trend of participants in using certain cohesive devices in influencing the quality of postings, and in enabling researchers to gain some perspectives on the participants' critical thinking performance. Thus, this research aims to fill this gap by investigating how the use of cohesive devices such as conjunction could reflect the presence of positive and negative critical thinking indicators in threaded discussions. The two specific objectives of this study are firstly, to determine the students' critical thinking abilities by assessing the threaded discussion transcripts based on content analysis scheme established by Newman, Webb and Cochrane (1995) and secondly, to delve into how the use of cohesive devices such as conjunction in reflecting the critical thinking performance of participants in threaded discussions. In relation to the stated objectives, the following are the research questions.

- 1) What is the frequency and percentage of each of the positive and negative critical thinking indicators attained by each threaded discussion?

2. METHOD

2.1 Participants and Setting

Via the use of a mixed-method approach, the threaded discussion data was collected from one of the public universities located in Klang Valley, Malaysia. Participants of the asynchronous online discussion were the postgraduate students of the Faculty of Languages and Linguistics of that public university. The participants consist of two groups of postgraduate students who were enrolled in two postgraduate courses. One group of the participants were the students who enrolled in the Research Methodology (RM) course while the other group consisted of participants who enrolled in the Second Language Acquisition (SLA) course. The threaded discussion activities form part of the course continuous assessment activities.

2.2. Data Collection and Data Analysis Procedures

Overall, a total of four topics of discussion which are relevant to the course content were assigned during the semester. The topics of discussion were known as RM 1, RM 2, SLA 1 and SLA 2. All these four topics were formulated in line with the goal to fulfill the learning outcomes of the courses. Two topics of discussion were designed for each course. The topics of discussion were posted on the class learning management system. Participants were required to post their personal comment at least once for each question and respond to their coursemates' responses at least twice. However, no limitation was set on the maximum number of responses one could post. The duration for each question to be discussed in the threaded discussion was about two weeks.

After all the online discussion sessions had ended, the online asynchronous transcripts were downloaded and imported into Nvivo 9, a computer data analysis software. In order to answer research question 1, the data were analysed based on Newman et. al (1995) content analysis framework which consists of positive and negative critical thinking indicators. One of the benefits of employing Newman et.al. (1995) content analysis scheme in assessing critical thinking found in threaded discussion transcripts is, it allows critical thinking to be quantified. Newman et.al (1995) content analysis scheme was chosen to analyse the data because it provides an explicit list of positive and negative critical thinking. Being able to quantify critical thinking aids educators or researchers who wish to access their students' critical thinking performance. This is because numerical values obtained could be used as learning evidence that can inform both the educators, researchers and students regarding critical thinking performance.

In order to obtain interrater reliability reading, both the researcher and a second coder coded about 20% of the overall data, and the interrater reliability values for both Kappa Coefficient and percentage of agreement were calculated using the coding compound query feature of Nvivo 9. It was found that the Kappa Coefficient value was 0.72 while the percentage of agreement value was 94.66%.

In terms of unit of analysis, the researcher of this study selected sentence as the unit of analysis. The reason being the use of sentence as unit of analysis was claimed to help in attaining higher interrater reliability Gorsky et.al.(2012). In the next section, the results and discussion will be presented.

3. RESULT

Table 1 illustrates the frequency and percentage of each of the positive critical thinking indicator sub categories and Table 2 illustrates the frequency and percentage of each of the negative critical thinking indicator sub categories which belong to the four threaded discussions.

Table 1. The frequency and percentage of positive critical thinking indicator sub categories of the rm 1, rm 2, sla 1, sla 2 threaded discussions

Threaded Discussion Transcripts	Positive Critical Thinking Indicators	A+	C+	I+	JS+	L+	N+	O+	P+	R+	W+	Total
a (i) RM 1	Frequency	213	58	112	72	67	114	46	26	213	60	981
a (ii) RM 1	Percentage %	18.65	5.08	9.81	6.30	5.87	9.98	4.03	2.28	18.65	5.25	85.90
a (iii) RM 2	Frequency	153	29	85	72	124	115	29	48	153	28	836
a (iv) RM 2	Percentage %	17.31	3.28	9.62	8.15	14.03	13.01	3.28	5.43	17.31	3.17	94.59
a (v) SLA 1	Frequency	287	81	40	140	134	247	133	16	287	120	1485
a (vi) SLA 1	Percentage %	18.84	5.32	2.63	9.19	8.80	16.21	8.73	1.05	18.84	7.88	97.49
a (vii) SLA 2	Frequency	130	20	29	45	55	91	45	37	130	54	636
a (viii) SLA 2	Percentage %	19.58	3.01	4.37	6.78	8.28	13.71	6.78	5.57	19.38	8.13	95.79

Table 2. The frequency and percentage of negative critical thinking indicator sub categories of the rm 1, rm 2, sla 1 and sla 2 threaded discussions

Threaded Discussion Transcripts	Negative Critical Thinking Indicators	A-	C-	I-	JS-	L-	N-	O-	P-	R-	W-	Total
b(i) RM 1	Frequency	37	25	15	11	7	19	0	7	31	9	161
b(ii) RM 1	Percentage %	3.24	2.19	1.31	0.96	0.62	1.66	0	0.62	2.72	0.79	14.11
b(iii) RM 2	Frequency	4	6	6	3	10	11	0	0	5	3	48
b(iv) RM 2	Percentage %	0.45	0.68	0.68	0.34	1.13	1.24	0	0	0.57	0.34	5.43
b(v) SLA1	Frequency	5	3	5	6	5	5	0	0	4	6	38
b(vi) SLA 1	Percentage %	0.33	0.20	0.33	0.39	0.33	0.33	0	0	0.26	0.39	2.56
b(vii) SLA 2	Frequency	4	2	1	3	4	2	0	5	4	3	28
b(viii) SLA 2	Percentage %	0.60	0.30	0.15	0.45	0.60	0.30	0	0.75	0.60	0.45	4.20

With reference to a (ii) RM 1 and b (ii) RM 1 presented in Table 1 and Table 2, it is obvious that the overall percentage of positive criticalness (85.9%) is higher than the percentage of negative criticalness (14.11%) and based on the postings found in (i) RM 1 and b (i) RM1, there are 981 occurrences of positive criticalness and 161 occurrences of negative criticalness identified from the transcript.

a (ii) RM 1 shows that R+ (Relevant statement)(18.65%), A+ (Clear, unambiguous statement)(18.65%), N+ (Novelty) (9.98%) and I+ (Important statement) (9.81%) are the most frequently detected indicators and the least detected indicators are P+ (Discussing the practicality of new ideas and suggesting solutions) (2.28%), followed by O+(Referring to outside knowledge/experience)(4.03%) and C+(Critical assessment of others' or own contribution)(5.08%). Where negative criticalness is concerned, b (ii) RM 1 showed that A- (Confuse statements) (3.24), R- (Irrelevant statement) (2.72) and C- (Uncritical acceptance or unreasoned rejection) (2.19) and N- (Repeating what has been said, or false or trivial leads, or accepting first offered solution) (1.66) are the most occurring uncritical thinking traits.

With reference to a (iv) RM 2 and b (iv) RM 2 shown in Table 1 and Table 2, it is found that the positive critical thinking indicators contribute 94.59% while the negative critical thinking indicators contribute 5.43 % to the overall scoring. Based on a (iii) RM 2 and b (iii) RM 3, there are 836 occurrences of positive criticalness and 48 occurrences of negative criticalness.

Referring to a (iv) RM 2 above, A+ (17.31%), R+ (17.31%), L+ (Linking of ideas and generating new data from information collected) (14.03%) and N+ (13.01%) are the most frequently detected positive critical thinking indicators in participants' postings. According to b(iv) RM 2, the most frequently detected negative critical thinking indicators are N- (1.24 %), L- (Repeating information without making inferences or offering an interpretation, or stating that one shares the ideas or opinions stated without taking these further or adding any personal comments) (1.13 %), C- (0.68 %).

Compared with the findings a (ii) RM 1 and b (iv) RM 2, the overall percentage of negative critical thinking instances in RM2 is much lower. This could be due to the fact that they had received feedback from the instructor on their RM 1 threaded discussion session, causing the participants to know how to engage in the threaded discussion and thus perform better. Apart from the instructor's feedback, topic familiarity was likely to cause the participants to perform better in RM 2 threaded discussion since Chou and Chen (2010) discovered that topic familiarity could affect their subjects' willingness to write postings. Thus, it seems imperative for the participants to have sufficient background knowledge towards a particular topic of discussion in order to ensure they are familiar with the topics of discussion because it would encourage them to write and post postings.

As presented in a (vi) SLA 1 and b (vi) SLA 1 respectively, it is obvious that, the overall percentage of positive criticalness (97.49%) is higher than the percentage of negative criticalness (2.56 %). According to a (v) SLA 1 and b(v) SLA 1 shown in Table 1 and Table 2, there were 1485 occurrences of positive criticalness and 38 occurrences of negative criticalness detected from the transcript.

Where positive criticalness of the SLA 1 threaded discussion is concerned, R+ and A+ which shared the same percentage value that is 18.84%, N+ (16.21%) and JS+ (Justification) (9.19%) are apparently the four most frequently detected indicators. These findings indicate that the participants were able to produce relevant and clear statements, bring in novel ideas and rationalize their arguments. However, their lack of competence in incorporating important input and critiquing their peers' contributions was detected if one refers to the percentage of both I+ and C+. The P+ indicator's percentage value is the lowest. This was probably because the topic of discussion was not designed for problem solving and it did not require participants to suggest solutions and discuss the practicality of each solution.

Referring to b (vi) SLA 1 shown in Table 2, it seems that W- (Narrowing the discussion) and JS- (Unjustified statement) are the two most frequently found negative critical thinking indicators which have the same percentage value that is 0.39%. They were followed by A- , L-, I- and N- indicators which also share the same value that is 0.33%.

Based on a (viii) SLA 2 and b (viii) SLA 2, it is noticeable that the percentage of positive criticalness (95.79%) is higher than the percentage of negative criticalness (4.2 %). In addition, a (vii) SLA 2 and b(vii) SLA 2 showed that there were 636 occurrences of positive criticalness and 28 occurrences of negative criticalness spotted in the transcript.

Where the positive criticalness of SLA 2 threaded discussion is concerned (See a (viii) SLA 2), both R+ and A+ indicators show the same percentage value that is 19.58%, followed by N+ indicator at 13.71% and L+ indicator at 8.28%, rendering the four of them to be the four most scored indicators while the least scored indicators are C+ at 3.01%, followed by I+ at 4.37% and P+ at 5.57%. These findings indicate that the

participants were able to produce relevant and clear statements, bring in novel ideas and link ideas and create new interpretation. However, similar with the findings in a (v) SLA 1, their lack of competence in incorporating important input, suggesting and providing solutions and critiquing their peers' contributions contributed to the low frequency counts of P+, I+ and C+ indicators. This is probably because the topic of discussion was not designed for problem solving and it did not require participants to suggest solutions and discuss the practicality of each solution. In addition, the low percentage value of C+ also suggested that the participants did not engage much in reflecting and commenting on their peers' comments critically. They simply agreed to what others said without further probing or providing reasons for their stance of agreeing to their peers' postings.

Referring to b (viii) SLA 2, it is noted that where the negative criticalness of the SLA 2 threaded discussion is concerned, the percentage values of the four most frequently detected negative critical thinking indicators found in SLA 2 threaded discussion transcript the were P- at 0.75%, L- at 0.60%, A- at 0.60%, and R- at 0.60%. As compared with the results tabulated in b (vi) SLA 1, generally, the similarity found between the coding for the SLA 1 and SLA 2 is there is a zero percentage of O-. The overall percentage of negative critical thinking indicators is also found to be higher in SLA 2 than in SLA 1. The lack of interest, followed by the lack of motivation to participate in threaded discussion, may be also the reasons why the participants overall critical thinking performance dropped in the SLA 2 threaded discussion as compared to the SLA 1 threaded discussion.

4. DISCUSSION

After inspecting , it is found that all the participants seemed to have less problems in contributing inputs that were assigned codes R+, A+, N+, JS+, L+ (Linking of ideas and generating new data from information collected) and O+. Interestingly, it is also noted that none of O- (Squashing attempts to bring in outside knowledge or sticking to prejudice or assumptions) input is detected in the four threaded discussion transcripts. Both the O+ percentage (Referring to outside knowledge/experience) for the SLA 1 and SLA 2 threaded discussions are also higher than that of the RM 1 and RM 2 threaded discussions. This may be due to the nature of topic.

The characteristics of both the SLA 1 and SLA 2 topics of threaded discussion seem to encourage the participants to bring in more of their own previous experience and background knowledge and also draw in more related outside materials to substantiate their arguments. The participants also proved that they were able to integrate their previous experience and background knowledge into the threaded discussion. This is probably because most of the participants were exposed to the second language acquisition theories during their undergraduate study. Therefore, it was easier for them to rely on their background knowledge and experience and include other relevant materials they gained from books, articles and internet into both the SLA 1 and SLA 2 threaded discussions.

On the other hand, in the case of the participants who participated in the threaded discussion sessions of the course Research Methodology, these students seemed to exhibit behaviour that showed that they did not have enough experience pertaining to relevant aspects of research which they were required to discuss. These students also did not show much abilities in locating and inserting external relevant information into the content of the discussion. This may be due to their lack of previous exposure to aspects of research, or their failure to relate to the existing knowledge. Another probable explanation may be linked to the fact that the research methodology course is an introductory course which is designed to expose the postgraduate students who are relatively new to the important concepts of academic research.

The importance of being able to locate and insert relevant information, be it taken from the outside materials such as books, personal experience or previous knowledge into the threaded discussion was highlighted by Woo and Wang (2009) study. Woo and Wang (2009) conducted a study to find out whether web blogging was effective in encouraging critical thinking. They were also interested in investigating the influence of different kind of blogging topic has on the overall results of the frequency of each critical thinking indicator. Their participants were secondary school students. The three topics of web blogging were designed based on secondary school History subject syllabus. The scheme they used to code their web blogging transcripts was similar to the one employed by the current researcher which is the Newman et.al (1995) content analysis scheme. They designed three topics for students to discuss in total. The similarity

found among the three threaded discussions was that R+, O+ and JS+ indicators were the three most frequent detected critical thinking indicators in all the three web blogging transcripts. They also claimed that because the topic 1 and topic 3, which allowed the students to use the information from the textbooks to substantiate their arguments, the C- percentage reported was insignificant as it was too small a value. On the other hand, topic 2 which was designed in such a way that the participants could not rely solely on the textbook information to support their arguments, the overall negative criticalness of topic 2 increased and C- indicator percentage became significant. The same phenomenon is observed in the findings of this present study. In the data of this study, it is noted that while the percentage of O+ (Bringing in outside knowledge/experience to bear on the problem) indicator in both the SLA 1 and SLA 2 threaded discussions are higher than that of the RM 1 and RM 2 threaded discussions, the percentage of C- (See Table 2) indicator for both the SLA 1 and SLA 2 threaded discussions are also lower than that of the RM 1 and RM 2 threaded discussions. These findings again show that being able to include relevant outside materials into the threaded discussion could be a crucial key to improve the participants' overall critical thinking performance.

For this study, another similarity identified throughout the four topics of threaded discussion transcripts was that the C+ indicator, which was recognized as one of the least detected indicators in all the four threaded discussion transcripts. This may suggest that in general participants did not engage much in evaluating their peers' postings critically. The same phenomenon was also observed and reported by Irfan and Noor (2010) who examined the trainee teachers' online discussion forum transcripts with the aim of finding out the positive critical thinking and negative critical thinking indicators that were exhibited. As mentioned by Irfan and Noor (2010), the subjects of their study were the trainee teachers who were all novice teachers. In other words, they did not have any teaching experience prior to their teaching practice. The online discussion forum was launched during their teaching practice in order for them to interact with their peers and lecturer by sharing and discussing the problems they encountered during teaching practice. One of their findings was that C+ indicator was one of the six least found positive critical thinking indicators, rendering them to assert that their subjects of study might be weak in their ability to evaluate their peers' and their own postings critically and the researchers posited that this was probably caused by their lack of real life teaching experience.

5. CONCLUSION

Critical thinking can be cultivated through engaging students in computer supported collaborative learning activities such as threaded discussion. The postings from threaded discussions can be assessed in terms of critical thinking ability. In this study, based on Newman et. al (1995) content analysis framework. it seems that the R+ (Relevant statements), A+ (Clear and unambiguous statements), N+ (Novelty), JS+ (Justified statements), L+ (Linking of ideas and generating new data from information collected) and O+ (Referring to outside knowledge/experience) were the most frequently detected indicators for all the four transcripts of threaded discussions. On the other hand, C+ (Critical assessment of others' or own contribution) was one of the hardly detected indicators found in all the four transcripts of threaded discussions. In addition, where the percentage of O+ (Bringing in outside knowledge/experience to bear on the problem) is higher, the percentage of C- (Uncritical acceptance or unreasoned rejection) seems to be lower. The results also indicate that participants who had sufficient amount of knowledge and personal experience pertaining to the matters under discussions, would most likely rationalize their responses in postings, and not exhibit behaviours that reject or accept others' viewpoints uncritically. Therefore, this may suggest that the amount of the personal experience and knowledge the participants have towards a particular topic of threaded discussion could affect their critical thinking performance. In short, participating in a well-designed threaded discussion task can inculcate critical thinking as it prompts the participants to share and reflect on the issues pertaining to course content.

In the future, the instructors may want to consider assessing the content of students' assignments in terms of critical thinking performance by employing rubrics that are designed specifically for assessing critical thinking. One of the means that may assist the instructors to detect the critical thinking aspects of students' work can be the use of cohesive devices such as the use of conjunctions and collocations. The instructors perhaps can draw the attention of students to the use of linguistic elements, particularly the use of cohesive devices in facilitating the flow of ideas. For instance, the instructors can demonstrate how the use of

conjunction can impact the writing quality by comparing writing samples. The instructor can also show the students the various manners they can employ the first personal pronoun 'I' in conveying personal but substantiated comments and stance. The instructors can also do the same thing when it comes to the use of substitution and ellipsis. Helping the students to acquire the skills of using linguistic elements such as conjunction, pronoun 'I', substitution and ellipsis effectively in the threaded discussion context is crucial as these skills help them to argue logically and improve their critical thinking ability. This can then act as a complement to the conventional rubrics which are used to measure the writing quality of postgraduate students' assignments.

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WORK-INTEGRATED LEARNING WITH WORK-INTEGRATED LEARNERS

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ABSTRACT

The digital era gives many new opportunities for higher education. Especially online education makes it possible to reach new groups of students like, for instance, full time working professionals. This case study investigates an online course in applied statistics constructed to attract “non-traditional students” such as full-time working professionals. The course was constructed using the Work Integrated Learning (WIL) approach as well as guidelines for statistics courses (GAISE) and online courses. The main goal of the article is to investigate if the course attracted the participants that were intended, and to summarize the pedagogical experiences from the course. Among the findings are that the course succeeded in attracting “non-traditional students”, it is also found that the concept of WIL and GAISE helps increase the participant’s interest in, and perceived usability of, statistics. Furthermore, the concept of WIL can be enhanced, both for the traditional and “non-traditional” students, by inviting the “non-traditional students” to share statistical problems from their workplace. This opens up for the pedagogical concept of using the participants in the course as a resource for WIL and hence building a course with the students rather than for the students.

KEYWORDS

Work-integrated learning, Non-traditional students

1. INTRODUCTION

Today’s heavily competitive employment market with shifting economic and demographic factors implies new challenges for higher education. Even though a degree from higher education may increase the chance of employment, a lot of companies demands working experience as a complement to the degree. Furthermore, in order to be competitive, companies are in need of continuous development of competence among existing employees (Agha et al 2012). It is suggested that higher education institutions must proactively examine and re-develop curricula in order to offer career development for both traditional and non-traditional students (Betts et al 2009). It is further suggested that curricula must support career development by applying and actualizing knowledge and skills in real-life settings, e.g. by adopting work-integrated learning (ibid).

From a company perspective, the development of competence, must be ongoing continuously due to the dynamic and rapid changes in the market. This continuous learning should be integrated with the everyday work and tasks (Tynjälä 2008). Moreover, companies want to find ways of offering learning activities which increase the competence without too much interference with everyday work, and preferably with as small costs as possible. To meet this challenging requirements Information and Communication Technology (ICT) may be a suitable platform for developing efficient learning tools and systems (Chuang et al 2008).

The digital era certainly offers new possibilities for higher education and via online education new groups of students could be reached, e.g. full working individuals who want to upgrade their competence. The technical development for distance education gives new opportunities and there are a lot of success stories (e.g., Volery & Lord 2000, Moore & Kearsley 2011), but research also points out potential gaps between promises and reality (e.g., Wilner & Lee 2002, Hartnett 2012).

In this study, an online course in applied statistics is used as a case. This course was designed in a way that allows combining the studies with work. Our intention was to attract “non-traditional” students, in this case participants who already are working, part or full-time. Especially we hoped to recruit participants who already are in the need of increased statistical competence within their profession or individuals who wants to advance/transmit their career towards more analytical work tasks. The design of the course was based on

guidelines and pedagogical principles for teaching statistics and efficient online education. Furthermore the most important pedagogical approach was to use work-integrated learning. In short, we wanted to offer a modern online course and work-integrated learning for work-integrated learners.

In this article we will briefly discuss work-integrated learning and present how our course was designed. But the primary aim is to present results from evaluations and summarize our experiences by answering the following questions: Did we attract the participants that we intended? What pedagogical experiences do we have after running this course for six years?

2. WORK-INTEGRATED LEARNING

The course used as a case in this article is offered by University West. Work-integrated learning (WIL) has been an important part of University West's profile already since it started, even though the perception and implementation of WIL varies (Kjellén and Tegnberg 2003). Generally work-integrated learning can be described as a pedagogical philosophy that emphasizes the values and quality gained by integrating theoretical studies with work-life experiences (Svensson and Östlund 2007). The implementation in practice may be done in numerous ways, but one way of categorizing related activities is the following: (taxonomy adopted from Kjellén and Svensson 2014):

(i) Using Practice as Inspiration (“Case”)

This category encompasses instructional designs such as “Teaching Cases”, “Practice-Oriented Simulations and “Role-Plays”, i.e. activities that to some extent are related to practice and may be more or less edited versions of actual situations.

(ii) Bringing Practice to Class (“Imprint”)

This category contains the use of imprints of practice as resources in educational practice. Examples are inviting “Guest Lecturers” and importing artefacts from various professional fields, e.g. “Commercial programming Code” and “Annual Reports” from existing corporations.

(iii) Utilising Professional Tools (“Tool”)

For the activities in this category, the point is to train students to use de-facto standard tools of a profession in the educational design, such as “Reference manuals or databases” (online or printed), “State of the art software packages”, or “Professional Routines and Procedures”.

(iv) Bringing Class to Practice (“Field”)

The activities in this category comprises empirically oriented fieldwork, where students leave campus in order to experience and study real professional settings as part of their education, e.g. “Projects” or “Thesis Work”.

3. GUIDELINES FOR TEACHING STATISTICS

Two decades ago a report called for a change in statistical education suggesting a greater focus on statistical thinking more than just handling the mathematics (Cobb 1992). The report has had great impact and generated several changes in statistical education regarding content (more focus on data analyses, less on probability theory), pedagogy (more active learning, less passive instruction), and technology (e.g., using statistical software), (Moore 1997). In order to summarize the experiences obtained during the reformation of statistical education, the American Statistical Association (ASA), developed guidelines for assessment and instruction for an introductory course in statistics (GAISE, ASA 2005). A review of the current status and a presentation of available web-resources related to statistical education are given by Tishkovskaya and Lancaster (2012).

4. GUIDELINES FOR ONLINE COURSES

There are a number of available guidelines related to efficient online education. The design of our statistical course was influenced by the work by Graham et al. (2001) which includes the following seven principles, which could be regarded as a practical lens useful for developing and evaluating online courses: “Good practice”...

- i. encourages student-faculty contact
- ii. encourages cooperation among students
- iii. encourages active learning
- iv. gives prompt feedback
- v. emphasizes time on task
- vi. communicates high expectations
- vii. respects diverse talents and ways of learning

5. DESIGNING THE COURSE

The course was designed by weighing up the following sources of information and aspects:

- Our own consolidated experiences from running introductory courses in statistics on campus for 20 years and online for a decade.
- Guidelines of teaching statistics (GAISE) described above
- Pedagogical principles for online teaching
- Adopt work-integrated learning
- The targeted populations are “non-traditional students”, i.e. the course should be possible to follow also for working participants

A more detailed description of the course design is given elsewhere (Gellerstedt et al 2014), but the most important concepts related to WIL and for attracting participants already on the labor market, are described below.

Some examples of strategies supporting WIL (category according to taxonomy described above is within brackets):

- Avoiding “naked data”, i.e. use real data from media, news, research, etc as often as possible (Case)
- “Learning by doing” – use SPSS for producing statistics and focus on interpretation (Tools)
- Set up a complete survey project, from identifying themes, constructing questions/answers, collecting data, data management, analyses and presentation (Field). This survey project is intended to mimic a real survey project as close as possible.

Some examples of strategies for facilitating participants that are working

- The course is divided in modules, with “checkpoints” where solutions to assignments must be submitted (these deadlines are the only time constraints in the course). This structure is intended to support an even pace during the course.
- Each module supported by detailed guidelines, including what to read, what to do, deadlines and an estimate of required time for fulfillment.
- Running the course in half speed, i.e. a duration of ten weeks instead of five (full time studies).
- No physical meeting, no synchronous activities – participants are free to study whenever they have the possibility. Well thought-through self-instructed learning-by doing assignments in SPSS.
- Standardized and professional pre-recorded video lectures to view on demand.
- Active discussion boards for lively discussions and prompt replies on e-mails.
- Participation – teachers frequently visiting the home page, writing comments and responding to questions

The name of the course is: “Applied statistics – to collect and summarize data” and attracts around 100 participants each time.

As mentioned previously we hoped that the course would in general attract participants who also are working. In particular we were interested in recruiting individuals who already uses statistics in their profession or individuals who wants to advance/transmit their career towards more analytical work tasks.

6. DID WE ATTRACT THE PARTICIPANTS THAT WE INTENDED?

Immediately when the course started for the first time there were a number of indications implying that the population of participants differs from traditional students attending the corresponding campus course. The activity on the learning management system (LMS) was heavily concentrated to evenings and weekends, indicating working participants. The presentations made at the LMS revealed working place for a large proportion of all students, e.g. working at a bank, in media, with marketing or with opinion polls. The initiated questions raised in e-mails and on the discussion board gave the same impression.

Inspired by these initial indications and driven by curiosity, we decided to investigate the population in more detail. A first small study, which was a questionnaire complemented with interviews via telephone, we found that roughly 80% of all participants worked (20% part time and 62% full time). Thus it was evident that the course attracted working participants.

In 2012 a more comprehensive survey was performed both before and after the course, comparing campus (n=54) and online students (n=44). This survey included a comprehensive set of variables, e.g. demographic variables, beliefs about statistics, interests in working with statistics, learning styles and strategies, self-confidence, procrastination, locus of control, attitudes towards the subject before and after the course.

The results show that online students were older (campus: average 23 years, online average 34 years), more experienced and not equally interested in achieving the credits for the course. We also found that the online students had more positive belief about statistics, e.g. that statistics is exciting, useful and a desirable ingredient in a future occupation. There were no significant differences between student populations regarding the psychological variables: self-efficacy, locus of control, and procrastination.

The proportion of participants who were working was consistent with the previous smaller study. Roughly 80% of the online participants worked (20% part time, 57% full time). Among campus students 65% worked part time (no full time workers). Thus, the majority of the online participants are working. An interesting follow-up question is whether they are using statistics in their current profession? The questionnaire gave us the following figures: 84% of those who are working full time were already using statistics in their profession. Among the part time workers the corresponding figure was 44%. Among the participants who worked full time but not with statistics right now, 96% wanted to work with statistics in the future. Among the part time workers and non-workers the corresponding figure was 67% and 60%.

These figures support that a large part of the participants have the incentives to increase job security, career advancement, prepare displacement or transition to other jobs. As a matter of fact, we have also had some graduated statisticians who have attended the course in order to update the competence and to learn new tools and develop skills.

In sum, the online course attracted a completely different population than “traditional students” attending a course on campus. The stereotype for an online participant is a middle aged person with working experience, interested and motivated, and either work with statistics right now or want to do so in the future.

7. IMPLICATIONS FOR EDUCATORS –WORKING WITH “NON-TRADITIONAL STUDENTS”

For us, as teachers, it is certainly pleasant to have interested and motivated participants who will have a direct use of the achieved knowledge and skills developed in the course. But, with a completely new kind of population of participants, one may wonder if there is a need for changing the pedagogical strategies?

A first question is related to working hours. Should we adjust our working hours due to the fact that the participants are using the LMS at evening and on weekends? Well, we have decided to not make any adjustments. Instead we have encouraged all participants to help each other and to keep a lively discussion on the discussion board. And, we have as a policy stated that our aim is to reply on questions and to take part at the discussion board within one working day, maximum two. We have also decided to spend an hour or two on the weekends where a deadline is set for submitting an assignment. In short, we have just made a small adjustment in working hours and adopted a policy for feed-back on the LMS. Beyond practical matters as working hours there are perhaps more important issues to consider, e.g. if the learning styles is different for online students than traditional campus students.

When we analyzed learning styles we found that a majority of online students (two out of three) generally preferred a reflective learning style while the situation is the other way around on-campus, where roughly two out of three students preferred more active learning. There was also a difference in study approach showing that online students to a higher degree focuses on deep learning strategies. We did some explorative analysis, which indicates that attitudes towards statistics is related to study approach: students who find the topic interesting and useful use a deeper approach than students with a less enthusiastic view of the topic. Thus the difference in learning strategy may be explained by the difference between traditional and non-traditional students described in previous section. Another difference related to preferred learning style is that the majority of online participants preferred working alone and did not wanted group assignments, while the situation on campus was the other way around. This goes hand in hand with the design of our course. In the campus version students are recommended to work in a group with three participants per group, while online participants are supposed to work individually.

Regarding the overall pedagogical strategies (WIL and GAISE) we asked if the course was as interesting and if it was as useful as expected? Answering alternatives were: less than expected / as expected / more than expected. The distribution of answers was:

Interesting? (4% / 15% / 81 %)

Useful? (4% / 27% / 69%)

These results were interpreted as good indications implying that the pedagogical approaches especially the WIL-approach and GAISE gives good results in terms of interest and usability.

However, when analyzing the WIL-concept more in detail it is obvious that the character of the online participants may be a valuable resource in the course, which could strengthen the WIL-concept even more. When we started the course for the first time we noticed that there were frequent mail from participants with a practical issue they had to deal with in their job. Sometimes the questions were directly related to the theoretical content of the course and sometimes out of the scope of the course. Anyway, we decided that this sort of “consultancy business” could be used as an exciting advantage in the course. We decided to start a new forum at the LMS a kind of discussion board which we called: “Work related issues board” (WRIB). In this forum participants could ask any kinds of questions, i.e. questions related to their work or reflections regarding a new study presented in media, etc. All questions are allowed!

The WRIB has over the years included a mixture of questions from different fields. Some examples of addressed issues are: how to handle drop-outs in clinical trials, how to measure accuracy in quality control, how to handle sensitive questions in a survey, how to present risk factors and standard for quality control in industry, just to mention some examples.

The WRIB has certainly strengthen our concept with work-integrated-learning (WIL). As mentioned above, activities related to WIL may include “Cases”, “Imprints”, “Tools” and “Field work”, and as a matter of fact the participants themselves contributes to all these activities. The WRIB together with the regular discussion board and in combination with the joint survey project in the end, the input from the work-experienced participant is a really valuable asset.

We regard this as a work-integrated-learning option, were other participants, especially traditional students could see that statistics are used in reality. In this way, the non-traditional students actually contribute with work-integrated-learning contents to the course. Teachers in the course finds it interesting and intellectually stimulating answering these, sometimes tricky, questions.

As mentioned above the online students are older and have working experience, a majority are in fact working with analyses already. This can be seen in the final examination project which includes making a survey. The online course have a higher dropout rate (44%) than the campus course (8%). But, among the participants who fulfills the examination there is a higher degree of examinations graded as “pass with honour”. Thus the non-traditional students have a lower degree of completion, but on the other hand, the completers produce higher quality assignments than campus students.

The dropout rate on this course is roughly the same or slightly lower than other online courses offered at Universities in Sweden. When we have analyzed the reasons for drop out, by analyzing answers in the questionnaires and by making follow-up phone interviews, we have made some interesting findings. Around every fifth students never start the course at all. These drop-outs could not be explained by failing pedagogical concepts. During phone interviews, one students had not understood the information, one student had taken a similar course at another university starting before this course, all other drop-outs among these nearly “non-starters” had external explanations, e.g. moving, illness, travel, changing work.

The non-starters corresponds to approximately half of all drop-outs. The other half are participants who have started but not completed. One explanation is that the participants have no, or very weak, incentives for delivering the rather comprehensive final assignment. Around every sixth participant claimed in the survey that it was not important to get the credits for the course. We estimate that around half of the remaining drop-outs actually are participants that have followed the course just for fun, but without incentive to take the credits and therefore don't "waste their time" with the final assignment.

It is nice to have students who attend the course just due to a pure interest in the theory rather than achieving the academic credits, but in Sweden a proportion of the financial budget we receive from the government is based on completion rate. Naturally, this is not a strong incentives for participants. So the question is how we could increase completion rate? One idea is to develop examination assignment which are too hard to resist, either due to interest or direct use in the profession. How to use the fact that a majority of these "non-traditional students" have professions were statistics is needed is a challenge that we are currently working with.

Thus, our next pedagogical challenges is to consider how we can adjust the course and make it more tailor-made for each individual. If the course starts with a small questionnaire regarding e.g. learning style, interest and profession it would be possible to offer some degree of individual adaptation. Assignments may be possible to adapt to each individual work place. This may increase the Wil-concept even more and may increase completion rate, however it is demanding and it is a challenge to find efficient ways of realizing such ideas.

8. FINAL REMARKS – CONCLUSION

We have found that our course fulfilled the intentions and recruited non-traditional students. The participants are older, experienced, interested and motivated, and a majority are working. There are several implications regarding pedagogical challenges for educational institutions arranging education for such non-traditional students. Our most important finding is that the concept with work-integrated learning can be enhanced by the participants. Originally our idea was to offer work-integrated courses in statistics *for* work-integrated learners. But, according to our experience the working experience among the participants is a really valuable assets which could be used proactively in the course. The course is a matter of co-creation between teachers and participants. In conclusion, nowadays our idea is to offer work-integrated courses in statistics *with* work-integrated learners, rather than *for* work-integrated learners.

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A FRAMEWORK FOR GAMIFIED ACTIVITIES BASED ON MOBILE GAMES PLAYED BY PORTUGUESE UNIVERSITY STUDENTS

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ABSTRACT

This paper starts by reporting the findings of a survey of Portuguese university students concerning their game habits and preferences. An online questionnaire was developed and 1101 answers were collected, 626 were mobile game players. The results from the survey indicate that the games most played by university students are essentially casual and puzzle games, existing differences between female and male students' preferences. Then, learning principles were identified according to Gee (2003) and game mechanics on the students' preferred games. Finally, based on these results we propose a framework for gamified interactive activities to university students, to get them engaged in learning with their mobile devices.

KEYWORDS

Mobile Games; Interactive Activities; University students, Learning Principles, Gamification.

1. INTRODUCTION

Students are playing mobile games everywhere: in the bus, train, at home, on campus, some even in the classroom with the sound turned off without the teacher's permission. We know that we can learn different skills with video games based on the type of game and gameplay characteristics (Connolly et al., 2012; Gee, 2007; Squire, 2011; Klopfer, 2008; Zimmerman, 2008) and "good video games incorporate good learning principles" (Gee, 2003, p.114). It was based on this idea of Paul Gee (2003) that we designed a research project called "From games to mobile-learning interactive activities".

This project intends to create interactive mobile learning activities based on students' mobile game preferences. The target population is students from K5 to Master's students. However, in this paper we focus on Portuguese university students, their game preferences and their playing habits. We analyze them and their game preferences according to Gee's (2003) learning principles and identified the games' mechanics. Finally, we propose a framework for gamified interactive activities that can help teachers to select the digital tools that can be more engaging to students.

2. THE SURVEY

The research questions focused on this paper are the following: (i) Which mobile games do students prefer? (ii) Which learning principles and game elements are embedded in students' preferred games?, and (iii) Which learning principles and game elements can be applied to develop interactive activities running on mobile devices?

To answer the first question, a survey (Babbie, 1997) was conducted in Portugal. A questionnaire was developed containing four dimensions: 1) Student characterization, 2) Mobile game habits (games played in each mobile device and time spent in gaming), 3) Game preferences (the games most played, reasons to play that game, the importance of some game characteristics in continuing to play it, whether they like to play alone or with others, and if they would like to use games for learning in class), 4) If they were to create a

game, what kind of characteristics would it have? Most of the items were multiple choice questions, but some were open ended questions. The instrument was validated by experts. The questionnaire was available online on a Google Drive Form.

A survey was carried out with university students from different Portuguese Universities. The responses were received from 21st May to 16th September 2013. We collected 1101 responses, although only 626 of them (56.9%) are mobile gamers.

Table 1. Respondents and Gamers

Subjects Gender	Respondents [All students]		Mobile gamers		The sample	
	f	%	f	%	f	%
Female	693	62.9	363	52.4	363	58.0
Male	408	37.1	263	74.5	263	42.0
Total	1101	100.0	626	56.9	626	100.0

The female sample is slightly larger (58.0%), and this corresponds to the female majority among university students in Portugal (PORDATA¹). In terms of levels, undergraduate students (65.3%) form the majority of our sample, also reflecting the Portuguese university population, where there are 231.230 undergraduate students and only 117.125 Master's students (PORDATA²). The majority of the students are under 23 years of age (70.8%), the most common age to complete a Master's degree in Portugal.

2.1 Results

Students mentioned 177 games. The top 5 played games are Candy Crush, Angry Birds, The Sims, Bubbles, and ranking in 5th place are Flow, Fruit Ninja and Solitaire (Table 2).

At the time of the survey, Candy Crush Saga was the game most played by university students in Portugal. This is a worldwide tendency, as it was the most downloaded portable game in 2013 in both the iOS App Store and in Google Play. Fruit Ninja was the 5th most downloaded portable game in 2013, Angry Birds the 6th and Hill Climb Racing the 7th. (App Annie, 2014). Newzoo (2014) also reported that Candy Crush Saga ranked 1st in France and Germany. Four of the games most played by Portuguese students appear in the worldwide ranking: Candy Crush Saga, Angry Birds, Fruit Ninja, and Hill Climb Racing.

In Table 2 we can see gender differences in what concerns the most played games. The only game common to both is Angry Birds, which ranked in 1st place for male and 3rd place for female players.

Table 2. Games Most Played by Portuguese University Students (All Students and Female Vs Male)

Ranking of games	All Students	Female Players	Male Players
1 st	Candy Crush	Candy Crush	Angry Birds
2 nd	Angry Birds	The Sims	League of Legends
3 rd	The Sims	Angry Birds	Football Manager
4 th	Bubbles	Bubbles	Pro Evolution Soccer
5 th	Flow	Fruit Ninja	Flow
	Fruit Ninja		Hill Climb Racing
	Solitaire		

Angry Birds has been able to mix the action and strategy of launching objects with the cuteness of the characters and the environments. Characters are highly friendly, and at the same time combative.

As with the mix seen in Angry Birds, we could say that Sims, played by females, and League of Legends, played by males, optimize each side of the mix. In Sims everything is related to the characters, to their lives, relations, cuteness and friendliness. On the other hand, in League of Legends, everything is related to the system of weapons and dependencies inside the game. Playing Sims is like managing a family, with no

¹ More information in:

<http://www.pordata.pt/Portugal/Alunos+matriculados+pela+1.a+vez+no+ensino+superior+total+e+por+sexo-1047>

² More information in:

<http://www.pordata.pt/Portugal/Alunos+matriculados+no+ensino+superior+total+e+por+nivel+de+formacao-1023>

specific goals nor victories, while playing League of Legends is more like managing a battalion: the players are all motivated by very specific objectives and a final victory.

The other games played by female players are Fruit Ninja and Bubbles, which are similar to Candy Crush. All these games work around highly rewarding systems. Each action carried out in the game, even the easiest one, will be rewarded with some kind of gratification. Throughout these games, the goal is never to achieve an end, or to be the best, but instead to be cheered, to be praised about your skills, and to feel good while playing.

Only male students report playing soccer games - 3rd and 4th in the male's preferences - which suggests the predominantly male orientation of this theme. Most of the sport games are played mostly by males. These games have well defined objectives, attainable through effort. To demonstrate the male player's love for systems (sets of structures, behaviors and connectivities within specific spatial and temporal boundaries), we just need to look into games like Flow, one of the mentioned top 5 titles by male players. A game where we are asked to find the best route within a space, and for this we need to use all our ability to create abstract systems in our mind, to be able to respond to the game requests. The goal here is not to be rewarded, but to be able to meet the challenge posed. The same applies to Hill Climb Racing, where one's skills are challenged to maintain control of the car.

Figure 1 shows that games are mostly played in the devices for which they were initially launched. For instance, The Sims was created for PC as well as Solitaire, both are mostly played in laptop computers despite the existence of versions for other devices. The same happens with Angry Birds and Flow which are mostly played on smartphones and tablets. Only Candy Crush Saga which has integration with multiple platforms over Facebook is used both in tablets and laptop computers.

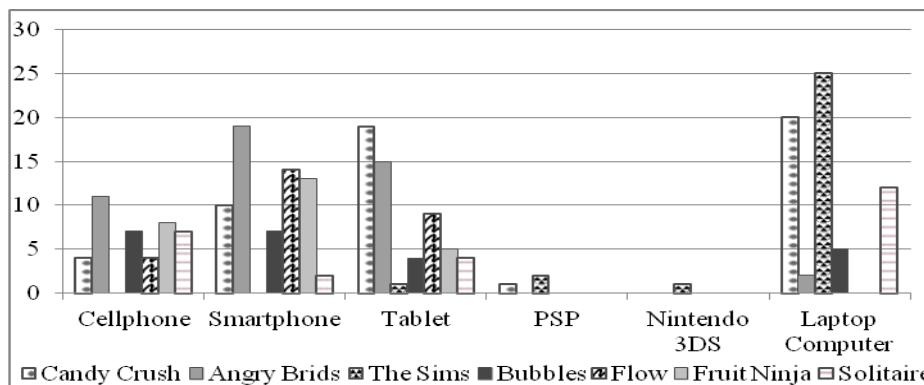


Figure 1. Mobile Device Used For Playing the Games Most Played (n=206)

One of the aims of our project is to figure out which are the most important characteristics of a game that keeps students playing it. This information will be important for the development of interactive activities that will be created in the project.

From Figure 2 we conclude that the most important characteristic of a game for university students is the gameplay, followed by scenarios, graphic effects and animations, story, and characters. The sounds and music are the less considered characteristics. Like Squire (2011) refers, today with so many graphical experiences it is understandable that our students are drawn to those features.

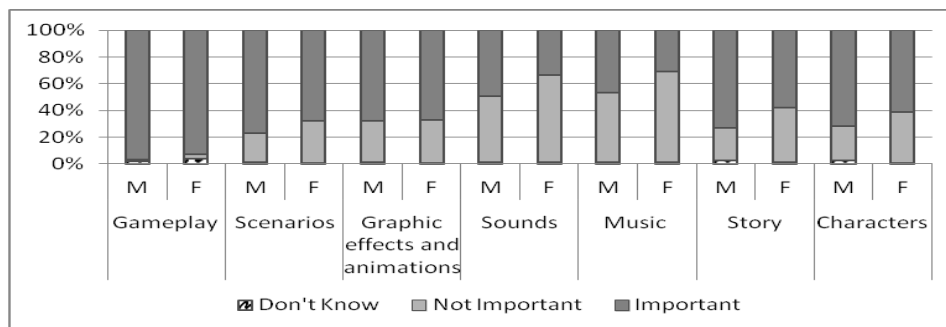


Figure 2. Importance of Some Game Characteristics to Continue Playing by Gender

One questionnaire item asked why they like to play those specific games. Based in Sherry et al. (2006) we tried to classify the answers of the students using the six dimensions: Arousal, Challenge, Competition, Diversion, Fantasy, and Social Interaction. But these dimensions were insufficient to classify all the answers so it was necessary to add three dimensions: Genre (type of game), Game Features (characteristic of the game design: music, scenarios, graphics, actions, story, rewards...) and Learning (the game helps to learn something).

It is possible to see in Figure 3 that the motives most mentioned are Genre (38.4%), Game Features (35.0%) and Diversion (18.9%). For these students the characteristics and type of game are the most important reason to play them, followed by diversion.

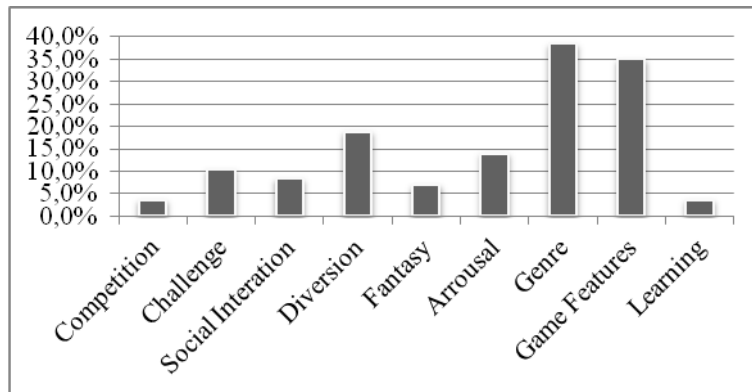


Figure 3. Motives for wanting to play the games

2.2 Playing Alone or with Others?

It is important to point out that most respondents prefer to play alone (71.6%), although the figure varies according to gender, 82.1% for female players and 57.0% for male players (Table 3). Those who prefer to play with others online (28.4%) choose to play mostly in teams rather than one to one.

Table 3. Preference for Playing Alone or With Others Online

Playing games	%	Female (%)	Male (%)
Alone	71.6	82.1	57.0
With others	28.4	17.9	43.0
	In teams	6.3	20.9
How	One to One	6.3	6.5
	Both	9.6	15.6

2.3 Playing Games to Learn at University?

We also questioned students if they would like to play games as a learning complement to their classroom activities. Most of them answered positively (78.12%), and there is a similarity between female (78.5%) and male (77.6%) opinions.

We inquired which game genre they would like to play. A list based on Connolly et al. (2012)'s work was available: Action, Adventure, Sports, Strategy, FPS, Casual games, Racing game, Sandbox, Board game, Fighting, Platform, Puzzle, Role-playing and Simulation.

In Table 4 the results are presented for all the positive respondents (n=489) about using games to learn academic issues. The most chosen game genre was strategy (72.8%) followed by simulation (58.7%) and action (41.9%). Other genres were rated below 50%.

Table 4. Preferred Game Genre to Learn

Game Genre	Total (f= 489)	Gender	
		Female (n=285)	Male (n=204)
Action	41.9	35.4	51.0
Strategy	72.8	77.5	66.2
Simulation	58.7	60.7	55.9

There is a similarity between female and male game genre preferences for learning. However, female students pointed out strategy games - a type of game that they do not usually play - as appropriate for learning. On the other hand, male students mentioned types of games they play or used to play as suitable for learning. Some examples are League of Legends which is a Real-time strategy with role-playing elements, or Football Manager and Pro Evolution Soccer which are games of sports and simulation.

The contrast between type of games they like to play for leisure and the type of games they would prefer for learning is more evident with female students.

3. IDENTIFICATION OF LEARNING PRINCIPLES AND GAME MECHANICS IN STUDENTS' PREFERRED GAMES

Gee (2003) presents 36 learning principles which it is possible to find in video games. It is important to note that he considers only games with long and intense play, in other words, video games that must be played for some hours to complete the tasks. The majority of games chosen by university students being short ones, only a few learning principles were identified from Gee's list. For the most played games seven learning principles were identified:

“6. Psychosocial Moratorium Principle - Learners can take risks in a space where real-world consequences are lowered.” (p.67)

“10. Amplification of Input Principle - For a little input, learners get a lot of output.” (p.67)

“11. Achievement Principle - For learners of all levels of skill there are intrinsic rewards from the beginning, customized to each learner's level, effort, and growing mastery and signaling the learner's ongoing achievements.” (p.67)

“14. Regime of Competence Principle - The learner gets ample opportunity to operate within, but at the outer edge of, his or her resources, so that at those points things are felt as challenging but not "undoable.” (p.71)

“22. Intuitive Knowledge Principle - Intuitive or tacit knowledge built up in repeated practice and experience, often in association with an affinity group, counts a great deal and is honored. Not just verbal and conscious knowledge is rewarded.” (p.111)

“25. Concentrated Sample Principle - The learner sees, especially early on, many more instances of fundamental signs and actions than would be the case in a less controlled sample. Fundamental signs and actions are concentrated in the early stages so that learners get to practice them often and learn them well.” (p.137)

“35. Affinity Group Principle - Learners constitute an "affinity group", that is, a group that is bonded primarily through shared endeavors, goals, and practices and not shared race, gender, nation, ethnicity, or culture.” (p.212)

Learning principles 6 and 10 are expected in almost all games, i.e., in a game the player is expected to take risks without consequences and to see things happening more quickly than in real life, as explained by the author.

Three others learning principles, 11, 14 and 22, are about the players' perceptions of skills. For each achievement in the game the player feels a pleasure, an intrinsic reward and the player knows that he is mastering a skill. The game manages the balance between challenge and player's skills, which with practice enables the player to go further. It is this practice that gives the player the “intuitive knowledge” to solve some tasks without being able to explain how it was done. These three learning principles made these players feel that they are capable of doing something, that they are in control.

For the 25th learning principle, rules of the game and possible actions are presented early on in the game. So they are learned faster, making the rest of the game easier and simpler.

Finally the last learning principle is about the players as a team. This interaction with others gives the player a sense of competition, but not face to face, they compete for the best score.

This information is about learning principles; we also need information about game design for the development of interactive activities we want to propose. In this study the students considered the following characteristics as the most important when playing a game: gameplay, scenarios, graphic effects and animations, story, and characters. Gameplay can be understood by the game mechanics used in the game. For Adams & Dormans (2012) there are five types of mechanics: Physics, Internal economy, Progression, Tactical maneuvering and Social interaction. The authors present a table that relates the type of game with the type of mechanics. Based on that, we can identify the types of mechanics in the genre of games mentioned by students for learning, presented at an early stage. Action and Simulation games have three types of game mechanics: Physics (“Detailed physics for movement, shooting, jumping, etc”), Internal economy (“Power-ups, collectables, points and lives” and “managing of resources”) and Progression (Pre-designed levels with increasingly difficult tasks, storyline to set players goals”), and Strategy games have all the five types of mechanics.

Looking to the genre of games most played we have puzzles (Candy Crush, Angry birds, Flow and Solitaire), simulation (The Sims) and arcade (Bubbles and Fruit Ninja). Puzzles involve the physics and progression type of mechanics, simulation games have the three mentioned previously and arcade genre do not appear in Adams & Dormans (2012), but we can infer that this genre has the physics and progression types of mechanics.

Based on Manrique (2013)’s identification of 35 gamification mechanisms, we analyzed the games most played to identify the game mechanics that are common, namely: Equipment; Power up; Trading Systems; Quest; Time events; Levels; Progress HUDs; Achievements; Social Standings; Punishments. These are related to the Internal economy and Progression types of mechanics proposed by Adams & Dormans (2012).

Scenarios of the most played games are unrealistic, they are based on the story of the game and look like cartoons. Graphic effects and animations give a positive feedback to the player, making him feel that he is proficient in that game. This way it promotes the player's self-efficacy and motivates him/her to go further.

Stories are simple. They typically have a short introduction to the game and motivate the player to play it (as in Candy Crush, Fruit Ninja, Angry Birds), or instead the player has to do the quests to find a bit more of the story (as in Bubbles). Sims has a more complex story, but it is the player that decides what will happen. Solitaire and Flow do not have a story.

As far as the characters are concerned, most of them are like cartoons and unrealistic; they make funny movements when the player achieves something. They are a fun element in the game. But these characters also show sadness when we lose. Showing feelings to increase the player's empathy and commitment gets the player engaged in the game.

4. A FRAMEWORK FOR GAMIFIED ACTIVITIES

As Kapp (2012, p.10) asserts “Gamification is using game-based mechanics, aesthetics and game thinking to engage people, motivate action, promote learning and solve problems.” Based on students’ mobile game preferences, game learning principles according to Gee (2003), and keeping reuse of students mobile devices in mind, we considered several aspects for the creation of gamified activities (Manrique, 2013; Adams & Dormans, 2012) that may motivate students to learn anytime and anywhere. In figure 4, we outline our framework for gamified activities based on all information retrieved from the analyses described above. This framework will be used to design and develop gamified activities to apply in class.

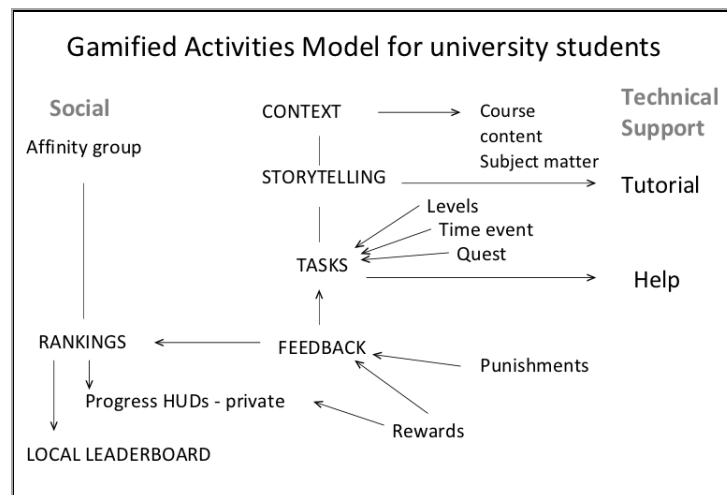


Figure 4. Framework for Gamified Activities

The gamified learning activities have to be related to the **CONTEXT** of the course content and particularly the subject matter to be learned, which will be the theme of the storytelling.

The students will have to solve several **TASKS** or missions. These tasks are related to **LEVELS** of difficulty or to different themes of the subject matter. Each task has a deadline for submission or accomplishment, some may have a time event to challenge students, and others may be a quest. The degree of difficulty should be moderate but challenging enough to get students engaged, keeping their interest and involvement (Csikszentmihalyi, 1992). There may be help mechanisms to support the student in difficulty, even help from the affinity group.

The tasks or missions will be devised to respect the following learning principles proposed by Gee (2003): Psychosocial Moratorium Principle, Amplification of Input Principle, Regime of Competence Principle, Intuitive Knowledge Principle Concentrated Sample Principle, and Achievement Principle.

FEEDBACK is very important in learning, particularly immediate feedback. Positive feedback has to be fun and it will make the student feel good. The graphic effects have to empower the achievements of the student. If the tasks or missions are not successfully completed, the student will receive punishments.

As soon as the student is solving the tasks his/her achievements will be seen in the progress HUDs (Heads-Up Displays). To complete this idea and maintain students' interest in their ranking in the team there will be a **LEADERBOARD** naming the five top students. For each task there is a leaderboard, allowing different students to be distinguished with the best results. Rewards and punishments are available through feedback, points and the leaderboard.

Another aspect that we consider important is the **AFFINITY** group principle (Gee, 2003) which is related with the social aspects of the group. It is important to maintain students' interest in their social group and to generate cooperation among students, as Whitton (2010) suggested.

Sounds and music are not very relevant to undergraduate and graduate students. The scenarios may be very simple but related with the subject matter.

When starting a gamified activity a **Tutorial** has to be available as well as a **Help** function.

The aim of our project is to create gamified interactive activities based on students' game preferences. The framework presented is based on the game analyses. The next step is to build a gamified interactive activity for university students based on these findings and then test it.

5. CONCLUSION

"In the last few years, games have converged with natural user interfaces to create an experience for players that more closely mimics real life. (...) For higher education, these game-like environments transform assignments into exciting challenges, reward students for dedication and efficiency, and offer a space for leaders to naturally emerge" (Johnson et al., 2014, p.42).

Knowing what our students are playing in their leisure time gives us information about what they like and it will allow us to propose more exciting, challenging and rewarding activities in class for students. As Burke (2014) states, “gamified solutions must put players’ motivations and goals first and make them the primary design objective” (p.21).

Our results show that female students prefer to play casual and puzzle games mostly alone.. Male students also like casual and puzzle games, but they also play strategy and simulation games with others to compete. Students are receptive to using games to learn the content of their courses.

Gamified activities are something that teachers should have in mind to motivate and engage students in learning. In this paper we propose a framework for creating gamified activities. It takes into consideration the context of the course to support interactive activity (storytelling, tasks and feedback), the social aspect (student support and leaderboards) and technical support (tutorial and help functions).

ACKNOWLEDGEMENT

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THE OPENFOREST PORTAL AS AN OPEN LEARNING ECOSYSTEM: CO-DEVELOPING IN THE STUDY OF A MULTIDISCIPLINARY PHENOMENON IN A CULTURAL CONTEXT

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ABSTRACT

This paper discusses the OpenForest portal and its related multidisciplinary learning project. The OpenForest portal is an open learning environment and ecosystem, in which students can participate in co-developing and co-creating practices. The aim of the OpenForest ecosystem is to create an extensive interactive network of diverse learning resources. In this case study, primary school students (ages 9 to 12, $N = 15$) participated in a cross-curricular learning project, in which they produced video artifacts and published them on the portal. The goal of the study was to determine the types of learning practices and artifacts that would emerge from this learning project. The OpenForest portal served as an emerging learning ecosystem, for designing an artifact that represented bread made from pine-bark flour as a multidisciplinary, open, and complex phenomenon. Based on our findings, we argue that the questions that students jointly co-developed at the beginning of the learning project generated a shared learning task. The final artifacts, arising from a multitude of perspectives, provided complementary pictures of this shared phenomenon. Analysis of the student-generated data and video artifacts indicates that the students reflected design and learning processes that explained the study and nature of experts' work. We found that primary school students are capable of collecting large amounts of data and that their construction of the informative and fun video artifacts from these data represent a strong understanding of the phenomenon.

KEYWORDS

Design-oriented pedagogy; learning ecosystem; OpenForest portal; co-developing; participatory learning

1. INTRODUCTION

Knowledge and knowing are collective products of the activity, context, and culture in which they are developed and applied (Brown et al. 1989; Roth & Lee 2004). Collective intelligence emerges in cultures of participatory knowledge, where people work together to collectively classify, organize, construct, and evaluate information (Lévy 2013). This highlights the need to extend the scope of education to include learning in real-world communities and exposure to phenomena and complex problems usually found in unstructured contexts. Currently, many researchers emphasize the need for students to learn twenty-first-century skills to develop their creativity, problem-solving abilities, collaboration skills, and technological proficiency in order to adapt to the demands of changing circumstances (Binkley et al. 2011). For example, Fischer and Redmiles (2008) emphasized that educational systems should promote transdisciplinary competencies that will prepare learners for meaningful and productive lives. Unfortunately, school activities, practices, communities, and learning environments are usually carefully organized and structured in homogenous ways by teachers, which are insufficient for meeting the requirements of a changing world. Co-development and co-creation are the most prominent practices of members of participatory cultures.

In participatory learning, the same practices are considered to have central significance to the learning of multidisciplinary content or problem-solving. Ito et al. (2013) argued that school should provide learners with opportunities to pursue interest-driven, production-centered work and encourage them to interact collaboratively with peers and mentors in productive ways, either via the open web or face-to-face. Kim et al. (2013) stated that educators should encourage learners to create their own scientific ideas and negotiate meanings rather than simply focus on a predetermined body of knowledge. Learning by designing and learning through making usually involve the creation of new knowledge in real contexts; this is one way to achieve deep learning (Harel & Papert 1991; Fullan & Langworthy 2014).

Participatory learning highlights students' self-organization in co-creation and other activities that utilize the ideas of all students (Lewis et al. 2010; Liljeström et al. 2014). Therefore, students should have opportunities to participate in co-developing and co-creation practices in extended and generative learning communities. According to Liljeström et al. (2013b), Finnish students are given very few opportunities to learn in diverse physical environments or in social and technological environments outside of the classroom. Learning usually takes place in formal school environments, mostly in classrooms involving the use of textbooks (NETP 2010). Apparently, in teacher education, the educational experiences of first-year students and their perceptions of the impact of diverse environments, communities, and technologies on their future careers as teachers are deeply connected (Liljeström et al. 2013b). This indicates a clear need to find new models for learning, particularly ones that involve students in real-life activities and communities situated outside the traditional classroom context and in activities that are supported by new technology. For example, NETP (2010) requires the building of learning communities consisting of students, fellow educators, and professional experts from museums, community centers, and other settings. Learning communities should be capable of facing complex and multidimensional challenges and phenomena and of addressing real objects outside the classroom. They should provide opportunities to articulate and formulate open learning tasks, to design and link their learning processes, and to construct and to share collaborative learning solutions (Vartiainen et al. 2012; Ito et al. 2013).

To address these challenges, teacher education at the University of Eastern Finland in Savonlinna integrates forestry-related phenomena and communities as a central part of learning and educational research (Vanninen et al. 2013). Forests are a natural theme in Eastern Finland, where they are rich from ecological, economic, and social points of view. This project has resulted in the construction of the joint OpenForest portal (www.openmetsa.fi). All students (from primary to university levels) can connect via the portal with professional forestry communities and share the products of their own forest-related learning projects. The main emphasis is on the multidisciplinary development and research of learning ecosystems and pedagogical models accessible via the portal. The ultimate goal of this case study was to develop participatory culture practices for learning. The primary school students who were observed took part in a cross-curricular project to study a multidisciplinary and complex phenomenon (bark bread). They were assigned an open learning task to design and produce video artifacts of the phenomenon and to share them via the OpenForest portal. The learning project was guided using the design-oriented pedagogy (DOP) framework. Previous publications have introduced the instructional model in more detail and have described case studies on its developed process. (Vartiainen et al. 2012; Liljeström et al. 2013b; Liljeström et al. 2014; Vartiainen & Enkenberg 2013a; Vartiainen & Enkenberg 2013b; Vartiainen & Enkenberg 2014, Vartiainen 2014).

2. THE OPENFOREST PORTAL AS A LEARNING ECOSYSTEM

As an open learning environment, the OpenForest portal was constructed as a web-based learning ecosystem for forestry education (Vanninen et al. 2013). The development of the OpenForest portal was strongly related to design-based research, in which the ultimate goal was to develop an instructional approach and pedagogical model of DOP. Its purpose was to expand and connect learning beyond the walls of schools or universities to authentic environments (especially natural and cultural ones) and related social networks in collaboration with people with shared interests and diverse types of expertise. The DOP model was tested and validated using several iterative design experiments and principles of design-based research (Vartiainen et al. 2012; Vartiainen 2014). The pedagogy was evaluated from multiple perspectives, with groups of learners with different backgrounds and using mixed-methods strategies (Johnson & Onwuegbuzie 2004).

The development of the OpenForest portal was built upon the three educational principles of DOP: (1) Participatory learning in extended and generative communities is a vital concept for learning; (2) Diverse technological resources and infrastructure are powerful social and personal tools; and (3) Co-development is a powerful social innovation for producing information resources that offer multiple perspectives on forest-related phenomena (Vartiainen et al. 2012). The OpenForest portal was designed to be a learning ecosystem that created space for learning that included participatory, complex, and multidisciplinary problem-solving. The portal offers information resources, community resources, and technological resources that support learning processes that focus on open-ended and whole learning tasks, as well as self-organization (Fig. 1) (Liljeström 2014).

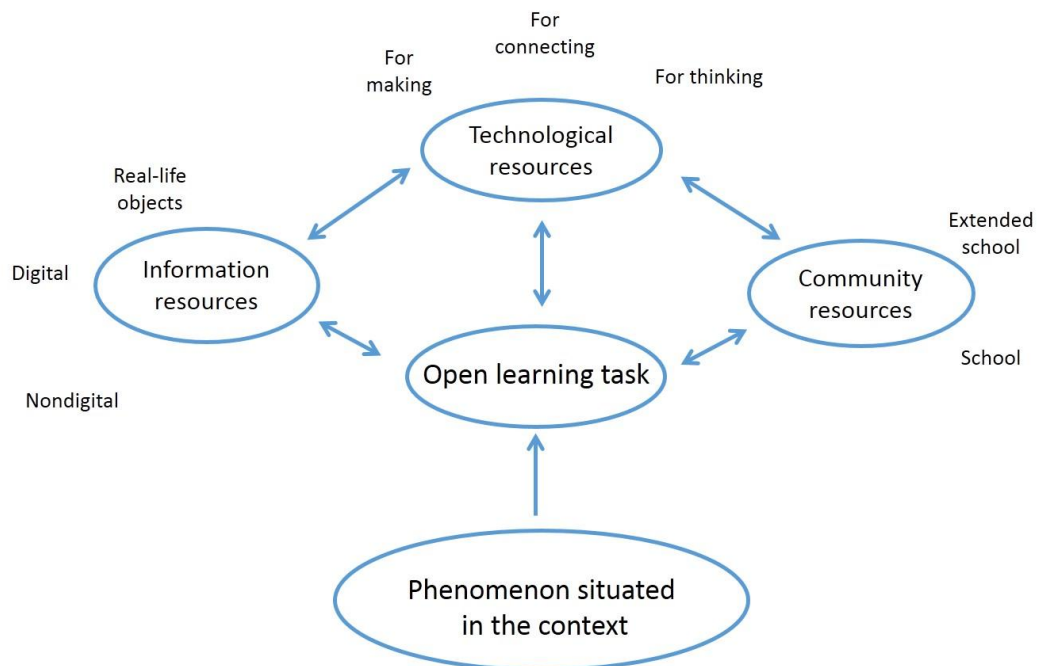


Figure 1. Conceptual structure of a learning ecosystem in OpenForest portal

It was hypothesized that by learning forest-related phenomena and participating in open learning tasks, students would create their own learning ecosystems that were interactive and part of an extensive network of diverse learning resources. The learners, who worked together in small groups, chose learning resources based upon personal preferences. They were encouraged to supplement their learning ecosystem through the use of their personal social networks, tools, or information resources.

The OpenForest portal offers information resources produced by experts in forest research, ecology, culture, and education. The contents of a Wiki may include diverse media, such as audio; 360-degree panoramic photos; and related virtual forest tours, pictures, videos, and texts, in any combination. OpenForest is related to the Finnish Forest Museum Lusto exhibitions and the database collections of several museum objects. The portal provides connections to real objects of the forest. Learners can navigate through the portal using the OpenForest mobile geographic information system using precise and informative maps. Wiki articles are usually situated according to the location of the Research Park and Punkaharju esker (ridge area) or the Savonlinna town area. The technology environment of the OpenForest portal provides a tool for learners undertaking their own projects. The portal can function, for example, as a tool for communicating (through sharing and publishing) and for thinking (through searching, organizing, presenting, and reflecting data). It offers space for presentations of digital productions and designs (e.g., simulations, models, and prototypes). When using the portal, students are able to explore and work with models, real research data, and tools that various experts use in their work.

3. THE CASE OF THE BARK BREAD PROJECT

The OpenForest portal includes productions of heterogeneous learner communities; e.g., the shared constructions of learning projects ranging from preschool to university endeavors. The aim is to always produce and share outcomes from education projects. This function accumulates learning resources and provides starting points for others pursuing their education. The portal's Wiki environment combines expert knowledge and personal perspectives to break down the boundaries of traditional school learning. These projects can also serve as models and examples of learning projects related to forest phenomena for teachers, teacher-students, and other learners.

In this case study, students in a rural school in Eastern Finland (ages 9 to 12, $N = 15$) designed five videos that portrayed pine-bark bread as a multidisciplinary phenomenon. Although pine-bark bread is not a typical phenomenon in the school context, it is one subject from a cultural and historical era offering a number of approaches over time periods to be explored in a multi-disciplinary manner. The learning project consisted of 25 lessons over a 2.5-week period in parallel with other school activities. The videos were published on the OpenForest portal as learning artifacts and information resources that other students could later utilize in their own projects (see www.openmetsa.fi).

The students were offered a diverse learning ecosystem: they could choose community, technology, and information resources to answer research questions. For example, they found and connected with new experts, discovered new books and websites, and asked about and found new kinds of tools for performing the necessary tasks. The students worked in three small groups. Each group used digital cameras that were owned by group members and the school, and was offered the use of desktop and laptop computers, as well as a variety of books and various tools, both during the workshop and later in their own studies. All of the groups participated in a workshop led by a museum expert on making pine-bark flour and baking bark bread.

3.1 Research Questions

The research questions addressed in this paper are the following:

1. What kind of learning process emerged?
2. What kind of data did the students produce?
3. How did the designed and constructed video artifacts answer the students' informal questions from the beginning of the learning project?

3.2 Research Data

The research data consisted of the students' produced data (photos, video clips, audio files, and other products), their 52 informal questions about the phenomenon, and their produced and published video artifacts. All five of these videos were published in 2011 on YouTube and were later transferred to the OpenForest portal and translated into English.

3.3 Research Methods and Data Analysis

The data was analyzed using qualitative deductive methods. First, all the students produced data categorized according to the use of the produced media, its meaning (learning ecosystem), and basic information (date and length). Second, a theory-dependent deductive method was used to categorize the emerging learning projects and ecosystems. The categorization was based on the DOP instructional model (Vartiainen et al. 2012) and the structure of the learning ecosystem (Fig. 1; Liljeström et al. 2014). The aim of the analysis was to deconstruct and then reconstruct the emerging learning ecosystem and learning process using qualitative content analysis (Mayring 2000). The data and final video artifacts provided digital narratives of the students' agency, research objects, and inquiry procedures. It was assumed that the video artifacts would represent the phenomenon in a manner similar to how the students actually experienced and perceived it. In this way, the data also served as reflective stories of the students' learning. Accordingly, the applied narrative thematic analysis placed emphasis on what the students said and demonstrated (Bryman 2004).

Third, a deep analysis was conducted of the students' informal questions related to the phenomenon from the beginning of the learning project in comparison to the final video artifacts.

3.4 Findings

3.4.1 Emerged Learning Process

The open learning task was presented to the students as follows: "Your task is to study the phenomenon of bark bread, design and construct digital videos as learning objects of this process, and share them on the OpenForest portal, which is a common nature and culture Wiki environment. The overall purpose of this project is to produce a video that other students can use in their own learning." At the beginning of the project, the students familiarized themselves with the phenomena by talking with their teacher and researching bark bread on the Internet and in books. They discovered that bark bread was culturally and historically made from pine bark.

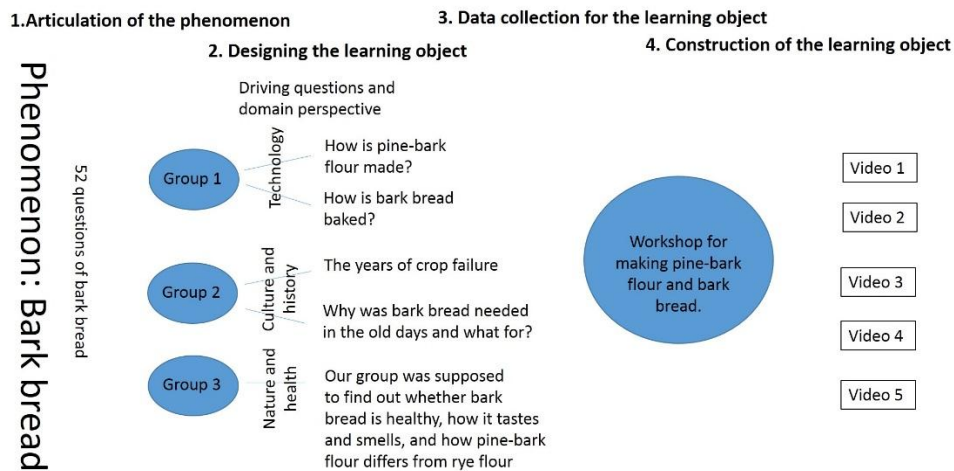


Figure 2. The emerged Learning Process

The students then came up with 52 questions about bark bread; the questions functioned as expressions of the students' informal ideas regarding the phenomenon. They categorized their questions according to culture and history, the process and technology used to make bark bread, and nature and health. The students continued to work in three small groups to choose a perspective for the project, determine their research tasks, design their own learning ecosystem, and establish methods for data collection. They also all participated in a pine-bark flour and bark bread workshop, which was guided by a forest museum expert. The small groups collected their own data (e.g., photos, video clips, audio files, and interviews) and constructed their own videos. The result was five video artifacts on the phenomenon of bark bread from different perspectives (Fig. 2).

3.4.2 Collected and Produced Data of the Learning Process

Altogether, the students collected and produced 113 video clips, 472 photos, 44 audio files, and 11 other file types (texts, pictures, and documents). The length of the video clips ranged from 3 s to 7 min 23 s (all together, 2 h 35 min 35 s). The data were categorized according to the meaning of the file (See Table 1).

Table 1. Number of students' data

	Video clips	Audio files	Photos	Other
Designing	3		58	2
Making	52	43	315	1
Studying and explaining	25		25	3
Reflection	24		8	1
Other	9	1	83	4

There were also the final video artifacts. The students constructed the videos using previously presented data, including video clips, photos, pictures, and audio files. There were five videos in all: the first two videos demonstrated how pine-bark flour is milled and baked into bread, the third video was a drama set in the time period in which a real need existed for baking and eating bark bread, the fourth video clip provided a deeper insight into that time, and the fifth video described bark bread from a perspective focused on nature and health (see http://www.openmetsa.fi/wiki/index.php?title=Bark_Bread). The length of the final video artifacts varied from 2 min 51 sec to 6 min 47 sec (mean = 4 min 16 sec).

3.4.3 Informal Questions Regarding the Phenomenon and Produced Video Artifacts

The students categorized their informal questions into three different classes and perspectives: culture and history, the process and technology of making bark bread, and nature and health. An analysis revealed that many of their questions overlapped between these categories; for example, many of the questions could be answered from both the perspectives of the process and technology used for making bark bread and nature and health. Seven of the questions applied to all three categories.

When comparing the informal questions and the produced video artifacts, it is clear that the dominant question was “What is the value of bark bread?” Many of the other questions were actually sub-questions of this overarching query. All of the video artifacts described the value of the bark bread from various perspectives. On the other hand, the videos proposed many new questions and issues that needed to be clarified and answered, pertaining to subjects like tools and their uses, explanations of the processes and studies, the nature of the experts’ work, and the use of all the senses for studying and reflecting in and on the design process. The analysis of the designed video artifacts revealed that the learning ecosystem in which the learning processes were situated was the same for all the small groups.

4. CONCLUSION

This case study, using the example of the bark bread project, has demonstrated how heterogeneous learning and extended learning communities can be connected in the OpenForest portal. As previously mentioned, different domain experts produced information resources for the portal. However, the ultimate goal of OpenForest portal is to create ways for experts to work, think, and produce information and to challenge students to develop their tacit knowledge by participating in the activities in which the experts are engaging (Bransford et al. 2005).

Based on the findings of the case study, we argue that the use of students’ co-developed informal questions for a learning project can initially generate a shared learning task that can—through the final artifacts—provide complementary pictures of the shared phenomenon. Additionally, it is interesting that this type of design process seems to raise the need to shed light on the principled knowledge that experts use to solve complex tasks. This was revealed in the students’ in-depth descriptions of their studies.

It can be concluded that students’ own informal questions at the beginning of the learning project helped to make the open learning task a mutual project and helped in efforts to study the phenomenon in a holistic manner. Students used innovatively offered learning resources and the project met the challenge of collecting an amazing amount of data. The construction of the video artifacts from such a large amount of data required a strong understanding of the phenomenon. Moreover, the quality of the video artifacts is high, they are informative and fun, and they present the phenomenon from diverse perspectives. The findings suggest that this study succeeded in ways similar to the ways described by Ackermann (2004), referring to Seymour Papert’s pioneering work in learning: “Becoming one with phenomenon under study” and as “a key to learning.”

As seen in this case study, learning should be situated in a diverse and extended learning ecosystem in which heterogeneous participants share different ways of working together, thereby mediating and enhancing their individual and communal expertise. For example, if our future society depends on innovation and design, we should situate learning in environments that challenge students with activities that involve innovation and design (Bereiter & Scardamalia 2003). Learning through the use of the resources available on the OpenForest portal stresses the approach to mediating tacit knowledge and expert problem-solving (Thomas & Brown 2009; Liljeström 2013a; Liljeström 2013b). Furthermore, as Wells (2008) argued, participatory learning is oriented toward outcomes that are both personal and collective.

This case study has demonstrated that students at the primary level can produce high-quality content to share with others, thereby cultivating future learning resources in a variety of ways. The aim of sharing and publishing the products of learning on the OpenForest portal is to provide outcomes that can serve as new learning resources for future users. Therefore, the outcomes of learning can become new cultural property that can be meaningful for individuals, groups, and a wider audience.

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DESIGNING PARTICIPATORY LEARNING

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ABSTRACT

The beginning of the twenty-first century has been described as a time of development for social innovations through which people use, share, and create knowledge in ways that differ fundamentally from those of previous eras. The topical and widely accepted focus of education should be toward twenty-first-century skills. However, there is no consensus regarding in which kind of environment these skills can be practiced and neither is there consensus on how to organize the instruction for learning these skills. To enhance our students' chances of becoming active agents in their own lives and learning in settings far beyond classrooms, a design-oriented learning system is proposed as a context for practicing twenty-first-century skills. A learning system is understood as a system that extends the network of resources, communities, and tools. Respectively, a design-oriented pedagogy has been developed for organizing the ways that diverse people, resources, and tools interact with each other, and for developing the best opportunities for learning from the system. The presented research-based design perspectives may help educators in different institutions to facilitate connected learning across spaces and communities.

KEYWORDS

Design-oriented pedagogy, participatory learning, collaborative designing, learning system

1. INTRODUCTION

At the beginning of the twenty-first century, we witnessed the emergence of the knowledge society, which is argued to have had profound effects on our health, educational, cultural, and financial institutions, and to have created an ever-increasing need for robust lifelong learning, innovation, and the knowledge and skills to solve the problems of the future (Scardamalia, Bransford, Kozma & Quellmalz, 2011). Rapid advancements in technology and socio-cultural developments have shifted the cultural logics and social practices that shape the ways we interact with people and with physical and conceptual artifacts. These changes point us toward a more participatory culture, one in which people have an expanded capacity to share and circulate their ideas, and one in which networked communities can shape our collective agendas (Clinton, Jenkins & McWilliams, 2013). Jenkins et al. (2008) define a culture of participation as “a culture with relatively low barriers to artistic expression and civic engagement, strong support for creating and sharing one’s creations, and some type of informal mentorship whereby what is known by the most experienced is passed along to novices.”

Fischer and Redmiles (2008) have argued that if the future of work and living is based on collaboration, creativity, problem identification, and framing, and if tolerance, change, and intelligence are spread over different cultures, disciplines, and tools, educational systems should promote trans-disciplinary competencies that will prepare learners for meaningful and productive lives. Similarly, Mizuko et al. (2013) argue that the function of schooling should be to prepare students for contributing to, and participating in social life, which includes economic activity, but also civil society, family, and community. Pursuing such forms of connected learning can lead to broader communal and societal outcomes such as high-quality culture and knowledge products, civically oriented collectives, and diverse and equitable pathways to opportunity (Mizuko et al., 2013).

At this point, many researchers prefer to discuss twenty-first-century skills, often emphasizing aspects such as being able to communicate and collaborate to solve complex problems, being able to adapt and innovate in response to new demands and changing circumstances, and being able to use technology to create new knowledge and expand human capacity and productivity (Binkley et al., 2011). However, it is widely recognized that the traditional ways in which schooling has been organized are no longer sustainable in

providing students with the knowledge and skills they will need for the future (Scardamalia & Bereiter, 2006; Thomas & Brown, 2011; Schank, 2011; Binkley et al., 2011). Recent discussions about disconnected learning, student disengagement in learning activities, and the non-relevance of learned skills and knowledge compared to the knowledge and skills demanded by the workplace and everyday life have emphasized problems in the existing learning ecosystems (Liljeström, Enkenberg & Pöllänen, 2014).

Rheingold (2013) argues that these changes in our society challenge educators to develop participatory pedagogy assisted by digital media and networked publics, which emphasizes catalyzing, inspiring, nourishing, and facilitating learning that is essential to individual and collective life in the twenty-first century. Joseph and Czarnecki (2013) note that we should no longer merely focus on questions pertaining to digital media access, but, increasingly, to inequalities in access regarding opportunities for participating in cultures supporting the development of these needed competencies and skills, such as working effectively and respectfully with diverse teams, exercising flexibility and having a willingness to make compromises to accomplish common goals, and assuming shared responsibility for joint efforts while valuing individual contributions. The participation perspective for learning and education is focused not on delivering predigested information to our students, but on providing opportunities and resources for them to engage in social activities, to create a shared understanding among diverse stakeholders, and to frame and solve authentic and personally meaningful problems (Fischer, 2013). It aims to support students so that they become active members who participate in culturally and personally relevant activities in which they appropriate various cultural resources that enable them to participate in and contribute to the larger society (Wells, 2010).

Creating learning opportunities that help students to prepare for the knowledge society and to participate in, contribute to, and benefit from knowledge-creating organizations must be informed by what we know about how people learn and the changes in learning environments that this implies (Scardamalia et al., 2011). If we want to develop these interactions in schools and create new kinds of learning spaces that people can change, design, experiment with, and use in a variety of ways, we have to intervene in the current practices in a purposeful way to change the relationships between people and resources (Loi & Dillon, 2006). Thus, this paper presents a design-oriented pedagogy (DOP) as an initiative for the creation of the new kinds of learning systems required in twenty-first-century societies.

2. DESIGN PERSPECTIVES

To enhance participatory activities situated in schools, out-of-school environments (especially natural and cultural environments), and in technological environments, our research group has developed a DOP (Vartiainen, Liljeström & Enkenberg, 2012). The DOP has been constructed on three pillars: participatory learning in extended and generative communities as a vital concept for learning; diverse technological resources and infrastructure as social and personal tools; and co-development, both as a pedagogical model, and as a powerful social innovation for solving the multidisciplinary and complex problems people face in their everyday lives (Vartiainen et al., 2012; Liljeström, Enkenberg & Pöllänen, 2013; 2014; Vartiainen, 2014). The DOP shares several similarities with inquiry-based pedagogies such as knowledge building (Scardamalia & Bereiter, 2006), progressive inquiry (Hakkarainen, 1998), project-based learning (Krajcik & Blumenfeld, 2006), and learning through collaborative design (Seitamaa-Hakkarainen, Viilo & Hakkarainen, 2010).

The DOP aims to transform learning by paying attention to the ways that diverse people, objects, artifacts, and tools interact with each other, and offers a pedagogical model and process, together with the underlying conceptual system embodied in the design. Figure 1 presents a design-oriented learning system of interconnected elements that derive their full meaning in relation to each other (Vartiainen, 2014).

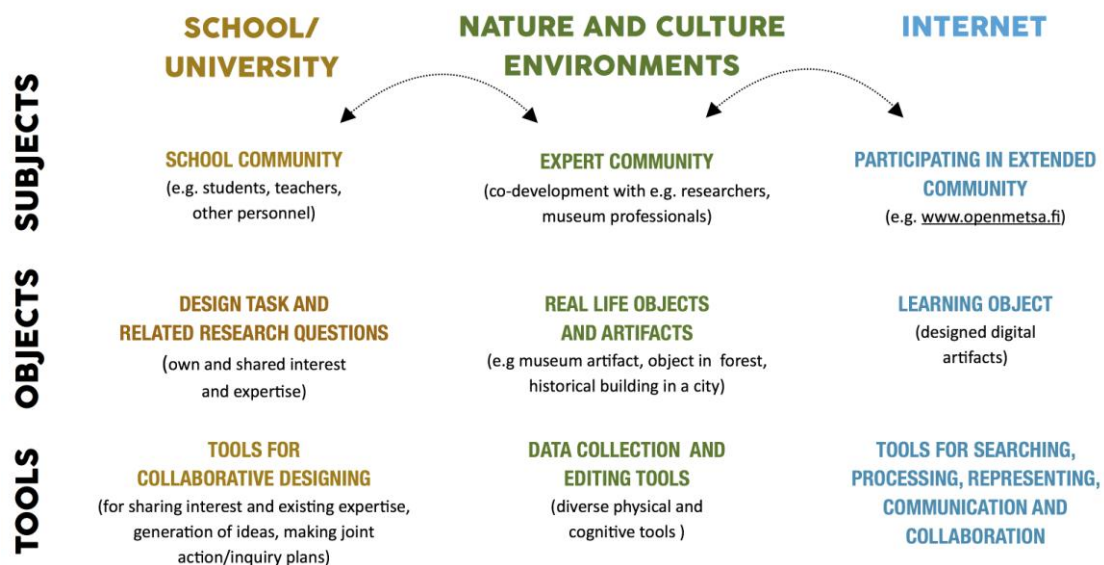


Figure 1. Design-oriented learning process, described as a system (Vartiainen, 2014).

2.1 Extending the Learning Community

While the overall goal of schooling is to prepare young people to be able to participate responsibly and productively in the wider society, the actual practices through which schooling takes place anchor learning mostly in classrooms (NETP, 2010; Wells, 2011). In the DOP, the participatory perspectives on learning are emphasized in situating the learning in extended environments and generative communities (Vartiainen et al., 2012). Classroom educators are encouraged to build learning communities consisting of students, fellow educators, and professional experts from museums, community centers, and other settings who can mediate and support the student's learning on demand (NETP, 2010) and enhance the activities in which students learn and work together by taking on different roles, perspectives, and responsibilities, and by applying their own expertise. Consequently, the learning environment is expanded beyond the walls of the school or university to authentic environments and related social networks, in which heterogeneous participants offer diverse ways of working together, mediating, and enhancing individual and communal expertise.

The important instructional feature of the learning system is the design task, which orients and structures the activities emerging in the network of the subject, objects, and tools. The design task aims to connect the heterogeneous interests, experiences, and expertise that learners bring to the school from other contexts (e.g., from home) with the affordances of the learning environment and for the use of the extended learning community. Complex design tasks and objects can be addressed from different perspectives (Seitamaa-Hakkarainen et al., 2010; Hakkarainen et al., 2013) and they intentionally bring into play multiple disciplines, multiple ways of working, and different habits of the mind and community (Lombardi, 2007). They also provide students with opportunities to design and perform inquiries (Krajcik & Blumenfeld, 2006), and to choose different kinds of perspectives and paths with which to engage in inquiry with the extended learning community (Liljeström et al., 2013a). Consequently, the participation in an expert community is driven by the students' own interests and research questions, where they work together in teams in pursuit of advancing their own understanding to be shared with the extended community (Vartiainen, 2014). The aim is to offer opportunities for the learner to join and be part of a larger social network, where people learn through their interactions and participation with others, in fluid relationships that are the result of shared interest (Thomas & Brown, 2011).

2.2 Extending the Learning Resources

In contrast to traditional "chalk and talk" classrooms in which knowledge is abstracted from real-life situations, the DOP involves collaborative work with conceptual and material artifacts that represent the

phenomenon in question. Furthermore, what distinguishes the design-oriented approach from the traditional school field trip to e.g. a museum is that the learners are encouraged to connect with the world around them through the objects and real-life artifacts they self-organize for their own action and thinking. The articulation of the shared task and the related research questions of the students themselves can be understood from one point of view as identifying, negotiating, and selecting the real-life artifacts that become part of the students' own learning resources in relation to their own interests, past experiences, and future intentions (Vartiainen, 2014). As noted by Kangas, Seitamaa-Hakkarainen, and Hakkarainen (2011), these intentions guide the design process, but may transform when the process advances. Thus, it includes the process of perceiving the function and meaning of the selected real-life artifacts and related information resources in terms of achieving a particular goal.

The artifacts in natural and cultural environments can be approached from different perspectives with various questions in mind and can take on different functions when the students select and embed them in their own activities (Vartiainen, 2014). A particular artifact and the related information resources (e.g., digital or printed media) can assume a different meaning for the different students, with the artifact and related information resources being a focus of inquiry for some, while, at the same time, being a background for others, for example (cf. Nicolini, Mengis & Swan, 2012). Furthermore, the human relationship with the real-life objects and related information resources is not considered as constant, but it may develop, as they are encountered differently in evolving design processes in which connections are established with other resources, tools, and subjects (Vygotsky, 1978).

In the DOP, the learners are deliberately provided with the possibility and means through which to share their ideas, thoughts, and their own designs related to real-life artifacts with the extended community in the form of a learning object (Vartiainen et al., 2012, see an example of a learning object: www.openmetsa.fi/dopvideo). The notion of the learning object in design-oriented learning is defined as “designed digital representations from real objects in context that are related to the phenomenon in question and to tools that mediate the process of the negotiation of meaning” (Vartiainen et al., 2012). The construction of learning objects shares the idea of triological inquiry by engaging students' learning in creative work with externalized ideas, and the objectification and materialization of thoughts in respect of creating their own (digital) artifacts in interaction with which the subsequent inquiry takes place (Hakkarainen et al., 2013; Seitamaa-Hakkarainen et al., 2012). As pointed out by Thomas and Brown (2011), promoting the opportunity for the students to share the outcomes of their inquiry activities with an extended collective structured around participation (e.g., www.openmetsa.fi) is very different to putting the outcome onto the school wall or into the public domain. By offering the students the chance to collaborate with their peers, to take part in face-to-face interactions with expert communities, and to be contributing members in an online community with a more dispersed population, the students are deliberately offered different forms of participation (Jenkins et al., 2008). Viewed through the lens of participatory culture, it offers the opportunities for and the means of participating in the practices of the social production of knowledge (Jenkins et al., 2008) in distributed networks of communities, resources, and tools.

2.3 Tools for Making, Thinking, and Sharing

The DOP also aims to enhance the opportunity to apply diverse physical, cognitive, and social tools and technologies in collecting, developing, and sharing information. The technologies that the students own provide tools to enhance learning across different contexts, and to collect various empirical data when implementing inquiries in authentic environments (Vartiainen & Enkenberg, 2013a). When working with expert communities, the learners are provided with the possibility of being able to use domain-specific tools that characterize such expertise (Vartiainen, 2014). Additionally, social media provides tools for learners to organize, develop, and share knowledge, and to collaborate within and outside the school community (Vartiainen et al., 2012).

However, rather than dealing with technology in isolation, the DOP takes a more systemic approach, by considering the interrelationship among tools, artifacts, and the communities, and the activities in which they are embedded. The tools derive their full meaning and functional role in relation to the other elements of the learning system in situated social practice: the subject(s) using the tools (e.g., students, experts, and teachers' agency); the object (e.g., shared tasks, students' own research questions); and the artifacts of their actions (e.g., material and conceptual); and the context of using the tools (e.g., designing, making inquiries, sharing

the results). Thus, the subject and real-life artifacts are not connected by the tool in a mechanical manner, but are dynamic interactions, and are grounded in particular activities. Different tools are needed during the process of collaborative designing and when implementing the inquiry activities in extended learning environments, and during this evolving process, the same tool may be used in different ways and may serve different purposes (Vartiainen, 2014). As Claxton (2002) argues, if the main thing we know about the future is that we do not know much about it, then the educators should not only provide young people with the tools of today, but should help them to become confident and competent designers and makers of their own tool environments when solving emergent problems.

3. SITUATED CONTEXT

Like activity systems (Engeström, 1987), the elements of the DOP system are not static but are continuously interacting with each other, through which they define the emerging learning system as a whole. This emergent form of the system ultimately shifts our focus to the situated context that these elements form, promoting the students' possibilities of shaping it. It proposes a clear transformation from a predetermined learning environment toward the creation of dynamic and extending learning networks (Vartiainen, 2014). Fischer (2013) argues that collaborative design and social creativity are necessities for the most complex and important problems in today's world. Rather than just emphasizing "what is already known," the "design" metaphor emphasizes the creative element in the interpretive activities of learners that goes beyond giving back what is already there (Säljö, 2010). Mäkitalo, Jakobsson, and Säljö (2009) note that we are now held accountable not just for what is in one particular artifact, text, or even in large numbers of information resources; the summarizing of what is known is not enough. Rather, it is our ability to make insightful and productive use of the collective resources in locally relevant ways that is of importance (Mäkitalo, Jakobsson & Säljö, 2009).

As argued by Liljeström et al. (2014), the focus is transformed in emerging learning ecosystems that offer the students the opportunity to self-organize and utilize the afforded community, technology, and information resources to construct their own interpretations of their chosen research tasks and related inquiries. This view overlaps with Barab and Roth's (2006) notion of affordance networks. They define this concept as the collection of facts, concepts, tools, methods, practices, agendas, commitments, and even people, with respect to an individual, that are distributed across time and space, and are viewed as necessary for the satisfaction of particular goal sets. According to Barab and Roth (2006), education should connect learners to an ecological system that stimulates an appreciation for, and a desire to be a part of contexts through which these networks take on meaning, as well as equipping students so that they can create new and useful affordance networks. From this perspective, learning and participation is about successfully participating as part of an ecosystem, which involves increasing the possibilities for action in the world (Barab & Roth, 2006).

The DOP utilizes the notion of self-organizing systems of participatory cultures by emphasizing that the process is not scripted in detail in advance, but has to be negotiated and actively designed by the learners themselves. It matters that various resources and more experienced community members (e.g., teachers, experts) are supporting and available for the use of the learners, but it is essential that the learners should be positioned in a key role when defining the specific network of artifacts, tools, and information resources in terms of their own intentions and negotiated research questions. Yet, the learners are supported by the instructional model and by joint activities with mature members of the community to design and build learning paths that mediate the practices of innovative professional or scientific communities (see Vartiainen et al., 2012).

As argued by Jenkins et al. (2008), schools, museums, and other public institutions have an essential role to play in creating more equitable opportunities for participating and contributing one's own expertise to a process that connects many intelligences and communities outside of the school. When the students participate in practices to address shared intentions beyond the school, the students become, at that moment, enculturated, participatory, contributing community members, and the students and the extended community's ecosystems may overlap (Barab et al., 1999). At the heart of the idea is to allow students to participate in knowledge-creating activities around shared objects and to share their efforts with the wider community for further knowledge building that is a legitimate part of civilization (Scardamalia & Bereiter, 2006).

4. FUTURE DIRECTIONS

Following the principles of design-based research, the perspectives and instructional model of the DOP have been tested and validated in several design experiments during the last seven years with groups of learners whose backgrounds differ from each other. Our research group has conducted several design experiments to develop the model and the related design principles to their present “state of the art.” Liljeström et al. (2013; 2014) have demonstrated how open-ended learning tasks and collaborative inquiry approaches can mediate the kind of authentic practices that scientists apply. Likewise, Vartiainen and Enkenberg (2013a; 2014) have examined the types of learning systems that emerge when different student groups collaboratively design their own specific network of museum artifacts, tools, and other resources in terms of the shared design task and their own specific research questions. Vartiainen and Enkenberg (2013b) have also assessed how applicable and acceptable the DOP is from an international perspective, and they found that the teachers saw the pedagogy as one way of being able to change and develop their current school practices toward more innovative ones. Furthermore, our research team, representing multidisciplinary expertise concerning educational and forest sciences, has constructed the OpenForest portal (<http://www.openmetsa.fi/>) for people to share, develop, and organize knowledge and to collaborate within and outside of the education community and institutions (Vanninen et al., 2013).

Summing up these design experiments and development work, there is evidence that the DOP can fruitfully be applied in diverse contexts for enhancing participatory learning situated across spaces and communities. However, the pedagogical design is not considered to be at a point of finality and perfection, but continues to be refined as part of an evolving design-based research process (Bielaczyc, 2013). While the DOP has been studied over eight years through several case studies in Finland, the next step in this longitudinal design-based research is the enlargement of these innovations. We are especially interested in developing international collaboration for future research on design-oriented knowledge creation and participatory leaning in networked communities. This could provide us with interesting opportunities through which to approach global phenomena such as sustainable development as a shared design object for learning and crowdsourcing in an international network of students, teachers, researchers, experts, and interested others. At the same time, it would provide researchers with interesting opportunities to examine how and in what ways the participants from different backgrounds use and share their own interests, their own and afforded tools and technologies, and local physical and social environments as resources for learning driven by joint co-development. The promotion of inquiry activities that enable students to participate in the co-development process with local and international communities might be particularly important for learning in a world of constant change in which the use of diverse knowledge resources, tools, and network connections are essential aspects when solving complex, emergent problems and creating situation-based solutions. It also emphasizes the importance of *design* in twenty-first-century learning (Vartiainen, 2014).

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THE RELATIONSHIP AMONG PRINCIPALS' TECHNOLOGY LEADERSHIP, TEACHING INNOVATION, AND STUDENTS' ACADEMIC OPTIMISM IN ELEMENTARY SCHOOLS

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ABSTRACT

This study empirically investigates the relationships among principals' technology leadership, teaching innovations, and students' academic optimism by surveying elementary school educators across Taiwan. Of the total 1,080 questionnaires distributed, 755 valid surveys were returned for a 69.90% return rate. Teachers were asked to indicate the effectiveness of technology leadership, teaching innovation, and students' academic optimism. The study used structural equation modeling with prospective data to test for model fit. The findings indicated that principals' technology leadership positively affects teaching innovation, which in turn directly affects students' academic optimism. Principals' technology leadership also positively influences students' academic optimism. The results suggest that principals should implement effective technology leadership in order to accelerate teaching innovation in school operations, thereby have a positive impact on student attitudes.

KEYWORDS

Academic Optimism, Technology Leadership, Teaching Innovation.

1. INTRODUCTION

Technology has changed our lives. Driven by a global trend of digitalization, the fashion of digital learning has been transforming. In an era with advanced information technology, technology products have made a significant impact on school operations, teachers' teaching, and students' learning, and a school leader's technology literacy is progressively valued and emphasized. Hallinger & Heck (2010) pointed out that school leadership may affect students' learning outcomes. The leadership of a school principal has the power of continuously enhancing the quality of education, the development of a school and students' learning. Furthermore, the leadership of a school principal could boost teachers' teaching skills, improve the way of learning, and make a positive impact on students' learning. A school leader should actively introduce resources to school, boost students' willingness to learn and teachers' teaching in the process of teaching. The integration of supporting education technology may be utilized to assist teaching successfully.

Also, the core of school education should be teaching. Teachers should be brave enough to face problems of teaching and put forward necessary strategies for revolution to ensure the quality of teaching, enhance students' participation in learning, and improve students' learning outcomes. The better concepts and skills of teacher teaching innovation are accompanied with better school effectiveness. Aside from teachers' self-initiated introspection and regeneration, a school principal should play the role of a teaching innovation exponent and encourager, who constantly encourages teachers to have a bold attempt to innovate norms of teaching, perfect their teaching skills, make more effective student learning, and in turn improve school effectiveness. Students would have more successful learning experiences if students face challenges along the way of learning with an optimistic attitude. Such positive energies are able to motivate students to make more efforts to learn. Hsieh & Hsiao (2013) pointed out that shall students be willing to endeavor to achieve an

academic achievement goal set by school teachers or parents, a school campus would be full of teachers who are enthusiastic about teaching and students who are diligent in studying. Such school atmosphere would prompt teachers' faith in students' ability to learn, students' higher motivation to learn, and students' better academic achievement. In light of the above statement, this study aims to explore the correlation between principal technology leadership, teacher teaching innovation, and student academic optimism in primary schools.

2. LITERATURE REVIEW

2.1 Principals' Technology Leadership

As the leader of a school, a school principal should be literate in information technology so that school staff can also make good use of technology in teaching, create a teaching environment which facilitates students' motivation to learn, and achieve the goal of being a highly-acclaimed school. The above statement has expounded on the importance of principal technology leadership. Ray (1992) pointed out that exceptional technology leadership calls for excellent people skills, communication skills, and technology skills. Bailey (1997) mentioned that a school leader should make use of leadership skills to assist an organization to utilize fast-changing technology for a good cause. Anderson & Dexter (2005) suggested that technology leadership refers to a school's more effective use of information technology in decision-making, policy-making, and actions. Principal technology leadership can facilitate changes in a school as well as incorporate and utilize diverse solutions in learning, teaching, and school administration (Afshari, Bakar, Luan, Samah, & Fooi, 2008).

Schmeltzer(2001) further pointed out that a technology leader has to know how to use technology to improve teaching, develop strategies to help teachers incorporate technology into teaching, as well as form a technology team and a support system to continuously promote an entire organization's use of new technology. Creighton (2003) proposed that a school principal's important tasks include planning and carrying out innovative technology strategies, assist teachers to perceive and understand the importance of teaching and technology, and integrate technology into curriculum and teaching in order to improve the effectiveness of teaching. Hsieh & Hsiao (2013) believed that a school principal should possess information technology literacy, the ability to integrate resources, and the ability to visualize a future scene of technology in a well-planned manner. In addition, a school principal has to utilize leadership skills to encourage school teachers and non-teaching staff to undergo training in order to have better information technology skills, develop skills in applying technology in administration and teaching, create a communal and supportive school environment, and bring school administration, teaching, and students' learning and performance to the best possible status.

Flanagan & Jacobson (2003) pointed out that effective technology leadership can positively facilitate students' learning and prompt a school's technology renovation projects. According to a study of Chang (2012), principal technology leadership could enhance teachers' technology literacy and directly encourage teachers to incorporate technology with teaching while teachers' technology literacy has a direct impact on the effectiveness of teaching. With respect of measurable sub-dimensions of principal technology leadership, we segment principal technology leadership into five sub-dimensions: "vision, plan, and management", "member development and training", "support of technology and basic infrastructure", "assessment and research", "interpersonal relationship and communication skill" after studying and systemizing relevant research (Chin & Chang, 2006; Chang & Wu, 2008; Hsieh & Hsiao, 2013).

2.2 Teaching Innovation

Teaching innovation refers to teachers' use of diverse and vivacious teaching methods coupled with miscellaneous contents of teaching to stimulate students' inner interest in learning, cultivate students' positive attitudes of learning, and enhance students' ability to learn in the process of teaching. Nie, Tan, Liao, Lau, & Chua (2013) pointed that teachers who receive commands from a leader would endeavour to better their efficacy and beliefs in teaching, change their teaching methods, and adopt active teaching innovation to let students acquire more useful knowledge. Teaching can also be more effective when teachers materialize

thoughts into real actions, improve existing teaching methods, or use new methods and instruments. Undoubtedly, teaching beliefs have a direct impact on the effectiveness of teaching as the foremost function of teaching beliefs is to guide and determine the presentation of teaching behaviors. For that reason, the presentation of a teacher in the action of teaching is reflective of the teacher's teaching beliefs, which directs the teacher's teaching behaviors and in turn affects decisions and judgments of innovative teaching strategies (Pu, 2011).

According to Fan & Chang (2013), teaching innovation is acquiring knowledge by making good use of technology, adopting new teaching beliefs, employing diverse and vicarious teaching methods, making changes in the content of teaching, teaching methods, methods of assessment, or software and hardware facilities to enhance students' interest in learning and students' learning outcomes while adhering to teachers' teaching goals and considering students' needs. Blitz, Van Rooyen, Cameron, Pickworth, & Du Toit (2010) mentioned that teachers should have knowledge of their own styles of teaching, constantly reflect on the process of teaching, contemplate on the existing knowledge and seek to go beyond it, use theories and beliefs of innovative teaching as the foundation, accommodate to students' different levels, choose appropriate teaching scenarios, make use of different teaching strategies skilfully, constantly improve and revolutionize the process of teaching, adopt new teaching equipment and teaching props, and incorporate multidimensional assessments to develop a comprehensive and systematic innovative teaching model.

Teaching innovation, which is revolution and changes in learning, not only affects teachers' teaching but also students' learning. Therefore, students would get different learning methods when teachers change their thoughts about and methods of teaching. In this study, we segment the dimension of teacher teaching innovation into four sub-dimensions: "innovative teaching beliefs", "innovative teaching content", "innovative teaching method", and "innovative teaching assessment" after studying relevant literature.

2.3 Students' Academic Optimism

Academic optimism is a complex variable involving the concepts of efficacy, trust, and academic emphasis, and these concepts are important features which can be used to describe a school's academic success (McGuigan & Hoy, 2006). A number of studies have looked into teachers' academic optimism (Chang, Hsu, & Yen, 2011; Hoy, Tarter, & Woolfolk-Hoy, 2006) and pointed out that teachers' academic optimism has a positive impact on students' learning achievement.

As rising importance has been attached to the concept of academic optimism, a number of researches have applied the concept of academic optimism on students learning, i.e. students' academic optimism. In a study of Smith & Hoy (2007), it was substantiated that academic optimism had a positive impact on primary school students' grades at school. Research of Beard, Hoy, & Woolfolk-Hoy (2010) also suggested the close correlation between academic optimism and students' learning achievement. When students are sure about school's important functions on their daily life, they start to put school and school-associated goals on an important position (Finn, 1989). A study of Klem & Connell (2004) pointed out a positive correlation between students' participation and academic achievement regardless of students' race, gender, and socioeconomic status. Lee (2012) also pointed out that enhancing students' participation is conducive to improving impoverished students' learning outcomes. Therefore, reinforcing students' attention on learning and keeping students' optimistic beliefs in learning are important factors that affect students' learning outcomes.

After examining students' identification with their school, their trust in teachers and emphasis on academics, Tschannen-Moran, Bankole, Mitchell, & Moore (2013) concluded that these three elements contribute to students' academic optimism and have a crucial effect on student learning. In this study, we segment students' academic optimism into the same three dimensions: students' identification with their school, students' trust in teachers, and students' academic emphasis.

2.4 Development of a Theoretical Model

2.4.1 The Impact of Principals' Technology Leadership on Teaching Innovation

According to relevant studies, there is significantly positive correlation between principal technology leadership and teacher teaching innovation whether as a whole or on each sub-dimension (Chang, 2011;

Chang & Wu, 2008; Hsieh & Hsiao, 2013). Also, there is significant correlation between principal technology leadership and teacher teaching innovation (Wu & Yang, 2009). As such, this study reasons that principal technology leadership has a significant and positive impact on teacher teaching innovation.

2.4.2 The Impact of Teaching Innovation on Students' Academic Optimism

According to relevant studies, there is significantly positive correlation between teacher teaching innovation and student academic optimism (Lee, 2012; Ngidi, 2012). Judging from the above statement, we can tell that there is a close relationship between teacher teaching innovation and student academic optimism whereas effective improvements in teachers' curriculum planning and teaching delivery are likely to trigger students' willingness to learn. As such, this study reasons that teacher teaching innovation has a significant and positive impact on student academic optimism.

2.4.3 The Impact of Principals' Technology Leadership on Students' Academic Optimism

According to relevant studies, there is significantly positive correlation between principal technology leadership and student academic optimism (Chang & Wu, 2008; Hsieh & Hsiao, 2013; Chang, 2011). For that reason, a school principal's technology leadership is the key for students' progress, effective learning, and getting an advantage over competitors. As such, this study reasons that principal technology leadership has a significant and positive impact on student academic optimism.

2.4.4 The Relationship among Principals' Technology Leadership, Teaching Innovation, and Students' Academic Optimism

With reference to the perspective of Baron & Kenny (1986), this study believes in the possible existence of a mediating effect between principal technology leadership, teacher teaching innovation, and student academic optimism. In specific, principal technology leadership has an indirect and positive impact on student academic optimism through the mediating effect of teacher teaching innovation. Based on an examination of the literature, We hypothesize the model (see Figure 1) that principals' technological leadership directly influences teachers' teaching innovation and students' academic optimism. Furthermore, teachers' teaching innovation directly influences the students' academic optimism. More important, principals' technological leadership, as mediated by teachers' teaching innovation, can affect students' academic optimism will be tested.

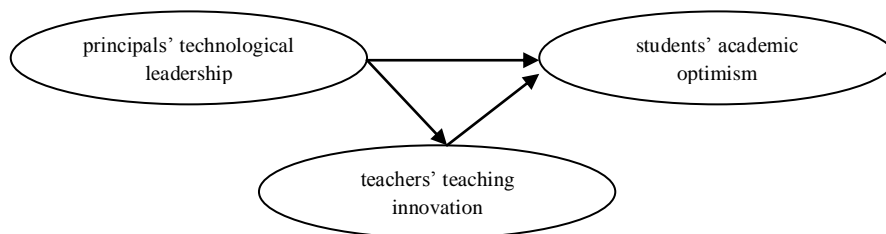


Figure 1. Hypothesized conceptual model

3. RESEARCH METHOD

3.1 Research Subjects

With public primary school teachers in Taiwan as research participants, this study adopts the stratified sampling method to perform questionnaire survey on the research participants. Among the 1,080 distributed questionnaire copies, 755 valid questionnaire copies are collected, a valid response rate of 69.90%. Among respondents of the valid questionnaire copies, 39.2% are male teachers, 49.5% are teachers with a master's degree, and 37.9 % are teachers who also perform school clerical and administrative duties.

3.2 Research Variables

3.2.1 Principals' Technology Leadership

The scale of Hsieh & Hsiao (2013) is employed to measure principal technology leadership. Among the scale's 19 question items, there are five questionnaires items about "vision, plan, and management", three question items about "member development and training", four question items about "support of technology and basic infrastructure", four question items about "assessment and research", and three question items about "interpersonal relationship and communication skills". Results of second-order confirmatory factor analysis reveal that the model's goodness of fit statistics including root mean square error of approximation (RMSEA), standardized root mean square residual (SRMR), and comparative fit index (CFI) are .059, .024 and .97 respectively, and all question items' standardized factor loadings are between .80 and .91, indicating good reliability and validity of the principal technology leadership measuring instrument.

3.2.2 Teaching Innovation

The scale of Fan & Chang (2013) is employed to measure teacher teaching innovation. Among the scale's 21 question items, there are five question items about "innovative teaching beliefs", five question items about "innovative teaching content", five question items about "innovative teaching methods", and six question items about "innovative teaching assessment". Results of second-order confirmatory factor analysis reveal that the model's goodness of fit statistics including root mean square error of approximation (RMSEA), standardized root mean square residual (SRMR), and comparative fit index (CFI) are .066, .036 and .95 respectively, and all question items' standardized factor loadings are between .73 and .85, indicating the good reliability and validity of the teacher teaching innovation measuring instrument.

3.2.3 Students' Academic Optimism

The scale of Tschannen-Moran et al. (2013) is employed to measure student academic optimism. Among the scale's 25 question items, there are 10 question items about "students' identification with a school", eight question items about "students' trust in teachers", and seven question items about "students' academic emphasis". Results of second-order confirmatory factor analysis reveal that the model's goodness of fit statistics including root mean square error of approximation (RMSEA), standardized root mean square residual (SRMR), and comparative fit index (CFI) are .063, .035 and .95 respectively, and all question items' standardized factor loadings are between .71 and .87, indicating the good reliability and validity of the student academic optimism measuring instrument.

3.3 Data Analysis

The scale of this study is an adaptation of the 5-point Likert scale, and a variable's higher score indicates the variable's stronger positive attributes. The data analysis is carried out by performing descriptive analysis on means and standard errors of each variable's sub-dimensions, using Pearson product-moment correlation to understand the strength of correlation, and using structural equation modeling to examine the correlation of variables.

4. RESEARCH RESULTS

4.1 Descriptive Statistics and Relevant Analysis

The means of principal technology leadership statistics fall between 3.62 and 3.91, with "member development and training" having the greatest mean ($M = 3.92$, $SD = 0.74$). The means of teacher teaching innovation statistics fall between 3.87 and 4.11, with "innovative teaching content" having the greatest mean ($M = 4.11$, $SD = 0.55$). The means of student academic optimism statistics fall between 4.05 and 4.30, with "students' trust in teachers" having the greatest mean ($M = 4.30$, $SD = 0.53$). Besides, the sub-dimensions of

each variable all have significantly positive correlation, with correlation coefficients between .31 and .81(see Table 1).

Table 1. Descriptive statistics and relevant analysis

	T1	T2	T3	T4	T5	I1	I2	I3	I4	O1	O2	O3
T1	—											
T2	.76	—										
T3	.81	.79	—									
T4	.77	.74	.81	—								
T5	.71	.69	.74	.76	—							
I1	.52	.53	.54	.58	.49	—						
I2	.42	.48	.46	.47	.38	.68	—					
I3	.45	.46	.46	.49	.39	.66	.75	—				
I4	.44	.42	.47	.51	.43	.65	.67	.79	—			
O1	.40	.45	.46	.46	.41	.57	.58	.57	.57	—		
O2	.33	.38	.37	.35	.31	.50	.60	.58	.56	.71	—	
O3	.44	.45	.46	.46	.41	.57	.60	.60	.60	.75	.72	—
<i>continuous</i>												
M	3.71	3.91	3.81	3.62	3.69	3.88	4.11	3.93	3.87	4.05	4.30	4.06
SD	.74	.72	.71	.73	.79	.57	.55	.57	.55	.50	.53	.51

4.2 Structural Equation Modeling Analysis

In this study, structural equation modeling is adopted to examine the theoretical model, and the maximum likelihood method is adopted to estimate coefficients(see Figure 2). Results of the analysis reveal that the structural model involving principal technology leadership, teacher teaching innovation, and student academic optimism has a χ^2 value of 246.84 (df = 51). Also, the model’s goodness of fit statistics including root mean square error of approximation (RMSEA), standardized root mean square residual (SRMR), and comparative fit index (CFI) are .071, .037 and .98 respectively, indicating a good model fit.

In terms of the structural coefficients, the standard structural coefficient between principal technology leadership and student academic optimism is .09 (t = 2.48, p<.05), indicating principal technology leadership’s significantly positive impact on student academic optimism. In addition, the standard structural coefficient between principal technology leadership and teacher teaching innovation is .63 (t = 15.83, p<.05), indicating principal technology leadership’s significantly positive impact on teacher teaching innovation. Furthermore, the standard structural coefficient between teacher teaching innovation and student academic optimism is .74 (t = 16.27, p<.05), indicating teacher teaching innovation’s significantly positive impact on student academic optimism.

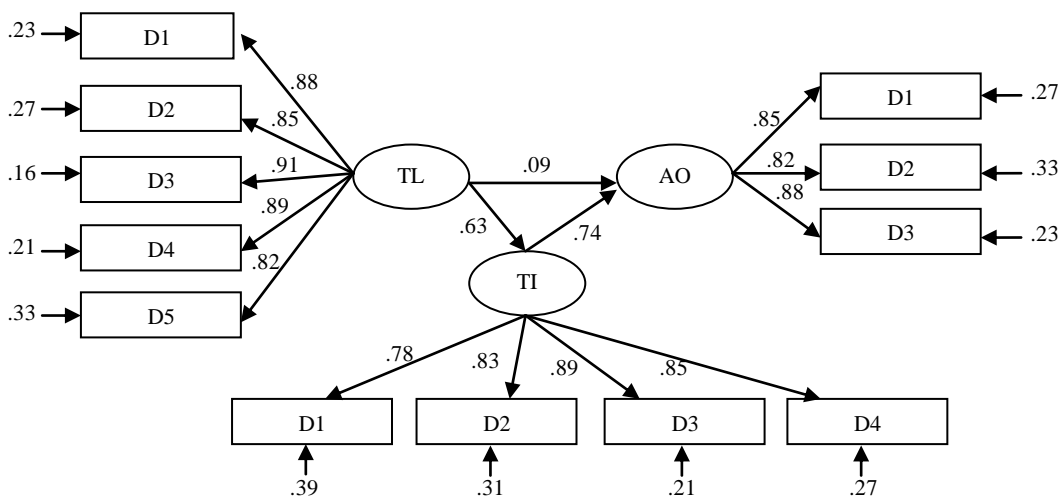


Figure 2. Final structural equation model

Following the above results, this study further examines the mediating effect of teacher teaching innovation on principal technology leadership's impact on student academic optimism. Adopting the Sobel test to test the significance of the mediating effect reveals a z-value of 10.46, indicating the presence of the mediating effect. As mentioned earlier, principal technology leadership could have an indirect impact on student academic optimism through the mediating effect of teacher teaching innovation. Nevertheless, given that principal technology leadership itself also has a significant impact on student academic optimism, teacher teaching innovation merely has a partial mediating effect on the relationship between principal technology leadership and student academic optimism.

5. CONCLUSION AND DISCUSSION

According to results of this study, principal technology leadership has a positive impact on student academic optimism, which is identical with results of the study of Hsieh & Hsiao (2013) yet the impact is not less powerful. Relatively speaking, principal technology leadership has an indirect and positive impact on student academic optimism through the mediating effect of teacher teaching innovation. An indirect mediating effect value of .47 indicates that teacher teaching innovation could have a more powerful impact on student academic optimism through the antecedent impact of principal technology leadership.

As this study indicates, principals as technological leaders must develop and implement vision and technology plans for their schools, encourage the technological development and training of teachers, provide sufficient technological infrastructure support, and develop an effective school-evaluation plan. Through technological leadership, teachers can display more teaching innovation, and promoted student' learning attitude and achievement.

The study uses structural equation modeling to test the relationships among principals' technological leadership, teaching innovation, and students' academic optimism. Worth mentioning, principal technology leadership as a concept at organizational level, for this reason that we suggest use multilevel analysis to test the effect of principals' technological leadership in future research.

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DESIGN RESEARCH METHODS FOR FUTURE MAPPING

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ABSTRACT

Although a strategy for business innovation is to turn a concept into something that's desirable, viable, commercially successful and that which adds value to people's lives but in the fast changing world, we are seeing weakening of relationship between product, user and the environment, thereby causing sustainability issues. A concrete futuristic vision will give overall direction to the efforts; it will also help us channel our energy and resources collectively for a more planned and sustainable future. This paper looks at various future research methods (forecasting techniques) used in the industry and evaluates their relevance and application to designing. The authors identified the importance of factors such as discovery of newer material properties, latest advances in technology realizability, socio-economic trends, cultural paradigms, etc. that have impacted the course of design visualization for the future. Thus, the available forecasting methods fall under these three paradigms:- Technological, People-social, and Environmental paradigms:- 1. Lastly, this paper identifies a need for coherent forecasting mechanism which makes the product designs of future more predictable, viable and thus, promote sustainability at large.

KEYWORDS

Future mapping, design research methods, design forecasting, business innovation

1. INTRODUCTION

Future visions help generate long-term policies, strategies, and plans, which help bring desired and likely future circumstances in closer alignment with the present potentialities. Businesses use futures methods to enhance understanding of future markets. Social leaders use them to develop and test both possible and desirable future visions (Glenn 2000).

'The future seems more complicated and more difficult than ever to forecast, yet people feel the urge, more than ever before, to know what lies ahead. It is of key importance for companies to satisfy this need by exploring the future and in this way remaining at the cutting edge and maintaining credibility and leadership' (Bevolo 2002). Any institution that takes care of present while planning for future, is more resilient to meet the needs of the society, both in the present and the future.

Furthermore, the use of futures methods enhances anticipatory consciousness, which in turn improves the foresight to act faster or earlier making the organization or individual more effective in dealing with change. (Glenn 2000)

However, the value of futures research is less in forecasting accuracy, than in usefulness in planning and opening minds to consider new possibilities and changing the policy agenda. Its purpose is to help us make better decisions today via its methods which force us to anticipate consequences in the form of opportunities and threats in future, and help us plan how to address them.

While many of the forecasting techniques rely on study and analysis of previous trends, their focus is confined to a limited scope. This limitation of scope is defined by the technique itself or its structure. Design Forecasting, on the other hand, requires a more holistic view and needs an overview on multitude of factors including technology, social, cultural and environmental symbiosis.

2. FUTURE MAPPING, FORECASTING AND BACKCASTING

Future mapping and Forecasting have come a long way from being a mere guess to crafting a calculated, scientific and more analytically accurate vision that could be useful in many ways. It is imperative to understand the basic structure and various parameters of forecasting techniques to understand their strengths and limitations.

2.1 Type of Forecasting Methods

The cornerstone for innovation forecasting is *monitoring* of specific data and further analysis. As cited by Evans (2003), Schwartz (1991) elaborated ‘The objective is not to get a more accurate picture of the world around us but to influence decision making inside the mind of the decision maker.’

Over past few decades, the list of future mapping methods and forecasting techniques have increased many folds to include enhancements over existing methodologies and certain newer approaches. However, broadly all these techniques can be classified on the basis of their nature of operation and focus.

2.1.1 People Centric Forecasting Methods

Many Forecasting methods have been designed with a base thought that some people are better aware about what is going to happen next in future. People centric Forecasting methods can further be classified on the basis of specialization or methodology.

A) Expert opinion

These methods involve the services of one or many experts in various relative fields.

Genius Forecasting refers to a more intuitive approach to forecasting. These techniques have been around for many millennia and has had wide acceptability among the common man who refer to these “gifted” *Oracles*. Some examples of this kind include Astrology, Tarrot card reading, Janam Patrika, Palmistry, etc. Many mainstream science researchers debate a lack of scientific rationale or logical explanation and claim that forecasting is often based on *intuition*.

Delphi Forecasting relies on combined knowledge of many experts. Proposed by Helmer et al (1959, 1961), a Delphi panel includes experts from various disciplines. The primary objective of this method is to obtain the most reliable opinion consensus of a group of experts by subjecting them to series of questionnaires interspersed with controlled opinion feedback.

B) Collective intelligence (Mass opinion based techniques)

Social Forecasting is a relatively recent method that works on *swarm intelligence*, collective intelligence of stakeholders. It is an innovative method to rely not on the experts’ but common man (stakeholder’s) intellect. The basic premise of this technique is that stakeholders are motivated to participate in this *Game of prediction* with some real time rewards.

2.1.2 Data Collection and Trend Analysis Based Forecasting Methods

Previous data from the past years is collected and studied closely. A trend or pattern is identified, which is further used to lay predictions for the future. These methods work well for the activities and cases in which we already have a good background data available.

These techniques of Forecasting can further be divided into three broad categories:

A) Data Collection

Bibliometric Analysis and Scientometric Analysis refers to collective information of all the research patents

B) Causal Models

Causal models indicate possible causes of a particular incident or anomaly. In *Futures Wheel*, the central term describing the change is positioned in the centre while its following probable consequences (direct and indirect) are plotted around it thus creating a web of possibilities. Some examples of this type include Causal layered Analysis, Cross Impact Analysis, etc.

C) Trend Analysis

These methods examine trends and cycles in historical data, and then use mathematical techniques to extrapolate to the future. The assumption of all these techniques is that the forces responsible for creating the

past, will continue to operate in the future. This assumption falls short while creating medium and long term forecasts.

Choice of an appropriate model depends on the historical data.

1) *Exploratory Data analysis*:- Its purpose is to identify the trends and cycles in the data so that appropriate model can be chosen

2) *Decomposition*:- This weighted-smoothing technique mathematically separates the historical data into trend, seasonal and random components.

3) *Turning Point Analysis*

4) *ARIMA* models such as adaptive filtering and Box-Jenkins analysis

5) *Simple linear regression and Curve fitting*

Long Wave Analysis also known as *Kondratiev waves* (also known as *Supercycles, K-waves*) are supposedly cycle-like phenomena in the modern world economy. They represent cyclic repetition of some key trends over a specified period of time.

2.1.3 Creative Thinking based Forecasting Methods

The biggest advantage with Creative thinking based forecasting techniques is freedom of thought. This gives ample scope to the researchers to look at many aspects including society, culture on the behest of advanced materials, technology or even something that is non-existing. Furthermore, the time horizon of the vision can be expanded to many generations in advance.

Scenario writing proposes different conceptions of future technology or events by amplifying some of the important causal factors of today and projecting them in future. They are often written as long-term predictions of the future. Key advocates include Schwartz (1991) and Dearlove (2002) who proposed, "*think the unthinkable*" by creating alternate stories, or scenarios".

On the other hand, Altshuller (1956) proposed a very formal and systematic approach such *Contradiction matrix* and *TRIZ* research model, which is "*a problem-solving, analysis and forecasting tool derived from the study of patterns of invention in the global patent literature*" (Zhang 2006); other researchers such as Rhyne (1981) proposed Field Anomaly Method (FAR) that works on principle of exploration of all imaginable patterns and elimination of contradictory possibilities.

2.1.4 Simulation Models based Forecasting Methods

Simulation methods involve using *analog*s to model complex systems. These analogs can take on several forms such as

a. *Mechanical analog* might be a wind tunnel for modeling aircraft performance.

b. *Mathematical analog*: An equation to predict an economic measure such as *S-curve* and other multivariate statistical techniques involving relationships between two or more variables, such as *Multiple regression analysis*

c. *Metaphorical analog* could involve using the growth of a bacteria colony to describe human population growth.

d. *Game analogs* are used where the interactions of the players are symbolic of social interactions. It involves the 'creation' of an artificial environment or situation and simulate through set of assumptions and rules of interaction.

Other Simulation based forecasting techniques

Cross-impact matrix method,

Gordon (1994) recognized that the occurrence of an event can, in turn, effect the likelihoods of other events and thus, proposed Cross-Impact Matrix method to determine how relationships between events would impact resulting events and reduce uncertainty in the future. Probabilities are assigned to reflect the likelihood of an event in the presence and absence of other events.

Sustainability Analysis

This forecasting method uses an LCA (Life Cycle Assessment) tool containing carefully directed questions covering each life cycle stage to help product teams identify possible sustainability challenges, if any. The answers result in a qualitative colour-coded matrix that communicates sustainability impacts to non-experts and benchmarks the wholesome progress.

2.2 Backcasting Methods

While Forecasting is the process of predicting the future based on current trends and analysis, Backcasting approaches discuss about the future from the opposite direction. Backcasting identifies a desirable future and then works backwards to identify policies, programs and steps that will connect the future to the present. Backcasting is increasingly used in Urban planning and Resource management of water and energy. Many researchers, Glielk (1995), Lovins (1973) and Robèrt (1997) used it to develop effective models and methods for Sustainable future.

While future researchers previously concentrated on extrapolating present technological, economical and social trends in an attempt to predict future trends, more recently they have started to examine social systems as a catalyst to change. However, for design research through future mapping, there is a need to study the evolution of needs and aspirations of people / society, along with scientific discovery and technological developments. Backcasting can then be used to derive alternative implementation strategies that lead to these preferred future visions.

2.3 Comparison of Various Future Mapping Methods

Any forecasting or future mapping method has a common underlying structure which is based on following main components:- *Model (Concept); Data Assimilation; Data Analysis and trend identification; Management of perturbation; and Simulation*. While all of these factors are present in any method, the intensity of any individual factor may vary depending on nature of technique itself and the purpose of forecasting. When the discussed techniques are compared with respect to this common underlying structure, their divergent focus becomes clearly evident.

While some techniques require more openness of thought such as *Scenario Writing*, there is a starting model defined by an existing set of boundary conditions, initiated by data gathering and analysis, but the core focus is on the hypothesis simulation / articulation of vision. On the other hand, techniques, such as *TRIZ*, have a clear focus on data assimilation and simulation of the structure.

Techniques which have a stronger availability of historical data, *Trend analysis methods*, focus on rigorous Data Analysis and identification of latent trends, that can be used later for future projections. In these cases, since the vision is based on pre-existing casestudies, perturbations are much more controlled. While in methods which involve people on a mass level, *Social Forecasting*, the method is run in a controlled manner which helps in marginally controlling errors by cancelling individual biases and public opinions.

Table 1 comprises of an enhanced version of Taxonomy of Future research methods proposed by Glenn (2000), plotted against the above mentioned five structural factors. This clearly shows the difference in focus areas of various techniques. Furthermore, the table asserts the importance of Method, assimilation of data and simulation for each forecasting type irrespective of the nature of forecasting technique.

Table 1. Mapping of Forecasting techniques with reference to the structure and prime focus area

Forecasting technique	Model	Data Assimilation	Data Analysis and trend identification	Perturbations / (Chance of error) 1-less perturb, 3-more perturb	Simulation
Agent Modelling	1	2	2	2	3
Bibliometrics	1	3	2	1	1
Causal Layered Analysis	1	2	3	2	1
Cross-Impact Analysis	1	2	3	2	3
Decision Modelling	1	2	1	2	3
Delphi Techniques	1	3	1	1	1
Econometrics and Statistical Modelling	1	2	3	2	3
Environmental Scanning	1	3	2	1	1
Field Anomaly Relaxation	1	2	2	2	3
Futures Wheel	1	2	1	2	3
Genius Forecasting, Vision, and Intuition	1	2	1	1	3
Interactive Scenarios	1	3	1	1	3
Multiple Perspective	1	3	1	1	3
Participatory Methods	1	2	2	2	2
Relevance Trees and Morphological Analysis	1	2	2	1	3
Road Mapping	1	1	1	3	3
Scenarios	1	1	2	3	3
Simulation-Gaming	1	1	1	3	3
State of the Future Index	1	1	2	3	3
Structural Analysis	1	1	3	2	2
Systems Modelling	1	3	3	1	3
Technological Sequence Analysis	1	3	3	1	2
Text Mining	1	3	2	1	1
Trend Impact Analysis	1	2	3	1	1
TRIZ	1	2	1	1	3
Sustainability	1	3	1	1	3

Note: 1- has to be present but not the key focus area; 2- is also important; 3- is very important and key focus area

2.4 Key Areas of Application of Future Mapping Methods

On the basis of area of application of these forecasting techniques, they are further classified as:

2.4.1 Technology Forecasting

These forecasting methods focus on looking towards the future of technology by various techniques such as:

- Gathering intelligence data over current researches and areas of thrust (Bibliometric)
- Trend mapping and analysis
- Asking panel experts (Delphi studies)
- Doing Simulation (Scenario writing, gaming models, mathematical models)

Limitations: Overt dependence on data (historical or fresh market data), ability to see through the underlying trends. Furthermore, due to reliance on historical data, it is innately based on a premise of history extending itself, which might not be holding true always. The results obtained are good for short term forecasting mostly and fuzziness increases as we aim for long term, with increased complexity and depth of probing.

2.4.2 People / Social Forecasting

These forecasting methods focus on looking towards the people aspect of future. Focus is on evolution of human needs on individual as well as social level (Maslow's law). The past data is collected and analyzed to identify latent trends for the future. While in some other cases, focused interviews of domain experts (Delphi panel studies) help us get an insight.

Limitations: increase of fuzziness due to variation in thought of stakeholders. Exceeding reliance on large number for better clearer forecast is another limiting factor.

2.4.3 Environment related Forecasting

These forecasting methods deal with higher level of complexity due to increase in number of factors and variables. Besides Sustainability issues, what type of environment and type of resources that will be available in future, will determine the structure of design. Techniques like LCA (Life Cycle Assessment) help us take a step back and look at the product development and manufacturing in a new light. While the insights from

LCA analysis allow us to identify product development pathways towards better sustainability through an innovative process, it is equally relevant for people in the society and environment itself.

Limitations: There are very few environment related forecasting methods in this area primarily due to complexity of factors involved. LCA is a good simulation tool which can be realized on people, social and environment level also. Furthermore, there is a limited availability of research and domain expertise in this area.

Future mapping and forecasting are extensively used to aid in the process of policy making for future, wherein the deployment of specific forecasting method is dependent on objective, focus and nature of the project, E.g. involving society at large or environmental change related. However, to achieve better results, many forecasting techniques are used and combined to offset the weakness of one method with strength of another.

2.5 Future Mapping and Forecasting Techniques in various Industries

Reger (2001) highlighted Technology Innovation to be largely identified as an unstructured and unsystematic process. His studies show that various companies use numerous different methods/ tools for technology forecasting with different intensity. Lichtenhaler (2004), cited by Madnick et al (2008) also examined various companies' technology intelligence processes and his study indicates that information sources used to gather technology intelligence processes for forecasting are focusing majorly on Technology.

However, as is evident, a technological capability, attribute or parameter that can be forecasted to be available in future does not account for the aspirations of the society or need of the capability.

The newer technology is often building on older technology and thus, leading to capability increase or performance enhancement achieved through synergy. Predicting these synergies is the prime focus area of forecasts and thus, the environmental impact, sustainability and need of the society do not appear in the priority list while gathering information before forecasting.

Table 2. Intensity of use of different information sources used for forecasting in various industries*

Forecasting Techniques	Type	Pharmaceuticals	Electronics	Auto/Machinery
Publications frequency analysis, Publication citation analysis, Quantitative conference analysis, Patent frequency analysis, Patent citation, S-curve analysis, Benchmarking studies, Product Technology roadmaps, Product roadmaps, Technology roadmaps, Quality function deployment, simulations, portfolios	Technology	65.7%	62.9%	57.1%
Delphi Studies, Expert panels, Flexible expert interviews, Experience curves, Lead User Analysis	People, social	20%	28.6%	32.1%
Options Pricing Models, Scenario Analysis	Simulation, Technology	14.3%	8.6%	10.7%

Note: *Table 2 is a derived observation from analysis over Lichtenhaler's study (2004)

Furthermore, while funding of the technological forecast defines the priority and direction of the future vision, people's needs and aspirations are often easily missed. On the other hand, in design industry, the products are directly related to people's aspirations and thus, supported by people through marketing and sales. Thus, design research methods hold people / user's needs and aspirations as more pivotal.

3. DESIGN FOR FUTURE

3.1 Design, in Contemporary Context

Design, in contemporary context, not only looks at the concerns of manufacturing industry but looks at other equally important aspects on the various levels such as individual level (product itself, functionality), user level (user experience, user research, functionality), social, cultural, economic and environment level (sustainability, recyclability).

Sustainable design (also called environmental design, environmentally conscious design, etc.) is the philosophy of designing physical objects, the built environment, and services to comply with the principles of economic, social, and ecological (environmental) sustainability. Applications of this philosophy range from the *microcosm* — small objects for everyday use, through to the *macrocosm* — buildings, cities, and the Earth's physical surface.

Certain underlying principles of Sustainable design ("Hannover principles", William McDonough, 2000) include use of low impact materials, emphasis on Energy efficiency, improving quality and durability for better longevity, design for reuse and recycling, LCA (Life Cycle Assessment) among others. *Three Pillars Model* of Sustainable Design proposes three factors for optimal solution for sustainable Design: *Environmental impact, Economical profitability and Socio-cultural impact.*

3.2 Design Research Needs for Future Mapping

While products are the reflections of the time we live in, every new product design is a vision of the future, an endeavor to foresee how the user, the society and the ecosystem is going to be effected by it. An important strength of designers' capabilities is the ability to look into future and endeavor creating it. Page (1966) defined it appropriately in his famous quote 'the imaginative jump from present facts to future possibilities'.

Evans (2003) quoted Kevin McCullagh, from Seymour Powell Foresight (SPF), who talked about the multi-disciplinary approach in future research processes '*the system for integrating the examination of economic, social, cultural and technological futures into the design process*'. (Evans 2003)

However, historical reviews indicate that there are many influencing forces that govern the design expectations for the future.

3.2.1 Technology

A newer technology can bolster the existing product range and open whole new horizons of limitless possibilities. Development in Microprocessor technology changed the way we look at Computing devices today and we have seen a similar impact of OLED technology and its usage in Mobile communication devices. Going ahead from thinner display devices, we are moving to display that can be printed from an inkjet printer (Pardo 2000).

A discovery of new material property, which is lighter in weight but stronger in use and more versatile, may open newer avenues of usage rendering the existing material to be relatively obsolete. While the invention of Plastics opened a whole new world of possibilities. Similarly, the recent discoveries in the field of Self-healing materials are opening new avenues of applications through research (Zang 2008).

3.2.2 People / User (Social)

Number of patent registrations, that are not been put to use, indicate that although the scientific finding or capability might be there, it is what people truly *need*, that defines the application potential. Papanek (1984) emphasized on designing for people's needs rather than their wants. Social relevance, contribution and cultural influence can play a major role in rethinking about the products of future. Margolin (2002) highlighted the designer's ability to envision products that have *social relevance* and address *social problems* on a broader scale. The products of tomorrow need to be more *inclusive* to serve larger segments of society and yet derive from ethos of culture for effective lasting experience. It is imperative for a designer to study how the user lives his life, to design a product that has better acceptability due to emotional involvement alongside better function.

While Prabhakar (2010) believed that social variables affect the behavior of other variables in the areas of economic, technological, demographic and ecological forecasts, some researchers like Kristen Day (2000) have observed great importance of Socio-cultural factors too. "*The key aspects of culture, such as cultural group history and life experiences, assets, beliefs and values, care-giving practices, activities and preferences, are considered while designing for people.*" (Day 2000)

3.2.3 Environment

Lastly, the whole debate of Sustainability has led us to reassert the sustenance of the product for longer life and value the relationship with environment and ecosystem. Life Cycle Assessment (LCA) has enabled us take a step back into foreseeing the end-of-life impact of our products. This inspired researchers like

McDonough (2001) to come up with new compelling theories such as Cradle-to-cradle framework to foresee and make our products more sustainable.

4. DESIGN TRIPOD

Thus, the Future of Product design stands on 3 broad paradigms: **-Technology, People and Environment**. An imbalance of one may cause an impact on longevity of the product.

- ❖ **Technology Paradigm:** Materials, technology, manufacturing
- ❖ **People- Social Paradigm :** People / User, Society, Culture
- ❖ **Environment Paradigm :** Sustenance, relationship with environment, Post life impact

4.1 Future Methods for Design

While deciding upon relevant future mapping methods for design for future, it is imperative to look at future assessment in view of the above mentioned factors. Future thinking can no longer be confined to data crunching and trend analysis only. While there are specific methods which cater to future mapping below mentioned individual factors, what is required for design forecasting is a framework to create a comprehensive blend. It is important to study and future map these factors together for a more summative and comprehensive overview for future design research.

Table 3. Design paradigms, along with existing future mapping methods

	Paradigms	Future mapping methods (Forecasting techniques)
1	Technology	
	Materials	Delphi panel, Technology forecasting methods, Bibliometric
	Technology / Scientific principle	Bibliometric & Scientometric Analysis, Trend Analysis, TF methods
	Manufacturing	Technology Forecasting methods, Patent analysis
2	People-Social	
	People / User	Delphi panel, Interviews, brain storming, scenarios
	Society	Delphi panel, interviews, brain storming, scenarios, Causal models
	Culture	Delphi panel, brain storming, causal models
3	Environment	
	Sustenance	Impact analysis, LCA
	Symbiosis with environment	Impact analysis, intermittent LCA, panel experts
	Post life impact	Sustainability analysis, LCA

Note: Although many of the forecasting techniques proposed above are speculative and are simply proposed because of their inherent strengths, the important observation is the underlying importance of carrying out forecasting for all the paradigms in coherence in Design Forecasting.

For example, while undertaking design forecasting for a product, evolving needs of the people and changing nature of the society are important, but the latest progresses in the field of other allied areas such as technology, materials, as well as the future impact of the product on its ecosystem and environment can not be ignored either.

5. GAPS AND OPPORTUNITIES

5.1 Limitations of Existing Future Mapping Techniques with Reference to Design Forecasting

A) Dynamic fast changing world, parameters, requirements and benchmarks

World is changing rapidly and in this premise of increasing uncertainty for the future, it is all the more important to develop an approach which is more holistic and justified in tapping these advances in parallel and their cognizance to each other.

B) Linear singular-objective approach of existing forecasting techniques

Many of the current forecasting techniques have a linear singular-objective oriented approach. Inherently relying upon existing data and adherence to previous trends is a narrow proposition and is limiting our vision.

C) Current forecasting techniques are good for short-sighted immediate future

Current forecasting and future mapping techniques do not support visions over longer horizons.

D) Current future mapping techniques have a focussed but very limited approach

Outcomes of forecasting techniques are **not holistic** as they very often fail to acknowledge and thus, overlook developments in other fields that could possibly impact the course of things.

E) Impact over social, culture and environment need to be acknowledged and registered

Although designers have been persistent in envisaging the impact of the product on individual and social level but the effort is isolated and only confined to a limited scope.

F) Design forecasting deals with the products for future that are directly related to people's aspirations and thus, supported by people through marketing and sales. Thus, design research methods for future mapping must hold people / user's needs and aspirations as pivotal.

5.2 Importance of Future Mapping for Design Education

Design education primarily focuses on teaching young students how to solve design problems with i) defined set of parameters and objectives; and ii) problems in which parameters are not yet defined. While approaches like *Scenario building* work well for problems of second type, *Trend mapping* help for the first type. But Design forecasting that stands up on three parallel paradigms provides a solid platform for the designers to perform on both set of design problems and thus, come up with a wholesome tool to look at future from a wider perspective and consider social, cultural and environmental paradigm also, alongside technology.

6. CONCLUSION

Trend predictions contribute to the creative process of design, trying to make future visions more plausible. As Evans (2003) claimed – *"They assist in helping the viewer to undertake a leap of faith and believe that the future may be radically different to the world of today"*. Having a clear vision, enables designers to prepare and gradually move the current generation of products into the direction of future through clear focus and deliberation. Evans (2003) identified trend forecasting to be an integral part of design process – *'The notion of what the future holds is often central to design process. In essence, it is part of the design process, intertwined with form, function, usability, suitability, sustainability, manufacturability, desirability, and the many, many other considerations designers address'*.

Woudhuysen (1992) identified forecasting as a *'periscope to future'* but also expressed his apprehension over lack of any concrete forecasting technique good enough to suffice *'...its pioneering stuff. There are no route maps for what we are trying to do, and we are probably doing half of it wrong'*. But perhaps the pessimism comes from the reliance over a singular future mapping approach.

There are several approaches to derive forecasts but no single approach is sufficient enough. A combination of several approaches make vision clearer and less abstract. Although the level of abstraction depends upon the timescale of the prediction, the further we look into the future- the forecast becomes more abstract and conceptual. Thus, creative thinking approaches such as stories and scenarios are commonly used for long-term predictions.

One of the key findings identified in this study is the multi-disciplinary approach required in design research methods for future. Future mapping activities include not only the valued input of designers, but also a selection of perspectives from experts from various backgrounds. While a designer's usual strength lies in comprehension and synthesis of visual information, they are able to visually represent the results and 'vision' for easy understanding. Other activities such as statistics, ethnographic research, trend analysis, socio-economic data analysis, etc. require different set of skills. A combined effort of this multi-disciplinary team is needed to envision and articulate all of the nuances and information involved.

Although future mapping is already seeing convergence in various businesses, the depth and extent seem limited due to approach, focus and clear methodology. Thus, there is a felt need to find a more unified and holistic approach which embodies these factors and concerns paving path towards a clearer vision.

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MAKAHIKI: AN OPEN SOURCE SERIOUS GAME FRAMEWORK FOR SUSTAINABILITY EDUCATION AND CONSERVATION

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ABSTRACT

Sustainability education and conservation have become an international imperative due to the rising cost of energy, increasing scarcity of natural resource and irresponsible environmental practices. This paper presents Makahiki, an open source serious game framework for sustainability, which implements an extensible framework for different organizations to develop sustainability games. It provides a variety of built-in games and content focused on sustainability; game mechanics such as leaderboards, points, and badges; a variety of common services such as authentication, real-time game analytics and ability to deploy to the cloud, as well as a responsive user interface for both computer and mobile devices. The successful implementation of six sustainability educational games in different organizations provides evidence regarding the ability to customize the Makahiki framework successfully to different environments.

KEYWORDS

Sustainability Education, Serious Game, Gamification, Cloud

1. INTRODUCTION

The rising cost, increasing scarcity, and environmental impact of fossil fuels as an energy source makes a transition to cleaner, renewable energy sources an international imperative. Moving away from petroleum is a technological, political, and social paradigm shift, requiring citizens to think differently about energy policies, methods of generation, and their own consumption than they have in the past. Unfortunately, unlike other civic and community issues, energy has been almost completely absent from the educational system. To give a sense for this invisibility, public schools in the United States generally teach about the structure and importance of our political system (via classes like “social studies”), nutrition and health (through “health”), and even sports (through “physical education”). But there is no tradition of teaching “energy” as a core subject area for an educated citizen, even though energy appears to be one of the most important emergent issues of the 21st century.

Another emergent issue is the explosive spread of game techniques, not only in its traditional form of entertainment, but across the entire cultural spectrum. The adoption of game techniques to non-traditional areas such as finance, sales, and education has become such a phenomenon that the Gartner Group included “Gamification” (Deterding 2011) on its Hype List.

This paper describes Makahiki, an open source serious game framework for sustainability education and conservation, in which we attempt to create synergy between these two emergent issues. The result of over three years of research and iterative development, Makahiki explores one section of the design space where virtual world game mechanics are employed to affect real world energy behaviors. The goal of the Makahiki project is to provide a framework for organizations to learn to not just affect energy behaviors during the course of the game, but to produce long lasting, sustained change in energy behaviors and outlooks by participants.

We initially used Makahiki to create an energy challenge called the Quest for the Kukui Cup (hereafter, the Kukui Cup) for approximately 1,000 first year students living in four residence hall towers at the University of Hawaii in 2011. During the three weeks of the competition, over 400 of the eligible students played the game, for a total of 850 game play hours. The game mechanics were designed to create a

self-reinforcing *virtuous circle* between the real world and virtual world activities. The challenge was well received and has been repeated in academic years 2012 and 2013 at the University of Hawaii. In addition, Makahiki, as a serious game framework, has been used in several organizations including Hawaii Pacific University and the East West Center, an international education institute in Hawaii, to implement their own version of the Kukui Cup serious game.

In this paper, we detail the innovative features of Makahiki framework, along with our experiences using them to implement several serious games related to sustainability education and conservation in different organizations.

2. RELATED WORK

Our research draws on previous work done in the areas of energy behavior research, energy competitions, gamification, and serious games. To reduce energy consumption, providing energy feedback is a critical foundation. Darby's survey of energy consumption studies from the past three decades found that consumption in identical homes could differ in energy use by a factor of two or more depending on the behavior of the inhabitants (Darby 2006). Another survey of energy feedback conducted by Faruqui et al. found that residents that actively used the in-home displays with near-real-time feedback averaged a 7% reduction in energy usage (Faruqui 2009). Darby also points out that feedback alone is not always enough: other factors such as training could lead to higher rates of energy conservation (Darby 2000).

Energy competitions or challenges have been introduced to college dormitories and residential homes as ways to facilitate and incentivize energy reduction. Petersen et al. describe their experiences deploying a real-time feedback system in an Oberlin College dorm energy competition in 2005 that includes 22 dormitories over a 2-week period (Petersen 2007). Web pages were used to provide feedback to students. They found a 32% reduction in electricity use across all dormitories. The Building Dashboard (Lucid Design Group 2008), developed by Lucid Design Group, is used to support Oberlin's dorm energy competition, as well as the Campus Conservation Nationals, a nationwide electricity and water use reduction competition on college campuses (Lucid Design Group 2011). The Building Dashboard enables viewing, comparing and sharing building energy and water use information on the web in compelling visual interface, but the cost of the system creates the barrier for wider adoptions. In addition, the building dashboard solutions focus on providing energy information as a passive media. There is little interaction between participants and the system.

Games on the other hand, have been shown with great potential as successful interactive media that provide engaging interfaces in various serious contexts (McGonigal 2011, Reeves 2009). Priebatsch attempts to build a game layer on top of the world with his location-based service startup (Priebatsch 2010).

Reeves et al. described the design of Power House, an energy game that connects home smart meters to an online multiple player game with the goal to improve home energy behavior (Reeves 2011). In the game, the real world energy data are transformed into a "more palatable and relevant form of feedback", and players may be incentivized by the in-game rewards to complete more energy-friendly real-world behaviors.

ROI Research and Recyclebank launched the Green Your Home Challenge as a case study of employing gamification techniques online to encourage residential green behavioral changes offline (Haiges 2011). Working with Google Analytics, the results show a 71% increase in unique visitors and 97% of participants surveyed said that the challenge increased their knowledge about how to help the environment.

The blending of real and virtual worlds has been explored in broader contexts. McGonigal designed the award winning serious Alternative Reality Game (ARG) "World Without Oil" (Electric Shadows 2010) and later "Evoke" (World Bank 2010) with the goal to empower people to come up with creative solutions to our most urgent real-world problems. ARGs have also been used to support learning. Connolly et al. discuss the development of an educational ARG to motivate secondary school students across Europe to learn foreign languages (Connolly 2009). The results of the pilot run of the game in 2009 indicated that 92% of students felt the game motivated students to learn a second language. One of problems the team identified is the limitation of Moodle platform the game is based on.

The report of the ARGOSI project provides insights to the use of ARGs in game based learning and the challenges in the field of higher education (Whitton 2009). The pilot was run at the University of Bolton with the aim to provide an engaging alternative to traditional methods of introducing students to university life.

The overall up-take of the game was fairly low with only 23 active players out of 173 total. The project identifies a number of questions surrounding educational ARGs, such as motivation, relationship to curriculum, marketing and timing. The report suggests that a complete ARG model may not be appropriate for wholesale learning, but there is certainly potential in using game elements.

3. MAKAHIKI SYSTEM DESIGN

Makahiki is an open source “serious game framework for sustainability”. It provides a framework for creating serious games for the purpose of education and behavioral change regarding energy, water, food, and waste generation and use. Makahiki intends to create synergy between the need to create knowledge and engagement regarding energy and the ability of so-called “serious game” techniques and energy feedback to create participation and engagement.

Makahiki consists of a configurable game engine that can be customized to the needs of different organizations. It includes a library of pre-built game “widgets” that implement a variety of game mechanics. Using the widgets, an organization can create a custom energy challenge in which players can compete individually and/or in teams to earn the most points by reducing their energy consumption as well as by learning about energy concepts in general.

Figure 1 illustrates a home page of the system implemented by using the Makahiki framework.



Figure 1. Makahiki home page

3.1 Architecture

Figure 2 illustrates the overall architecture of Makahiki.

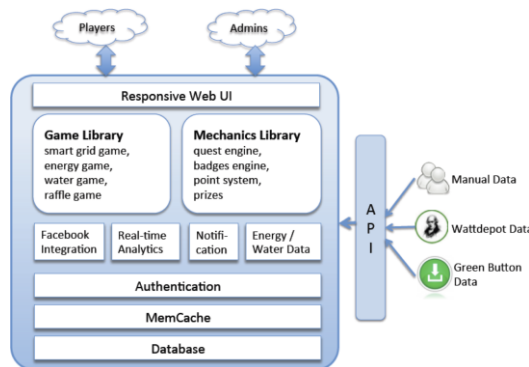


Figure 2. Architecture of Makahiki

The core component of Makahiki is a configurable game engine that can be customized to the needs of different organizations. It includes two libraries of games and game mechanics. These libraries consist of a set of pre-built “widgets”. By selecting and configuring these game and game mechanics widgets, an organization can create a customized serious game.

Makahiki interfaces with the outside environment in three different ways. First, the top side of the architecture diagram shows that Makahiki has two primary user interfaces: one for the players of the serious game, who directly interact with the game and game mechanics widgets; the other for the administrators of the system, who configure the system and monitor the real-time game analytics.

Second, the right side of the diagram illustrates that Makahiki must obtain real-world environmental data as the challenge progresses in order to provide feedback to users about the impact of their actions. In some cases, environmental data can be input automatically into the system through a combination of “smart” meters and additional services, such as WattDepot (Brewer 2011) for energy data collection, storage, and analysis). If that is not possible, then manual meters can be read by administrators on a regular (typically daily) basis and input into Makahiki using an administrator interface.

Third, the bottom side illustrates that Makahiki stores its data in a database repository (currently PostgreSQL). To reduce database access and improve performance, Makahiki provides support for caching (currently memcached).

3.2 A Library of Configurable Games and Mechanics

Makahiki builds in a set of configurable games and mechanics that can be turned on or off, or customized by the game designers to the needs of different organizations.

3.2.1 Energy and Water Game

A fundamental requirement for enabling more active participation in sustainability behavior is feedback regarding their resource such as energy and water usage. The Energy and Water game in Makahiki are implemented as the Daily Resource Goal Game. The Daily Energy Goal Game widget provides a way for players to see the outcome of the energy reduction behavior, and to make it a game by earning points from their behavior. By reducing their teams' daily energy consumption from a baseline by a set percentage, the players in the team will all earn the configured amount of points. Figure 3 illustrates this widget.



Figure 3. Daily Energy Goal Game Widget

This interface uses a spotlight metaphor to show at a glance whether or not the team is making the goal. In this case, the spotlight is green, indicating they are currently below the goal. We have found additional perspectives of the energy feedback to also be useful. One useful perspective to a team is a real time power meter visualization that shows the current power usage of a team. This visualization displays the real time power consumption which updates at a specified interval such as 10 seconds. Another useful perspective to a team is a historical, calendar-based visualization that shows the results of the energy goal game for each day of the current round.

3.2.2 Smart Grid Game

Smart Grid Game (SGG) is Makahiki's approach to support “gamified” delivery of educational experiences. Educational actions are organized into a grid of squares (hence the name “Smart Grid”) and organized by category columns and levels. Players use its grid interface to discover “actions” they can perform. Successful completion of an action earns the player a variable number of points depending upon the difficulty of the action, and can potentially “unlock” additional actions and higher levels in the SGG. Figure 4 shows a typical Smart Grid Game interface for players:

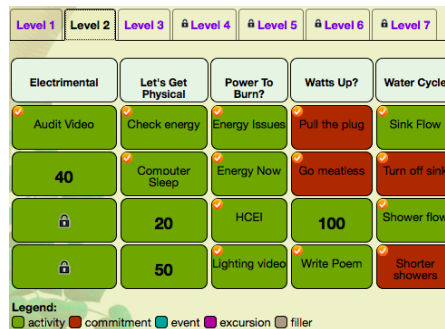


Figure 4. Smart Grid Game widget

To make your SGG more interesting to players, and more pedagogically sophisticated, Makahiki supports the definition of “path” through the educational content or actions. In most cases, when a new player sees the SGG for the first time, there should only be a few actions available to them, possibly only one. All of the rest should be locked. Makahiki provide a set of predicates that can be used to define the path. The predicates determine if an action or level is locked or unlocked for a player, which in term depends on the outcome of another action or multiple other actions.

3.2.3 Raffle Game

The Raffle Game widget provides a way to incentivize participation from all individuals, even those who are not in the running for a top prize. For every 25 points a player earns, they receive one virtual raffle ticket. Players can dynamically allocate their tickets to any raffle prizes they are interested in at any time, up to the end of the raffle. Figure 5 shows an example of the Raffle Game.

Round 2 Raffle Game					
Your total raffle tickets: 5 Allocated right now: 2 Available: 3					
Prize	Value	Your tickets	Total tickets	Current odds	Change ticket allocation
Recycled bike	\$200.00	1	2	50.0%	+1 -1
UH t-shirt (1)	\$28.00	1	1	100.0%	+1 -1
Outback card	\$25.00	0	0	0.0%	+1 -1
Smart strip (2)	\$25.00	0	0	0.0%	+1 -1
Smart strip (1)	\$25.00	0	0	0.0%	+1 -1
Down to Earth card	\$25.00	0	0	0.0%	+1 -1

Figure 5. Raffle Game widget

Raffle tickets are independent from a player's score, and allocating a raffle ticket does not affect their rank. The system provides random selection of the winner of each raffle item at the end of a round.

3.2.4 Social and Referral Bonuses Game Mechanics

The Social and Referral Bonus widgets are the game mechanics that help encourage participation by providing additional points to players who participate in activities with other players, and facilitate the entry of new players into an energy challenge. The social bonus is a configurable option when an action is created in the Smart Grid Game. Players earn extra points if they perform the action with another player. When a player submits a response for an action with a social bonus, the player can provide the email address of the

person who jointly completed the action. Once the other player completes the action, the social bonus is awarded.

Players are led through a setup process when logging into Makahiki for the first time. One of the steps in this process is the referral bonus. If a player was referred by another player in the system, he can use this step to input their email address. Once the new player earns a certain number of points in the competition, both players are awarded a referral bonus of a configurable number of points.

3.3 Real-time Analytics

Makahiki is designed to support energy challenges involving hundreds or thousands of users lasting weeks or months. In these circumstances, effective use of the technology requires the ability to understand the state of the game, such as: Who is using it? What are they doing? What is the player response to activities, commitments, excursions, and events? Such state information is important for planning purposes, such as assessing the transportation needs for an upcoming excursion by seeing how many players signed up. It can also be used for making in-game changes to game design, such as changing the point values associated with activities to encourage or discourage participation. It can also help identify breakdowns in game play, such as significant numbers of unallocated raffle tickets indicating that users do not understand the nature of that game mechanic. To address these needs and others, Makahiki includes a variety of widgets that work together to provide high level overview of game play state to the administrators of a challenge.

3.4 Cloud Deployment Support

Another Makahiki feature is the ability to deploy to a cloud platform such as Heroku. Cloud computing has the advantage of simplifying IT administration by eliminating the need to acquire and maintain hardware and operating system software. This also can dramatically decrease the cost of deployment. Figure 6 shows a screen shot of the Dashboard showing the 2012 East West center Kukui challenge deployed in Heroku, one cloud platform provider, and the monthly cost for this deployment.

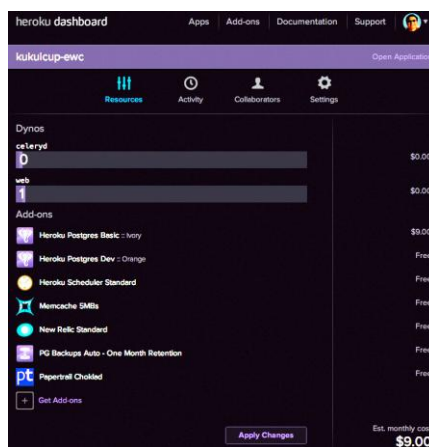


Figure 6. Heroku cloud deployment

4. EXPERIENCES WITH MAKAHIKI

We have used Makahiki to create six different energy and water serious game instances, all called “Kukui Cup” challenges. Three Kukui Cup Energy challenges were held at the University of Hawaii (UH) in 2011, 2012 and 2014 for over 1,000 first year students each year living in the residence halls. Hawaii Pacific University (HPU) held a Kukui Cup Energy challenge in 2012 and 2013 for about 200 students each year. An international organization called the East-West Center (EWC) held a Kukui Cup Energy and Water challenge for approximately 600 international residents living in their residence halls in 2012. Since the EWC residence

halls did not have internet-enabled meters, resource consumption data had to be entered by the game managers manually.

The successful creation of these serious game challenges by three different organizations provides evidence that Makahiki can be successfully tailored to the needs of different organizations. First, UH and HPU used different metering infrastructure, and EWC collected their resource data manually. Second, while UH and HPU challenges involved only energy consumption data, the EWC challenge involved both energy and water consumption data. Third, the IT infrastructure at UH and HPU provided authentication services using CAS (Central Authentication Service) and LDAP, while EWC used the built-in Django authentication. Fourth, the user interface was customized to “brand” each challenge with the logo, thematic elements, and the education contents of the sponsoring organizations.

The evaluation of Makahiki includes both qualitative and quantitative sources of data regarding the system. Makahiki provides custom quantitative instrumentation that enables us to track when, where, and for how long each player accessed each page of the site. Unlike generic web server logs, we could track per-player application-specific behaviors. We also gathered qualitative data through a survey that players could complete as part of a Smart Grid Game activity during the final week of the competition. The survey asked participants to provide short answers to questions regarding the way the competition and website was designed. 41 players completed this survey.

In response to a survey question asking how the player might describe the Kukui Cup, 83% said “Fun”, 95% said “Educational”, while 7% said “Difficult” and 2.3% said “Boring”. In response to the question, “What was confusing in the website”, 46% of the players said “Nothing”, and 32% of the players also responded “Nothing” in response to the question, “What would you change about the website? When asked what they liked most about the website, 60% of the survey respondents said “ease of use”. Instrumentation also indicates that the game was generally easy to use. 73% of the 418 players never accessed the “Help” page, and only 5% of the players sent questions to the administrators. The data bear out the success of the raffle game. Players mentioned the raffle game repeatedly as the most interesting incentive in the game, and over half the students with at least 100 points participated in the Raffle.

To assess the effectiveness of the framework for designing games that improve player literacy in sustainability, we conducted two energy literacy surveys during the 2011 Kukui Cup Challenge at the University of Hawaii at Manoa. One survey was administered before the challenge (pre-game) and one after (post-game). 24 players completed both surveys. Out of the total 19 energy literacy questions, the average number of questions answered correctly is 7.54 before the challenge, and 8.96 after the challenge. This result indicates an 18% improvement on the energy literacy. We also surveyed non-players as a control condition, and found that their literacy did not change, indicating that the improvement in player literacy was indeed due to the game.

To assess the effectiveness of the framework for designing games that produce positive change in sustainability behaviors, we recorded and analyzed energy consumption data before, during and after the challenge. Before the challenge, an energy usage baseline was established. During the challenge, compared to the baseline, 12 out of the total 20 teams reduced their energy consumption, with the highest reduction of 16.1%. However, 3 teams actually increased their energy consumption, with the highest increase of 11.7%. Overall, the average reduction of the 20 teams was low, approximately 2%.

We also assessed player engagement of the game. We calculated a variety of engagement metrics based on the analytics data collected by the Makahiki framework. The participation rate of this challenge is 37%, which is good compared to other sustainability challenges. Over the course of the challenge, an average player spent about 27.7 minutes per day on the website. One player spent 8.5 hours on one day. There were an average of 266 activity submissions and 208 social interactions between players per day. The average number of website errors per day was 0.6. The data indicates that Makahiki can be successful in achieving player engagement and literacy improvement, although the evidence of positive change in behavior is not significant.

5. CONCLUSION

The Makahiki research presents an innovative information technology infrastructure that can support effective and efficient development of serious games for sustainability education and conservation that can be

used by different organizations. Its tailorability and game analytics also provides a useful platform for research on gamification, sustainability education, and behavior change.

Our research suggests that several enhancements to the Makahiki framework would be useful. One is real-time player awareness. It is not possible currently in Makahiki to know who is currently “on line” and playing the game. Creating this awareness opens up new social gaming opportunities (performing tasks together), new opportunities for communication (chat windows), and potentially entirely new games (play “against” another online player).

Makahiki currently ships with over 100 possible “actions” already developed for the Smart Grid Game. However, the content is intimately tied to the Smart Grid Game implementation. An enhancement is to provide a “content management system” for “actions”, separating “content” from the “presentation”, thus new contents can be added and more games can be developed using this content library.

We are also exploring a future direction involving the development of a consortium of organizations in order to scale the use of the Makahiki framework in new settings. Moving outside of the context of either Hawaii or college-aged players will necessitate development of significant new forms of content, as well as new game mechanics.

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THE RELATIONSHIPS AMONG PRINCIPALS' DISTRIBUTED LEADERSHIP, SCHOOL KNOWLEDGE INNOVATION AND ICT USE IN TAIWANESE ELEMENTARY SCHOOLS

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ABSTRACT

The aim of this study is to investigate the relationship among principals' distributed leadership, school knowledge innovation and ICT use in Taiwanese elementary schools. The sample group of this Study includes 957 teachers from randomly chosen Taiwanese elementary schools. In order to evaluate these relationships, a questionnaire method was used that inquired into teachers, principals' distributed leadership, school knowledge innovation, and ICT use in Taiwanese elementary schools. In addition, we used a structural equation model in order to test the models and carried out an analysis targeting the relationship between these variables. The regular adaptive pointer clearly shows that the proposed model has a good fit with the questionnaire's data. The results show that, through the mediating effect of school knowledge innovation, principals' distributed leadership directly affects ICT use in Taiwanese elementary schools. The study suggests that the distributed leadership of the principal promotes, and improves the overall application of, school knowledge innovation.

KEYWORDS

Distributed leadership, knowledge innovation, ICT use

1. INTRODUCTION

With the development of the school organization's leadership and management theory, the disadvantages associated with traditional bureaucratic management systems in schools are growing, which has prompted researchers to explore new practices of leadership that are suitable for the management of schools. As a result, the research on the school organization's leadership theory has become increasingly diverse.

Of these diverse leadership theories, principals' distributed leadership is one of the most influential theories. The research of Harrison (2006) finds that teachers in schools where the principal has implemented distributed leadership have felt that coordination and cooperation have improved, they support each other, the relationship between the teachers and the principal is positive, and the campus has a positive and harmonious atmosphere. Principals who implement distributed leadership must empower others in order to establish greater influence. They also focus on equal rights, mutual assistance and the division of work, students' interests, professional ethics and the school's general development (Group, 2004). Both Belhiah (2007) and Somekh (2008) suggest that distributed leadership increases the empowerment of teachers. Empowering teachers through distributed leadership encourages teachers to positively express their concerns for the school's policies, and encourages them to participate more actively in the operations of the school. Given this, in the constant flux of society and schools, distributed leadership emphasizes visions and goals, shares responsibility, focuses on school culture and promotes leadership practices as an integral part of the modern principal's leadership.

Moreover, given that the general context of education is changing, and is impacted upon by globalization and ‘informatization’, in addition to practicing distributed leadership, schools must also use knowledge innovation to face the modern knowledge-based economy and transform tacit knowledge to explicit knowledge in order to innovate and thereby improve the studying performance of students (Nonaka & Takeuchi, 1995; Van der Spek & Spijkervet, 1997). The more focus is placed upon knowledge management, the more schools and teachers share knowledge and the more knowledge innovation opportunities are provided. Therefore, faced with an ever-changing society, schools must positively encourage teachers to use knowledge innovation to increase students’ interest in learning, improve the quality of the school’s teaching and thus achieve the goals of education.

Furthermore, in our knowledge-based economy and information explosion era, the application and processing of knowledge is particularly important, and so the application of information and communication technology (ICT) becomes a key part of the school’s organization. Chang (2005) believe that administrative operations in twenty-first century rely heavily on the assistance of network technology, such as carrying out internal and external communications and knowledge management through both the intranet and internet in order to improve administrative efficiency. With information technology constantly developing and an emphasis in society on speed, school organization is influenced by external factors. In addition to changing teaching methods, the development of ICT also helps to innovate the school’s administrative operations. ICT is therefore a basic professional ability that should be possessed by modern teachers, which would improve teaching and learning performance, and create a positive environment for technology, culture, innovation and emerging technologies (Chang, 2010; Harris & Muijs, 2005; ISTE, 2007; OECD, 2006; Schrum & Levin, 2012; Yeh, 2003).

Generally speaking, this study discusses and analyzes the relationships among principals’ distributed leadership, school knowledge innovation and ICT use in Taiwanese elementary schools, in order to review principals’ distributed leadership and the interactions between school knowledge innovation and ICT application. It is expected that the research results will provide specific recommendations for future academic theory and practice.

1.1 The Purpose of the Study

The aim of this study is to investigate the relationships among principals’ distributed leadership, school knowledge innovation and ICT use in Taiwanese elementary schools. This study also explores the effect of school knowledge innovation and principals’ distributed leadership on ICT application.

2. THEORETICAL FRAMEWORK

2.1 The Dimensions of distributed Leadership

Principals’ distributed leadership refers to a leadership model under which principals encourage members of the school to participate equally in the school’s administrative affairs, cooperate with organizational culture, share power and cooperate with the principal’s leadership with the help of many school leaders and in accordance with the school’s visions and goals. More and more research has pointed out the importance of distributed leadership (Christy, 2008; DeMatthews, 2014; Gordon, 2005; Harris, 2014; Harris & Muijs, 2005; Leithwood & Jantzi, 1998; Spillane, 2007; Terrell, 2010), which highlights the importance of distributed leadership in the field of principal’s leadership.

This study considers domestic and foreign scholars’ discussions and interpretations and refers to the DLRS (Distributed Leadership Readiness Scale) designed in Connecticut in order to divide distributed leadership into four levels, which serve as the variables of principals’ distributed leadership in this study:

(1) Constructs prospects and objectives: the principal shapes the school’s visions and goals with the help of the school’s members and transforms the school’s vision in the pursuit of the school’s development (Christy, 2008; Davis, 2009; Gordon, 2005; Leithwood & Jantzi, 1998; Spillane et al. 2004).

(2) Creates school culture: the principal focuses on school culture and creates an open and participatory school environment in order to establish a good model of interaction between the leader and the led (Christy,

2008; Davis, 2009; Gordon, 2005; Group, 2004; Harris & Spillane, 2008; Harris, 2012; Spillane, 2007), or to form a professional learning community (De Matthews, 2014).

(3) Shares common responsibilities: with respect to distributed leadership, all people within the school have the potential to be a leader (White, 2014). On the distributed account of leadership, all people within the school are viewed as potential leaders. Given this, the principal shares leadership authority and encourages the empowerment of the members of the school (Harris & Muijs, 2005), so that they share and develop a sense of responsibility (Christy, 2008; De Matthews, 2014; Gordon, 2005; Gronn, 2002; Harris & Muijs, 2005; Leithwood & Jantzi, 1998; Spillane, 2007).

(4) Promotes leadership practices: the principal focuses on the potential leadership of other members of the school and establishes appropriate beliefs and values among these members, so that consensus is formed through participation and discussion, which in turn promotes the efficiency of the leader. Distributed leadership can also have a positive influence on organizational change and improvement (Christy, 2008; Gordon, 2005; Harris, 2014; Spillane, Halverson & Diamond, 2001; Leithwood & Jantzi, 1998; Spillane, 2007).

2.2 Distributed Leadership Influences School Knowledge Innovation

With the technological revolution and the advent of globalization, society is facing many challenges and change and knowledge innovation have become necessary. Harris (2008) says that most leaders believe that innovation and constant change present their main challenges. This is also the case in education; if the system is unable to be innovative, a considerable economic and social cost will be paid, and when the class structure disappears, along with the disappearance of class-style leadership, distributed leadership will play an important role.

Distributed leadership provides an acceptable organization structure for professional interactions, cooperation and diversified leaning. Much research has found that school leadership and innovation are positively correlated, and that distributed leadership is beneficial to a school's innovation change, transformation and sustainability (Fullan, 2006; Harris et al., 2007; Schrum & Levin, 2012; White, 2014).

If a principal wants to establish a collaborative school atmosphere, he must implement innovation and a change of leadership in order to change organizational culture and build an innovative environment. Establishing leadership innovation professional development courses and using incentive systems to encourage teachers to be innovative, enhances innovation and creativity within the school.

2.3 Distributed Leadership Influences ICT Use

Take America as an example, "learning with technology" is not only a challenge facing principals of American elementary schools, but it is also an important policy of the United States Ministry of Education to improve every student's learning ability (Chang, 2003). However, teachers are the most important figures when it comes to improving a student's learning achievement; as Somekh (2008) said, if teacher wants to use the ICT teaching method, then the surrounding environment must be cooperative, and the leadership of the principal is crucial. From the point of view of distributed leadership, focusing on potential leaders and the concept of sharing power will empower teachers; and these teachers are more positive in their teaching, which is good for the acceptance and performance of the ICT application and makes the shift to this teaching and learning model (paradigm) easier. However, for the principal, who is the leader of the school, facilitating this paradigm shift in teacher practice is the responsibility of the school's leadership (White, 2014). Again, in addition to helping with the shift in these empowered teacher's teaching model, distributed leadership can also foster collaborative learning communities where teachers are able to work together in order to integrate ICT into their teaching and learning (Harris & Muijs, 2005; Schrum & Levin, 2012).

It can thus be seen that the school's leadership model will affect the ICT curriculum and teaching (White, 2014). In other words, the successful application of ICT depends on the principal's support, and, in addition, the principal can affect the use of ICT in schools because information technology enables innovative administrative management and develops curriculum and teaching innovation. Above all, how the school applies information technology will generate a considerable and positive effect on the school's future competitive status.

2.4 School Knowledge Innovation Influences ICT Use

What we face is an increasing knowledge and information economy, where knowledge resources can be bought anywhere. OECD (2006) proposes that ICT, a new information technology, is able to form part of a new pedagogical model in education. Real-time and accurately obtained information is what we will need in the future. Moreover, from an organization's point of view, knowledge is an important resource in terms of organizational competition; and so knowledge about how to manage an organization has become an important research topic in the field of management science. This reflects the fact that modern society not only emphasizes the creation of knowledge, but also the circulation and added-value of knowledge, and, in this context, ICT becomes a very important tool for promoting knowledge innovation (Karlsson, Johansson, Kobayashi & Strough, 2014; White, 2014).

Because information technology has the ability to quickly organize and search for information, in the process of promoting knowledge innovation, the role of information technology is always a subject of concern to organizational managers. In a constantly changing social environment, learning and the implementation of new technology becomes more and more important. We are now in an information technology age, and so information technology must be integrated into the curriculum and management of schools. The Information Technology Advisory Group (1999) also points out that in the knowledge economy, the ability to apply ICT has become an important factor in leading change, and is considered the main facilitator of knowledge innovation. With the assistance and evaluation of ICT in a student's learning process, ICT helps teachers to understand a student's situation and give appropriate assistance, and in relation to administrative management, promotes the school's effectiveness.

The research shows that only when the user perceives the usefulness and ease of use of his personal system will he help the organization and other members to realize the relative advantages of innovation and ICT. Technology and leadership could also be beneficial to the overall effectiveness of ICT use during the innovation process. I hypothesize the model (see Figure 1).

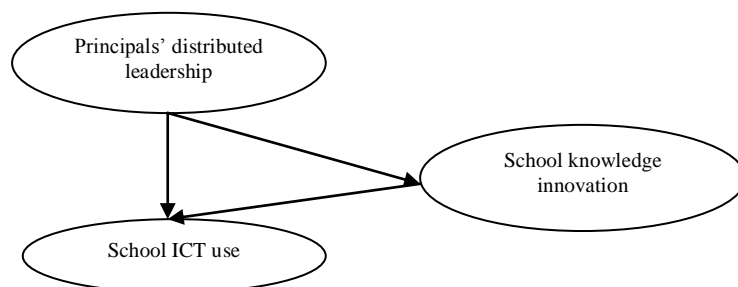


Figure 1. Hypothesized conceptual model

3. RESEARCH METHOD

3.1 Data Collection

The investigation subjects of the study's questionnaire are elementary schools' principals, serving directors, teachers and administrative officers, and the school is the analyzed unit. The population of the study is Taiwan's elementary schools. The research subjects are randomly chosen from the population mentioned above. According to the statistical data of each county's elementary schools listed by the Ministry of Education's *2010 Statistics Table of Each County School-elementary schools*, regard the northern, central, southern and eastern parts of the administrative region as the stratification criteria, which includes a total sample of 58 schools. We sent out 957 questionnaires and 781 were received. The response rate for the questionnaire is 81.61%; 105 of these were invalid questionnaires, leaving a total of 676 valid questionnaires, and an availability ratio of 86.56%. The basic data of the subjects include sex, age, education background, the scale of the school, teaching seniority and current position, as shown in Table 1.

Table 1. Number and percent of respondents by demographics * N=676

Demographics		Frequency(Percentage)		
Gender				
Male		Female		
233 (34.5%)		443(65.5%)		
Age				
30 (or below) years old	31-40 years old	41-50 years old	51 (or above) years old	
80(11.8%)	338(50.0%)	222(32.8%)	36(5.3%)	
Education Level				
Bachelor		Master (including the class with 40 credits), Doctorate		
404(59.8%)		272(40.2%)		
School Size (N of class)				
6 (or below) classes	7-12 classes	13-24 classes	25-36 classes	37 (or above) classes
77(11.3%)	64(9.5%)	160(23.7%)	107(15.8%)	268(39.6%)
Teaching Year				
5 (or below) years	6-10 years	11-15 years	16- 20 years	21 (or above) years
59(8.7%)	208(30.8%)	171(25.3%)	141(20.9%)	97(14.3%)
Position				
Teacher and director	Teacher and group leader	Home room teacher	Subject teacher	Principal
80(11.7%)	188(27.6%)	308(45.6%)	67(9.9%)	33(4.9%)

3.2 Instrumentation and Variables

The *Principals' Distributed Leadership Questionnaire* can be conceptualized on four levels, namely creates school culture (the principal emphasizes school culture and creates a respectful and open, participatory environment in the school), promotes leadership practices (through discussion and participation to form consensus), jointly promotes the practice of effective leadership, shares responsibility (the principal shares leadership so that school members share in responsibility for the school) and constructs prospects and objectives (the principal shapes the school's vision and objective with other members of the school).

The *School Knowledge Innovation Questionnaire* is divided into knowledge transmission extensiveness (shaping knowledge to benefit the condition of the school's knowledge innovation through interaction, sharing and transformation), knowledge application diversity (applying knowledge in the school to promote self-learning) and organizational context flexibility (the timely and appropriately adjustment of policies in accordance with the situation).

The *ICT Use in Taiwanese Elementary Schools Questionnaire* is divided into effective use of ICT resources (making the best use of ICT tools), ICT technology integration (applying ICT technology in the school's administrative affairs, teachers' professional development and teaching plans), ICT curriculum and teaching (applying ICT to the curriculum, and increasing the authenticity of the interaction) and ICT public relations and ethical issues (guiding students to select appropriate ICT tools and building network security).

The study adopts a five-point Likert scale, and the subject teacher fills in the questionnaire in accordance with his own observations and feelings. Each question consists of very consistent, consistent, moderately consistent, not consistent and not at all consistent as the check items, which are respectively allocated 5, 4, 3, 2 and 1 point. The Cronbach's Alpha value for each level in the scale is as follows: creates school culture (.917), promotes leadership practices (.808), shares responsibility (.843) and constructs prospects and objectives (.872). The other results were as follows: knowledge transmission extensiveness (.909), knowledge application diversity (.901) and organizational context flexibility (.901); effective use of ICT resources (.922), ICT technology integration (.907), ICT curriculum and teaching (.945) and ICT public relations and ethical issues (.849).

Using reliability and validity analyses, we tested each of the above-mentioned dimensions. The explained variances of principals' distributed leadership are: 45.370% (creates school culture), 8.712% (promotes leadership practices), 6.685% (shares responsibility), and 5.983% (constructs prospects and objectives), which accounted for 66.705% of the variance. The explained variances of school knowledge innovation are: 25.604% (knowledge transmission extensiveness), 23.774% (knowledge application

diversity), and 22.894% (organizational context flexibility), which accounted for 72.273% of the variance. The explained variances of ICT use in Taiwanese elementary schools are: 21.898% (effective use of ICT resources), 21.113% (ICT technology integration), 18.093% (ICT curriculum and teaching), and 12.500% (ICT public relations and ethical issues), which accounted for 73.843% of the variance.

3.3 Data Analysis

The study has conducted an empirical investigation of principals' distributed leadership, school knowledge innovation and ICT use in Taiwanese elementary schools, used a structural equation model, analyzed the reliability and validity of factors with SPSS, and adopted AMOS in order to complete the structural equation model.

4. RESULTS

In regards to principals' distributed leadership, the analysis of the relationship structure and overall adaptation between school knowledge innovation and ICT use in Taiwanese elementary schools, this study took the absolute adaptation index (χ^2 , GFI, AGFI, RMR, RMSEA, ECVI) and simple adaptation index (PGFI, PNFI, NC, AIC, CAIC) as a basis. Except for $\chi^2=5.978$ (N=681, df=39, p=.000), which is not ideal, the other absolute adaptation indexes GFI=.942 and AGFI=.901 are greater than .90, RMR=.017 is smaller than .05, RMSEA=.08 is greater than .08; the model is acceptable; ECVI is smaller than the independent model and closer to the saturation model and falls between the confidence interval, which means that the theoretical model has predictive validity and has reached a good adapter standard. The simple adaptation indices PGFI=.556 and PNFI=.861 are both greater than .05, the Chi-square degree of freedom NC=5.978 is close to 5, CN=181 is close to 200, and AIC and CAIC are both smaller than the structural model but reach a reasonable level of adaptation, which means that, overall, the adaptation of the model is reasonable.

As shown in Fig. 2, if school principals want ICT, as used in Taiwanese elementary schools, to provide the maximum benefit, they should trigger the teachers' desire to use ICT technology through knowledge innovation. In other words, the current Ministry of Education has provided adequate ICT tools and has a budget for annual maintenance and updates, but ICT tools can only make a significant difference through the innovative ideas of users.

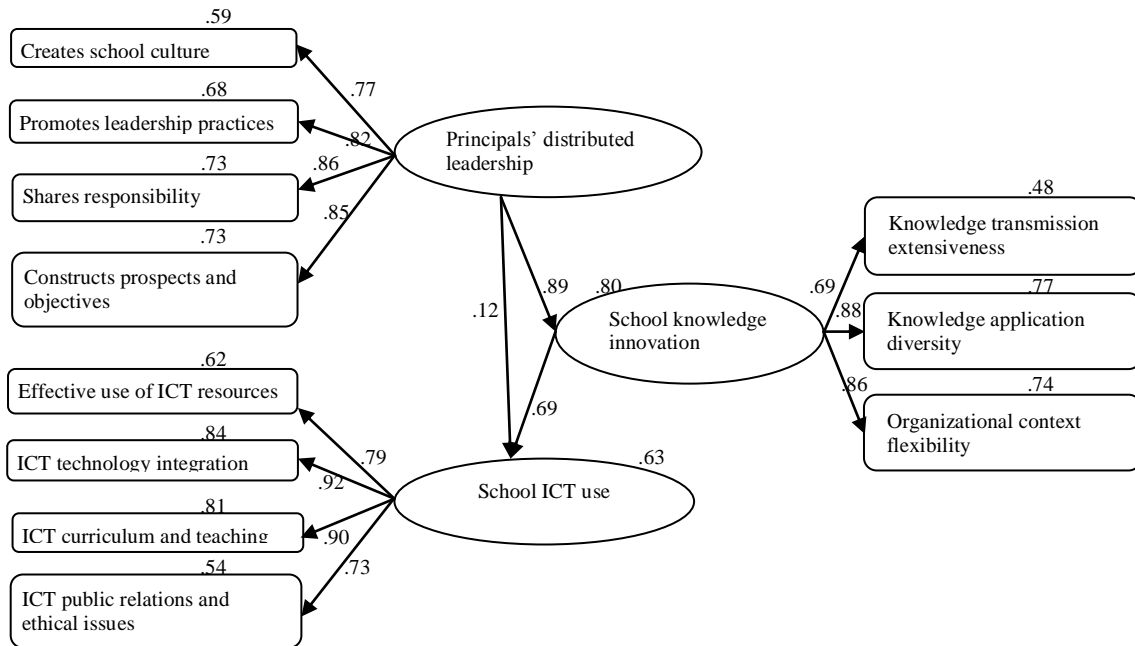


Figure 2. Final Structural Equation Model

At present there is no research on principals' distributed leadership and school knowledge innovation's predictions for ICT use in Taiwanese elementary schools; there is only research on leadership and technology innovation. From the study of Wu (2009), 'establishes significant school vision' and 'organizes a knowledge innovation community' were included in principals' technology leadership as having the highest degree of correlation, presenting technology and innovation as intrinsically linked. This study tries to integrate the above study and finds that principals' distributed leadership (shares responsibility and constructs prospects and objectives) and school knowledge innovation (organizational context flexibility and knowledge application diversity) could significantly predict ICT use in Taiwanese elementary schools.

5. CONCLUSION

As a whole, this study found that principals' distributed leadership and school knowledge innovation have a significant and positive influence on ICT use in Taiwanese elementary schools. The better principals' distributed leadership, school knowledge innovation and ICT use conditions are, especially the creation of school culture and sharing responsibility, the more superior the performance of school knowledge transmission and ICT use on curriculum and teaching, etc. Principals should therefore pay particular attention to creating school culture and sharing responsibility among teachers, and should promote the inclusion of ICT into the curriculum, and improving the quality of teaching through innovation and the dissemination of knowledge. Moreover, school knowledge innovation is actually the intervening variable of school distributed leadership on ICT use. The greater school visions and objectives are, with superior knowledge orientation, and the higher responsibility sharing is, the better is ICT use in Taiwanese elementary schools.

As the 21st century, computer networks and information technology are developing at full speed, which means that schools have to face the prospect of innovation. The success of school innovation is related to a school organizational leadership strategy. Only potent school leaders can successfully master opportunities for change. This study uses principals' distributed leadership, school knowledge innovation, and ICT use in Taiwanese elementary schools as a model to review school knowledge innovation, and as a reference for improving ICT use in Taiwanese elementary schools. One of the most important findings from this study is that school leaders should build specific education visions through appropriate authorization and empowerment, so as to develop teachers' common responsibility sharing. Moreover, making the best use of school organization flexibility as well as innovative and diverse knowledge to improve the innovative thinking and ICT capabilities of staff could further promote the goal of education through the integration of ICT technology.

This study adopts structural equation modeling in order to understand the relationships among principals' distributed leadership, school knowledge innovation and ICT use in Taiwanese elementary schools. Except for distributed leadership's significant and direct influence on ICT use, school knowledge innovation, as a mediating effect, could also affect ICT use. When interpreting the relationships among these three variables, mediating effects should also be stressed, namely the influence of distributed leadership on ICT use through school knowledge innovation.

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"BEAUTY OF WHOLENESS AND BEAUTY OF PARTIALITY."NEW TERMS DEFINING THE CONCEPT OF BEAUTY IN ARCHITECTURE IN TERMS OF SUSTAINABILITY AND COMPUTER AIDED DESIGN

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ABSTRACT

The great shift in sustainability and computer aided design in the field of architecture caused a remarkable change in the architecture philosophy, new aspects of beauty and aesthetic values are being introduced, and traditional definitions for beauty cannot fully cover this aspects, which causes a gap between; new architecture works criticism and its practice, even architecture education has witnessed this gap. This research coins a term concerning architecture as the beauty of wholeness(Beauty by capital B) and the beauty of the partiality of wholeness (beauty by small b) , where Beauty is an alternative term to aesthetic values with a wider range, and it is concerned with all aspects of beauty of the architecture work form, performance, durability, culture values, while the beauty will be concerned with a particular aspect of beauty concerning the architecture work such as its ecological value, structure innovation, its reduction in energy consumption, both together can redefine architecture and can reinterpret its nature, this would open the gate for a new era of architecture criticism, education, and practice. The research will introduce scientific beauty - a beauty of the partiality of wholeness- as an example related to beauty in terms of sustainability and will use a theoretical case study to illustrate it.

KEYWORDS

Beauty - beauty - Scientific beauty - Sustainable design development - Sustainability.

1. INTRODUCTION

Beauty can be considered as a universal theme, debates concerning the interpretation of how to define it are many, different thought and trials were held by thinkers, philosophers, artists and even scientists in order to investigate such issue. However, Plato dialogues concerning beauty and aesthetic values are considered to be one of the most significant interpretations to this field among history, he was seeking actually the aspects of aesthetic values through discovering and defining its vocabulary, that's why he has more than one definition for beauty through his various dialogs. He considered aesthetic values a term wider than beauty, aesthetic has its core define through understanding beauty, imitation, and inspiration. Artistically and philosophically, aesthetic has a wider meaning (Stanford Encyclopedia of Philosophy,2012), and it is the contemporary definition for beauty.

In the field of architecture, the beauty can be measured in terms of form morphology, appearance, and its form values, actually architecture has different perspectives defining its beauty, many definitions where held to formalize the meaning of its beauty, the fifteenth properties of architecture beauty by Christopher Alexander in *Nature of Order* applied in architecture, all were related to the form composition and scale, even when Huib Koman, Stephan Luijks, and Arno Pronk (Huib Koman, S. L. 2014) tried to define aesthesis and beauty in architecture in a mathematical order named mathematical beauty contributed from previous works for same trials, all defined beauty in the form of equations but at the same values related to form and proportions .

Architecture in the last decades has witnessed a great development accompanied by a change in architecture design thinking methods, tools, and trends. This development took place in a very rapid way, and a new architecture language is being created for a new architectural era and may be a new paradigm (F.McLennan, 2004), different design qualities and values are introduced, calling for a new elements and aspects defining its beauty and language, where this can redefine architecture, and open the gate for a new era of architecture criticism, architectural education, and better understanding of practice and architects role.

In terms of sustainability; as well as different computer form generation designs methods, side by side algorithms, parametrisism as defined by Patrik Schumacher (Jabi, W. 2013), all has shifted architecture thinking into a new era, where traditional aspects of beauty wouldn't be enough to fully define aesthetic meanings and values of this type of architecture, beauty should regard a complex set of new aesthetic aspects related to economic, environmental, social values and scientific technical values. The research purpose is to coin a new term for the Beauty with the capital (B) as an alternative term to aesthetic values and to define beauty with the small (b) as a partial beauty defining an aspect or an element concerning the Beauty. the aim of coining such terms is to assure that aesthetic measurements are no more enough to measure beauty in architecture

The research is important as it helps in defining how can we criticize architecture today, and what are those qualities of architecture that are not considered during education, and how this can help in edging the gap between education and practice, as a result this would help in understanding the nature of architecture of today, how to learn, practice and criticize it.

2. THE RESEARCH HYPOTHESIS

The great progress architecture is witnessing - *related to sustainability and computer aided design* - has introduced new qualities for beauty, traditional definitions for beauty or aesthetic values are not enough to judge or completely understand it. And with any new progress there would be new introduced values, as a result beauty has to be defined on two levels; that would both cover the wholeness and the partiality as follow: A domination level: Where this research is proposing to coin it as the Beauty by capital B and A sublevel: which is related to a certain kind of progress and named as beauty by small b, in order to judge a certain architecture work as being completely beautiful, and has almost a complete set of aesthetic values. It should verify both levels of wholeness and subs(partiality).

3. THE RESEARCH PROBLEM

The research asks what the elements are defining the new term of beauty of wholeness and partiality. and How it can be understood? The second research question is related to new contemporary architecture can we introduce scientific beauty as a sub definition added to the major term Beauty with capital B and how it can be defined.

4. THE RESEARCH OBJECTIVES

The research major objective is to coin the new terms Beauty of wholeness and beauty of partiality as follow:

- To give a full definitions to the meaning of each with regard to its elements.
- To design a model diagram illustrating the concept of the new terms to be as a blue print.
- To compare through a theoretical case study on the comparative methods, the major difference between regarding an architecture work with the new introduced perspective of beauty if compared to the traditional one (the chosen case study is a comparison between the SwissRe Building, and the Turning Torso with a new interpretation). This will give a spark for other researches to follow this approach for deeper understanding and further studies.

5. THE METHOD AND DESIGN

The research is studying a philosophical meaning and term **beauty in architecture** so it is non-experimental research as it seeks analysis of the term itself, so it is explanatory and descriptive, as it describes beauty in architecture on two levels and scales and explains how this defines the new language of contemporary architecture.

5.1 The Research Variables

- Beauty by capital B: Where it is a dependent variable on quality of design, it is the beauty of wholeness, where it regards all aspects of beauty in architecture as form shape, structure performance, philosophy, culture value, sustainable aspects.
- Beauty by small b: Where it is considered as a partial aspect of beauty such as the form only, the structure innovation, so it is concerned with a particular aspect of beauty in architecture.

6. ARCHITECTURE AESTHIC VALUES ARE CHANGING IN THE NEW MILLINUM

"The mother art is architecture. Without an architecture of our own, we have no soul of our own civilization." Frank Lloyd Wright . (Francis D. K. Ching, a. J. 2013).

The quotation of Frank Lloyd Wright represents the belief of many peoples, where architecture is considered as the mother of arts, but what makes architecture unique is that it is concerned with the physical properties of space, its arrangement, and design proportions. Not like other forms of art, it provides a space for daily life activities, then architecture in addition to its artistic form it carries functionality as an another aspect defining it, architectural products represent its society politics and culture.

"We shape our buildings, and afterward our buildings shape us."—Winston Churchill, 1943. (committee, P. u. 2002).

Among history, architecture aesthetic aspects were discussed in terms of form, and space arrangements in addition to architectural elements proportions, classic architecture in old Ancient Roman and Greek had its own rules regarding classic orders named the five classic orders (Fletcher, S. B. 1924)Fig.(1-a), all we seeking how to find a certain ratio regarding the relationship between spaces, and architectural elements. In classic architecture, ornaments were considered an aspect of beauty; the same was in Islamic architecture. The Renaissance age represents the revival of old Ancient Roman and Greek classic proportions in terms of humanism, that was the basic concept controlling everything in early Renaissance age, it represented a culture shift, art and architecture; both together were completely affected by this philosophy, human was the center of life and the center of thinking Fig.(1-b);, the paintings were always pointing on human features body and flesh, colors were very dynamic, artists wanted art that shows joy in life, this helped in deeper thinking of art; on the other hand architecture was also affected by humanism; architects began to look for architecture that focuses on human, architecture with smooth joy features and dynamic colors (Fletcher, S. B. 1924); this movement was based on some principles like the mathematical sequence generated by the mathematician *Leonardo Fibonacci*, which led to the theory of golden ration Fig.(1-c), (Ushakov, I. 2012). Renaissance artists and architects used the Golden Ratio to determine beautiful proportions in buildings and their painting compositions.

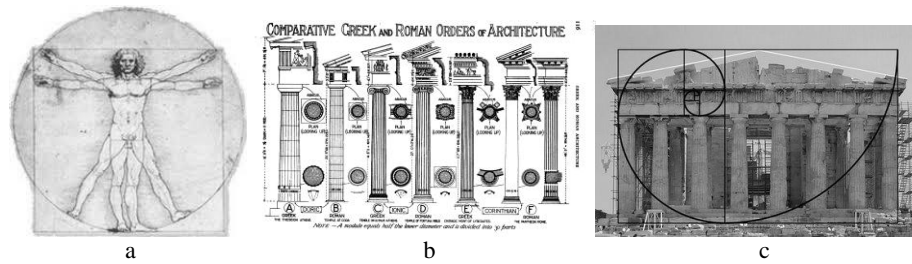


Figure 1. (a) The Vitruvian Man by Michelangelo (humanism in Renaissance), (b) The five classic orders between Roman and Greek, (c) Applying the Golden Ratio on architecture forms.

Starting from the middle of the nineteenth century followed by the twentieth century, architecture witnessed great changes in its ideas and perspectives; this was due to the modern movement, the different avant-gardes, and the concept of modernism, futurism, and constructivism. All were a reason for massive changes in architectural conceptual design forms (Demartini, F. P. 2006), ornaments became a crime (Loos, A. 1997); his was the argument of Adolf Loos. Minimalism was introduced under the expression of Less is More; even architecture was considered as a machine, after the middle of the twentieth century, the death of modernism was declared, and the new schools of late-modernism and post modernism were introduced, but yet all different changes in architectural thinking did not face problem in criticizing its beauty and aesthetic values.

The age of High-Tech followed by De-Constructivism in parallel to the movement toward sustainability -since 1987; when Brundtland report in Our Common Future coined the term of sustainable development -represents a transition phase towards Contemporary Architecture of the new millennium (Brundtland, G.H. 1987) & (Bartlett, A. A. 1994). New aspects for beauty has started to appear in terms of performance, energy consumption reduction, it became quite clear with the great development in technology and the introduction of computer aided design tools to the scene of architecture, algorithms, parametrisism; that all were calling for new aspects measuring their aesthetic values.

7. BETWEEN CHRISTOPHER ALEXANDER'S NATURE OF ORDER AND MATHEMATICAL BEAUTY IN ARCHITECTURE

In 2002, Alexander's Christopher proposed fifteen rules for good and beautiful architecture, he spoke about wholeness and center properties, and this was his interpretation to architectural beauty his rules were as follow (Alexander, C. 2002):

1. Levels of scale: It shows how strong centers are created through strong centers of smaller parts defining an architecture particular composition.
2. Strong centers: Where centers play a fundamental role in defining architecture beauty.
3. Boundaries: Where living centers become stronger when surrounded and defined by boundaries, where boundaries create a field of force around its center.
4. Alternating repetition: Where total compositions can be reinforced and strengthened through the repetition of centers in a defined way.
5. Positive space: Where positive spaces are geometry related to the mass from which the space is resultant in a strong way.
6. Good shape: When all elements of the architectural composition are complementary and define the goal of the whole composition the shape would be good, as the centers of all elements will be reinforcing each other.
7. Local symmetries: This would happen when symmetry is achieved on different levels of scale, that means having a composition of different elements that have a local symmetry
8. Deep interlock an ambiguity: The creation of a new unity through the interlocking of different elements, this would create a new center.
9. Contrast: Through combining different elements of different shapes, colors, and textures in order to emphasis a certain composition.
10. Gradients: It is the remarkable similarity at a mathematical function.

11. Roughness: Roughness can be defined as a pre-defined grid, which has certain imperfections, which are related to the pattern composition, their contrast results in a more comprehensive and unified whole.

12. Echoes: It is the repetition of a base object with different possibilities and alternations; it depends on angles and families of angles.

13. The void: It can be considered as an empty center, a void can be used to develop activities at empty spaces.

14. Simplicity and inner calm: It represents the use of simple geometry forms that can be easily understood and defined.

15. Non-separateness: It represents the unseen connections between forms and centers.

Christopher Alexander's rules were discussed mathematically through a research work by Huib Koman, Stephan Luijks, and Arno Pronk; that is named Mathematical Beauty in Architecture, this was not the first trial to define beauty in a mathematical form; but many mathematicians' tried to define beauty mathematically. Bertrand Russell was one of the most influential mathematicians and philosophers known in the twentieth century has expressed his interpretation to mathematical beauty in some word as follow: " *Mathematics, rightly viewed, possesses not only truth, but supreme beauty - a beauty cold and austere, like that of sculpture, without appeal to any part of our weaker nature, without the gorgeous trappings of painting or music, yet sublimely pure, and capable of a stern perfection such as only the greatest art can show. The true spirit of delight, the exaltation, the sense of being more than Man, which is the touchstone of the highest excellence, is to be found in mathematics as surely as poetry.* " (Russell, B. 1918).

However, all attempts to define beauty were always targeting the appearance, which is an aspect of beauty, but to call something beautiful there might be many other characteristics, similarly in architecture. For the structure innovation how can we define it as beautiful, the building performance, all these qualities and others were the reason to let us call the traditional defined beauty is an incomplete beauty; then its partial, that what makes the research propose a new term Beauty by capital B to be a universal beauty that carries all alternatives and aspects of beauty measurement and to classify the beauty related to appearance, colors and proportions as one of many partial beauties by small b; that all together would define the "Beauty"

8. "BEAUTY" BY CAPITAL B IN ARCHITECTURE

This term in architecture represents the beauty of wholeness, thus everything; where it can see all aspects of beauty regarding aesthetic values, performance, quality of space, and environmental aspects, whatever. "Beauty " is composed of a set of partial beauties that define the aspects of the field.

In art Beauty would be much more different than in architecture or music, each field should be measured in terms of its aspects defined by its purpose, in the field of architecture the research propose three partial beauties; that define the beauty of wholeness as follow:

1. The beauty of form (artistic beauty): " It is the beauty that is concerned with the building form appearance (shape, color, proportions...ect). This type of beauty is the well-know type; where it can be felt by any nonprofessional viewer to the architecture work, it's based on culture of the viewer, his education and his perception, so it measures visual qualities".

2. The beauty of conceptual idea (philosophical beauty): " It is the beauty that is concerned with the philosophical background affecting the form generation and architecture solutions"; as a real architecture work should have its own philosophy; that can define a certain kind of beauty, and it is not necessary to be related to form appearance, but in way or another it should be linked. So it measures the quality of idea(meanings-architects message to users-language....ect)

3. The beauty of functional performance (scientific beauty): " It is the beauty that has a scientific value, where it represents a scientific innovation solution in terms of form, the form here would not be targeting a good appearance only; but it would be solving a functional problem.

For example Sustainability in architecture design may have to be measured with the third partial beauty as the major scale taking in considerations the other aspects of beauty, when a building is capable of reducing the usage of a certain forms of energy or can provide a better performance of space this would be beautiful.

It is recommended in next research work to study what indicators should measure each term(the three partial beauties); those indicators can be inspired from the sustainable development indicators in addition to social and economic indicators. By understanding that beauty of architecture has changed, the education and evaluation and criticizing methods should change. This would make the understating of contemporary architecture much better.

9. THE NEW MODEL OF "BEAUTY" IN ARCHITECTURE

The beauty of wholeness interactive model Fig.(2), is proposed to solve the inter correlation between the three partial beauties of architecture, it is designed in a three dimensional form composed of three interlocking cylinders embed with in one form, each represents one of the three partial beauties, not like the three circles of sustainability. The three cylinders are characterized by height, which is an indicator to the degree of effectiveness of the type of beauty in the proposed deigned architecture product; normally there would be no absolute beauty or optimum beauty, which means there is no 100% beautiful; so the importance of height is that it can indicate an effective value of beauty if compared to the optimum model(100%).

Each type of beauty should be measured and defined through indicators, the future research work will work on determining these set of indicators and their relationship, by defining the indicators affecting each cylinder (type of partial beauty) through further researches this can be an effective measurement tool to Beauty, this would introduce a new term the degree of Beauty.

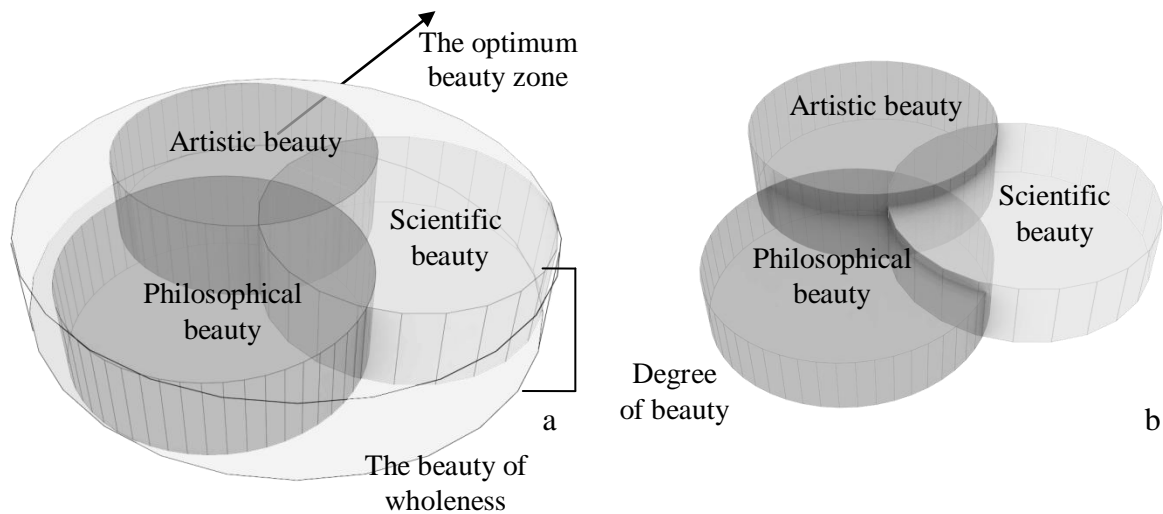


Figure 2. (a) The new model of beauty in architecture (b) The relationship between partial beauties

9.1 The Partial Beauty Effective Value (bv)

"It is the value measured through the partial beauty Indicators to indicate the degree of the partial beauty effectiveness" each cylinder represents a measurement scale to the type of beauty, the measurement scale can be divided into set of indicator and by calculating the sum of degrees of each indicator value the effective value can be known. The bv is proposed to be measured in 100.

9.2 The Degree "Beauty"

The degree of beauty represent the percentage of beauty compared to the absolute Beauty of wholeness, it is measured by applying the equation of beauty as follow:

$$\frac{\Sigma (bv^1 + bv^2 + bv^3)}{\text{(Three) the number of partial beauties}} = \text{the degree of beauty\%}$$

Where bv^1 = the beauty of form (artistic beauty) effective value.

Where bv^2 = the beauty of conceptual idea (philosophical beauty) effective value.

Where bv^3 = the beauty of functional performance (scientific beauty) effective value.

10. THE TURNING TORSO AND SWISS RE BUILDING IN TERMS OF BEAUTY

This comparative analysis represents the research new approach to define beauty, as it represents two different perspectives for beauty represented in the design of two towers, the Swiss -rebuilding Fig.(3-c&d) (180m height); design by Norman Foster, and the Turning Torso (190m height) Fig.(3-a&b); designed by Santiago Calatrava, the research is comparing both towers in terms of "Beauty" where both are equivalent in height, twisted in somehow, and considered as vertical tall structures.

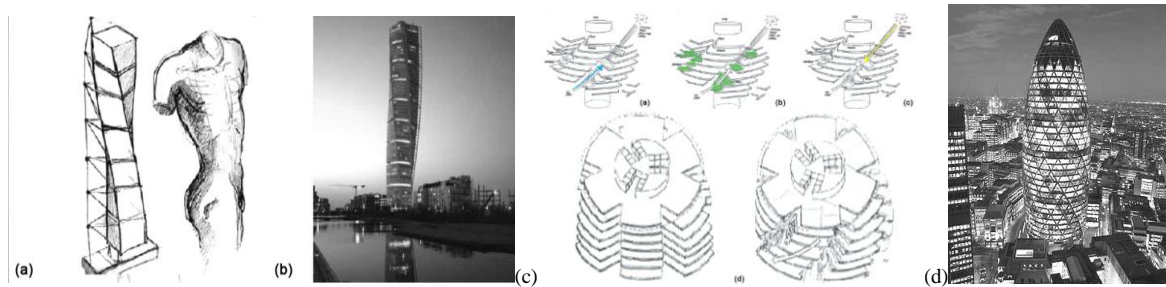


Figure 3. (a),(b) The turning torso, (c),(d) the Swiss Re-building tower

10.1 Swiss Re Building Tower

It is a tall structure of 180 m height having a diagrid; as a structure system to its form; it is considered to be from the first ecological buildings designed in London, it added a special and unique character to London's sky line; the form is designed through the twist of a circular plan having six triangular cuts, the circular plan widens from bottom to the middle of the tower then tapers toward its peak, this form is designed to overcome lateral forces and vortex shedding phenomenon, the tower is a sustainable structure where the twist of the circular plan with a five degrees creates a spiral cavity with a multifunction's as follow (Wells, M. 2005):

- 1- Providing natural day lighting.
- 2- The use of sky gardens to bring spatial quality.
- 3- Providing natural ventilation and reducing CO₂ by using natural systems to control the climate inside the building.

Although the twisted form shows many aesthetic values visually, this design used to hide the twisted floor plates, with a diagrid skin ,where performance of the form was much more important that showing the twist its self, the beautiful value here was through the :

- 1- The innovation of structural form.
- 2- The use of spiral cavities created from the twist to be a sustainable treatment.
- 3- The tapering of the form to overcome the wind.

So in addition to the creative form the hidden dimension of beauty was a scientific beauty rather than being an artistic one.

10.2 The Turning Torso Tower

The design is inspired from a previous sculpture work by Santiago Calatrava, when he was convinced to design a tower based on the same concept of the sculpture work, this high rise structure of 190 m height formed of nine similar cubes twisting through 900 from top to bottom, echoing the form of human body see fig (3-a). It is a concrete shear wall core carrying cantilevered floor plates twisting around the core and supported with an outside exoskeleton steel spine. In the Turning torso design the twisting form is emphasized in the contradiction to the case of Swiss re-building, which shows that the artistic and aesthetic values inspired from the proportions of the human body; were the major motivation in the creation of the designed form, the structure innovation of the mix between exoskeleton and the core with cantilever structure were used as a tool to express the form, so it is quite clear that the artistic philosophical beauties are stronger than the scientific beauties as values (Lepik, A. 2008).

11. CONCLUSION

The meaning of beauty in architecture should be redefined; as the beauty of wholeness (Beauty by capital B) where it is composed of three partial beauties defined as the beauty of form (artistic beauty), the beauty of conceptual idea (philosophical beauty), and the beauty of functional performance (scientific beauty). The "Beauty" of an architecture work is measured in terms of the three partial beauties.

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GALVANIZING LOCAL RESOURCES: A STRATEGY FOR SUSTAINABLE DEVELOPMENT IN RURAL CHINA

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ABSTRACT

China has been undergoing a rapid development over the past decades, and rural areas are facing a number of challenges in the process of the change. The ‘New Channel’ project, initiated to promote sustainable development and protect natural and cultural heritage in Tongdao county in China from a rapid urbanization and economic development, employed an ethnographic study and a strategic design approach to explore the local context and to identify opportunities for sustainable development. In particular, Hengling village, a small village consisting of 307 households in Tongdao county, was studied by a group of design researchers for ten days. Findings from an ethnographic study and a strategy planned to promote sustainable development in Hengling village are presented.

KEYWORDS

Sustainable rural development, Cultural heritage, Rural China, Design for social innovation

1. INTRODUCTION

As scholars pointed out, rural development is a big issue in China (Lou, 2013: 17-21). A large number of Chinese villages are “*undergoing a tremendous process of change*” (Fei, 2013), although the process and consequences of the changes are often questionable from a perspective of sustainability. Fei (ibid.) claims neither ‘a reproduction of the West’ or ‘restoration of the past’ can be the answer to the villages in transformation, and emphasizes “*A correct understanding of the existing situation based on empirical facts will assist in directing the change towards a desired end.*” (ibid., p.25)

The ‘New Channel (新通道)’ project presented in this paper shares a similar perspective. China has achieved significant improvements in some areas such as GDP and urbanization in the past 30 years, but rapid urbanization has destroyed many regional, cultural, and traditional communities (Ji, et al. 2014: 345). To promote alternative – more sustainable, and community-oriented - ways of development, the School of Design at Hunan university has initiated the project ‘New Channel: Design and social innovation summer camp’. Since 2009, groups of researchers and students have carried out field studies in several villages in Tongdao (通道) county in order to better understand the situation of small, under-developed rural villages in this area. Tongdao (which means ‘channel’), located in Hunan province in China, is well-known for its beautiful landscape, traditional architecture, and cultural heritage of Dong ethnic group (侗族), but small villages in the county are ‘one of the poorest places in the country due to the lack of economic development (Ji & Yang, 2010)’. The natural environment, traditional architecture, and unique culture of Dong minority group are still well-preserved in small villages, but a rapid development has taken place in the city center of Tongdao (e.g. figure 1) recently.



Figure 1. Tongdao city center



Figure 2. Hengling village

2. ETHNOGRAPHIC STUDY

This year, the field study was carried out in ‘Hengling (横岭)’ village (Figure 2) in Tongdao county. The Hengling village is a small village consisting of 307 households, and 1500 residents in total. A team of three design researchers and four postgraduate students stayed in the village for ten days from 18th to 27th July 2014 to conduct an ethnographic study. The ethnographic study aimed to gain better understanding of the local lifestyle, the needs of residents, and material and non-material heritage in the village. Data were gathered mainly through observation, and face-to-face in-depth interviews. Interview participants were chosen by researchers to involve villagers with different age, gender, and occupation. Ranging from the youngest participant, a 17-year-old high school girl, to the oldest participant, a 63-year-old retired construction worker, twelve local residents were interviewed in the home or workplace of the interviewee (Figure 3). Interviews were conducted based on eighteen questions about family member, daily life, income, living expenses, traditional culture, and dissatisfaction with current life. The interviewees were also asked to give a tour of the house, and show their favorite everyday products.



Figure 3. The research team interviewing an old lady living in the Hengling village

Although the number of interview participants was limited, the data collected from interviews revealed a number of facts that is noteworthy. Firstly, all of interview participants have family members who moved out to other cities for economic reasons (Figure 4). As it is difficult to find a stable job with a sufficient salary in the village, young members of the village tend to move to nearby cities such as Guangdong, Guangxi, and Shenzhen. As a result, the majority of the residents in the villages are the elders and their grandchildren, since many young couples moved to cities to make a living, but left their children in the village.

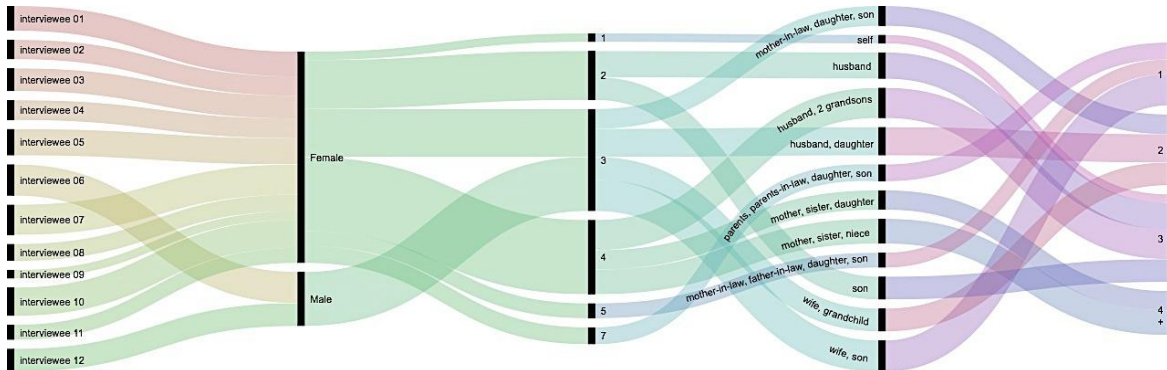


Figure 4. Visualization of data collected from interviews: Interviewee, gender, the number of family member living in the village, family member who live with the interviewee, and the number of family member living outside village for economical reasons.

It was also found that people who currently live in the village have experience of living outside the village for economic reasons. Among the twelve people we interviewed, nine people used to live other cities to earn money. Half of them had lived in other cities for more than 10 years before they retired and came back to the village. Although the residents of the Hengling village prefer to live and work in the village, and their expected minimum salary to work in the village is relatively low (most of the interviewees answered 2000 yuan - which is less than 250 euros - per month is acceptable), the limited job opportunities have led young generation to leave the village to find a job in cities. Statistics shows that each household in the Hengling village owns land for farming, but the amount of the produce is not enough to contribute to the income of the household due to the limitation of the land (0.7 mu; approx. 0.1155 acre per household), the poor quality of soil and insufficient irrigation facilities.

From the interviews, and observation, it was noticed that the residents of the Hengling village have a strong sense of community. A number of communal space in the village were always full of people chatting with each other (Figure 5, left), playing games, and taking a nap. Communal dinners were often organized when there was a special occasion ranging from a marriage to a funeral. Even during the short period of time the research team stayed in the village, a couple of communal meals were organized; one day to welcome the research team (Figure 5, right), and another day to celebrate a newborn baby in the village.



Figure 5. People chatting at communal space (left), Local women preparing communal lunch (middle), A banquet organized to welcome the research team (right)

The traditional lifestyle is still maintained in people's everyday lives. Most houses are traditional wooden houses, and most furniture is made of wood too. Domestic appliances like washing machine, air conditioner, and microwave oven are rarely used. It is very common for the residents to wash clothes in the river (Figure 6, middle) instead of using washing machine. Among the twelve interviewees, eleven people told us that they eat rice and vegetables that they cultivate, instead of buying food from a market.



Figure 6. An interviewee's kitchen (left), a villager washing clothes in the river (middle), a villager working in her farm (right)

3. EMPOWERING LOCAL ECONOMIES BY VITALIZING LOCAL RESOURCES: A STRATEGY FOR SUSTAINABLE DEVELOPMENT

From the perspective of the 'three pillars of sustainable development' (United Nations General Assembly, 2005), the weakest aspect of the Hengling village seemed the economic development. Environmental protection has been managed strongly since the village is nominated to the Tentative list of Chinese World Cultural Heritage. The local and central government have been active in protecting the natural environment and traditional architecture against imprudent land development or construction of new buildings that may have a detrimental effect on the environment. From a perspective of social sustainability, the strong sense of community among villagers, and various social events and communal activities that strengthen social bond do not seem to need additional interventions.

However, the ethnographic study revealed the needs of enhancing local economy for the future of Hengling village. Thus, based on a hypothesis that (re)vitalizing local physical, cultural, and social resources (e.g. figure 7) can be one way to empower local economics and promote sustainable development in the village, the New Channel project pays particular attention on three local resources: Brocade, Landscape, and Wood. Consequently, under the framework project 'New Channel (新通道)', three self-standing projects that aim to develop these resources into local businesses - Brocade, Tourism, Furniture - are proposed.

Firstly, the brocade project intends to utilize the rich cultural heritage of Dong brocade (figure 8, left). There exist a few local businesses producing brocade products, which are mostly replicas of traditional brocade. Secondly, the tourism project intends to make use of the beautiful landscape and traditional architectures in the village. Interestingly, during the interviews with local residents, some of the interviewees showed special interests and high expectation in tourism business as they believe it can be a good opportunity for them to develop a new career within the village. Thirdly, Hengling village is rich in wood, since 81% of the land is woodland. Yet, the furniture available in the local markets is quite limited in terms of style and type. Given the high quality of wood produced in this area, it is considered that there is a potential to develop local business through collaboration between product designers and local wood manufacturers (figure 8, right).

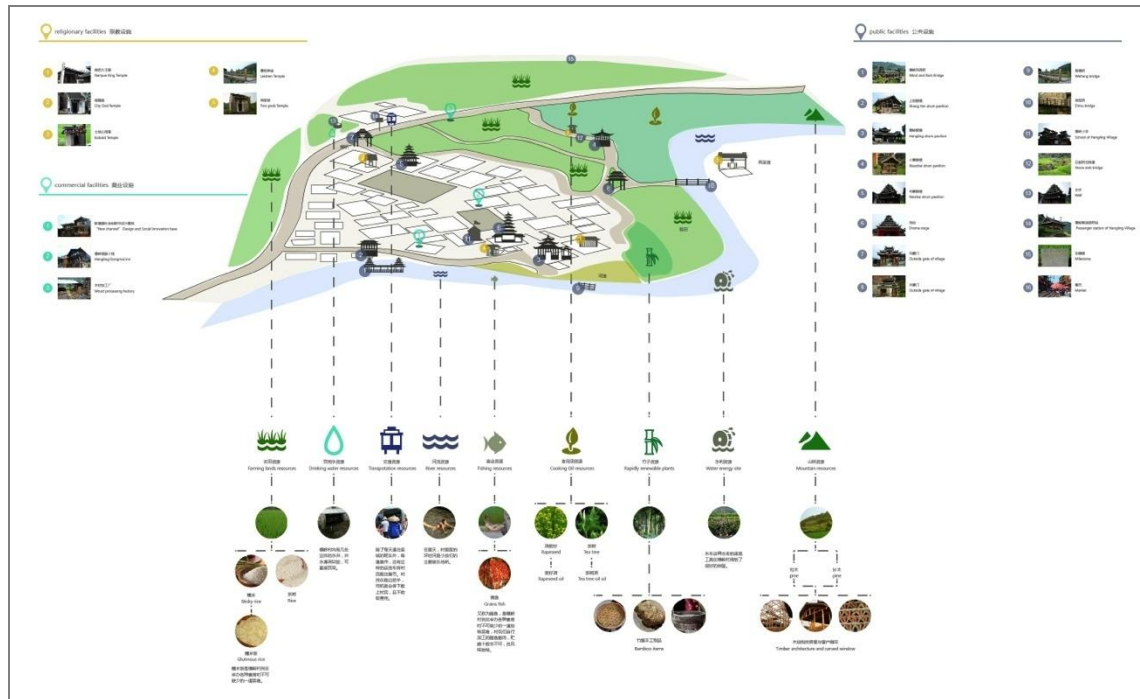


Figure 7. A map developed by the research team to visualize various resources in the village (image by Mengdie Chen)



Figure 8. Products in the local brocade store (left), local wood manufacturer (right)

Among the three projects, the brocade project has commenced first. The project team rented a house in the village and transformed it into a workshop for brocade (figure 9, left). Local residents – mostly elderly women – who have the knowledge and skills of making traditional brocade are invited to collaborate with fashion designers to produce more marketable fashion items including cloths, scarfs, and bags (figure 9, right). Currently the local weavers are paid by the research fund of this project, but the brocade project team is preparing to launch an e-commerce platform to promote the brocade and to connect local producers with customers (e.g. city dwellers) who want to buy the products.

Although it is difficult to evaluate the contribution of these projects at this moment, as they are under development, the three projects are expected to create more job opportunities in the village and increase residents' income by creating synergy under the framework project of 'New Channel'. A similar strategy, described as 'acupunctural planning' (Jegou, 2011; Manzini, 2010) or 'planning by projects' (Manzini & Rizzo, 2011) has shown how large-scale transformation processes are fostered when interrelated small-scale projects are synergised and amplified by larger initiative. Similarly, the above mentioned three projects - Brocade, Tourism, and Furniture - will be developed into different local businesses, but ultimately the three projects aim to mutually reinforce in improving local economy and at the same time vitalizing and promoting the values embedded in the natural, material and cultural resources of the village.



Figure 9. Local women working at the workshop established as a part of New Channel project (left). Collaborative work between fashion designers and local women (right). The pattern was designed by the fashion designers, then woven by local women

4. NEED FOR SUSTAINABLE DEVELOPMENT IN RURAL CHINA

The current situation of Hengling village seem environmentally and socially sustainable to a considerable extent, since the residents have maintained traditional ways of living: they consume locally grown food, make products by using locally available materials, appreciate the natural environment, and have a strong sense of community with their neighbors. While developed countries have put an effort to envision and promote such ways of living for sustainable futures (e.g. SPREAD, 2012), rural areas in developing countries often exhibit ‘sustainable qualities (Manzini & Tassinari, 2013)’ in current everyday lives.

Yet, the situation can be changed anytime soon. Similar to developed countries where unsustainable ways of living have become dominant lifestyle in the process of the rapid industrial development and urbanization, the lifestyle of rural areas in developing countries may undergo a change towards an unsustainable direction in the near future. In fact, some changes were already observed in Hengling village. More and more houses are refurbished in a so-called “modern” style (figure 10, left, middle), instead of traditional style (figure 10, right). Household products made of straw or wood are becoming replaced by plastic products, which the villagers think more durable and stylish. Traditional costumes of the Dong ethnic group (e.g. figure 11, left and middle) were still popular among elderly women, but rarely worn by young generation (figure 11, right). Such change may be accelerated in 2015 when a high-speed train will connect Tongdao to nearby big cities.



Figure 10. Houses refurbished in a modern style (left, middle), a house renovated in a traditional style (right)

Outsiders like a team of researchers cannot stop the change nor force certain ways of living to local people for the sake of sustainability. Still, researchers have a role to play to steer the change towards a more sustainable direction. For instance, tourism business, which is high on the agenda of local government, can be a double-edged sword for the future of Hengling village. Undoubtedly, Hengling village is rich in natural and cultural resources attractive to tourists, and the development of tourism industry can contribute to local economy. However, a growing number of tourists may damage the well-preserved natural environment of Hengling village, and also may disrupt the traditional lifestyle of local people. The identity and cultural heritage of the village may be put in danger of commodification, as already happened in other villages in

Tongdao. Whether the tourism industry will improve or deteriorate the quality of life of local people and environment will depend on the way the tourism business will be headed for.



Figure 11. Elderly women wearing traditional costume (left, middle), young women in the village (right)

One way to steer the change towards a more sustainable direction is to propose an actionable, sustainable option. As Thackara (2013) pointed out, material and cultural qualities in a territory “*might be not so obvious to those who live in them*” (p.4), thus the new work for designers is to cast fresh and respectful eyes to reveal them (ibid.). Similarly, the ‘New Channel’ project started by exploring tangible and intangible assets in the village and bringing them into light. Then, some of the assets were highlighted and proposed as business opportunities - brocade, tourism, and furniture - not only to empower local economy, but also to protect and promote the material and cultural qualities embedded in Hengling village. For instance, a young women we interviewed told us that she has not tried to learn traditional weaving skill because she was not interested in the brocade, like most young women in the village. But she said she is willing to learn the skill if it will help her to find a job in the village because she prefers to live and work in the village, rather than moving to a city to make a living.

It will take a considerable amount of time and effort to implement these ideas, and it is not certain whether these businesses will succeed or not. Yet, these proposals may provide a more sustainable, and community-oriented way to develop the village beyond a paradigm of modernization and urbanization or nostalgia for the past. Wen et al. (2012) argued today’s problems that rural china face require “*different ways of thinking*” beyond the scheme of modernization, and “*forms of thought that respect local, indigenous culture*” (p.35). This paper underlines that a design-oriented approach can be a promising way by virtue of its appreciation of cultural, social, and environmental qualities, and collaborative ways of working with local communities. This paper discussed a case of the Hengling village, but the implication is not limited to this specific village. After all, many rural villages in China face similar challenges, ranging from ‘vanishing traditional skills’ to ‘low income’, and to ‘population loss and empty-nest households’ (Lou, 2013: 20-22).

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TEACHING ASSEMBLY FOR DISASSEMBLY; AN UNDER-GRADUATE MODULE EXPERIENCE

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ABSTRACT

This paper is about the experience of teaching Assembly for Disassembly to fourth year architect students within the module of sustainable design. When designing a sustainable building one should take into consideration the fact that the building is going to be demolished in some years; thus the materials should be assembled in such a way so that the building is not just demolished, but disassembled in a practical way, so that its items and materials can be reused or at least be recycled in other buildings or products or be decomposed. Yet, the structure should be safe during its lifetime. With this technology, the building's sustainability spans also to its "grave". In this paper the methodology for teaching students how to design for the disassembly of buildings is presented. Apart from the respective lectures, the fourth year students have been asked to design a small home for a homeless person, following, apart from bioclimatic design and the zero-CO₂ building design, an "assembly for disassembly" design. They have also been encouraged to use, apart from conventional building materials, materials that could be collected from municipal waste, provided they have a small environmental footprint. Frequent tutorials are made during this project. Different groups of students have followed different concepts in their design; some students have focused on the assembly for disassembly of a home from municipal waste, others from construction materials, while others, apart from assembly for disassembly, have also taken into consideration the movability of their design as well as its incorporation in the urban tissue. The results and the conclusions are presented in this paper.

KEYWORDS

Assembly for disassembly; sustainable construction; sustainability; education; building materials; design.

1. INTRODUCTION

When teaching sustainability to architects, students should be able to practice sustainable architecture both in a holistic and in a serialist way by the end of the module, so that they are able, according to Race (2001), to both "comprehend" the issues, so that they can make decisions, and also to "operate" certain tools (algorithms, sun charts etc.). Apart from energy and water savings, the use of ecological materials, as well as the use of passive solar systems and the implementation of Renewable Energy Sources, students have to be introduced to the Life Cycle Analysis of buildings, should they design sustainable buildings and settlements. Assembly for DISAssembly (ADISA) is one of the most prominent techniques to designing sustainable buildings, which will not form building waste, but, if demolished properly, their materials and items can be reused, or at least recycled or decomposed. ADISA, as a sustainable construction technique, is taught during the spring semester module "Sustainable Design II", preceded by the winter semester module "Sustainable Design I" to the fourth -year students of the five - year course in Architecture at the University of Patras, Greece. During the academic year 2012-13 further emphasis has been placed on ADISA, so as to teach the students that apart from the ecology of materials, the bioclimatic design and the low energy and water consumption as well as the low waste production of buildings, they cannot be holistically sustainable, unless their disassembly has been put into consideration since their design, putting into consideration the Life Cycle Analysis of the design and the structure. As ADISA is not so often part of the curriculums of sustainable design modules, the pedagogical approach that has been followed for teaching ADISA to undergraduate architecture students and its results are presented in this paper, hoping to open up a dialogue on the methodology of teaching ADISA to undergraduate architect and engineering students.

2. TEACHING METHODOLOGY

As one learns through practice and assessments should be oriented towards learning (Gibbs and Habeshaw, 1992; Webb and Willis, 2010), emphasis is given on the students' practice on learning how to design for Assembly for Disassembly. For this reason students are asked to perform a group assignment (two to four people), which makes up to 40% of the module's final mark and to design an ADISA small shelter for a homeless person, which could be easily placed, either as a stand-alone shelter or as a group of shelters in the city of Patras public spaces (squares, parks), providing zero-CO₂ emissions, water savings and zero-waste, healthy, ergonomic living space for the homeless. They are also asked that the shelter or group of shelters are placed in such a way so that they do not form ghettos nor encourage deprivation in the public space. The structure has to be earthquake-proof and easily assembled and disassembled. Students have been encouraged to provide designs that could be constructed by unqualified people (e.g. by the homeless themselves) and be easily deconstructed, with reusable members, so that they are not left behind when the homeless have found a proper home, as had happened with the "isobox" shelters of the 1999 earthquake homeless in the greater area of Athens. Budget limitations have not been placed.

2.1 Description of Teaching

The respective lectures explain the importance of reducing building waste, as, before the country's economic crisis they made up to 31% of the municipal waste (Dimoudi, 2006). The lectures focus on an introduction to the Life Cycle Analysis of buildings as well as on the principles of ADISA, as have been put forward by Burge (2001). The rationale of "reduce-reuse-recycle" is reminded in every step of the design and ADISA is thoroughly explained; it is made clear that when designing, from blocks of buildings to structural details, one should bear in mind that building materials should directly be reused, so as to lower building waste. Thus, the building's separate layers should be technically separated (e.g. piping separated from walls), each layer should be easily disassembled with simple mechanical strength and that standardised, mono-material components should be used, so as to encourage reusing. In this way, ADISA constructions can be easily separated into identical components and materials during demolition, ready to be useful components in another structure and not pile up in the municipal waste. The "joke" used during the lectures, to alert the students, is the comparison of ADISA buildings to LEGO structures most of the students made when they were kids. The ecology, embodied energy, reusability and recyclability of building materials is also presented thoroughly, covering all the building layers and the notion of the Life Cycle Analysis is put forward for many building materials. Respective notes are also given to students on the module's electronic platform (e-class).

As the lectures also focus on the importance of reducing building and municipal waste, the rationale and the work of architect Michael Reynolds is presented (Reynolds, 1993) and a documentary is also shown to students, the "Garbage Warrior", where Reynolds' work and its application in providing temporary shelters in earthquake-struck areas is presented (Hodge, 2007). For pedagogical reasons, not the whole documentary is shown, but mostly the parts that focus on the materials and structures from municipal waste, rainwater harvesting and waste management. During the documentary show, comments are made by the lecturer and further information is given to the students where they can watch the whole documentary, if they wish to.

During the lectures, examples are also given on ADISA buildings, especially from Roaf et al (2007) and Burge (2001). Yet, not such great detail is presented from the beginning, especially regarding construction details, so as to encourage students to think out of the box and come up with their own ideas about the materials they chose and whether they use construction materials or municipal waste for their assignment. Although there is a plethora of information on how to design for the homeless, with both municipal waste and structure materials, from both Universities and practitioners (e.g. Azari et al, 2009; D'Apolito, 2012; Meinhold, 2013 etc.), this information has not been provided to the students, so that they mostly focus on ADISA and either make up their own structural details or research. The structural details are further examined during the assignment tutorials.

The lectures are also followed by class exercises, asking the students to design structural ADISA details, with materials of their choice and to discuss whether the use of municipal waste could be used for the construction of safe and healthy buildings, especially during the recent years that the country is under great economic depression. The class exercises are corrected and handed in to the students during the following class. They are marked for the participation and not for their content, as students have just been introduced to

the respective concepts and a negative mark might be discouraging and unfair.

Great emphasis is given on the tutorials of the assignment. All members of the group are asked to be present during the tutorials, where their sketches, drawings and ideas are reviewed, discussed and corrected. Apart from ADISA, the choice of materials, the bioclimatic design and the zero environmental footprint of the structure are discussed. About six tutorials have occurred for this assignment, providing guidance through every step of the students' designs.

There is also a mid-term presentation of the assignments, where all students can see and comment on their colleagues' projects and further comments are made by the lecturers.

3. RESULTS

Regarding the first class exercise (the ADISA structure details), some students manage to come up with efficient ADISA structural details, while for others, influenced by their existing knowledge on concrete – brick structural details, it has been harder to think differently just by listening to lectures. Regarding the second class exercise (the discussion on the use of municipal waste as structural materials), there is a number of students who think that transforming municipal waste into building materials would help provide shelters and generally, less expensive buildings during the economic crisis and be a solution to the management of municipal waste, while there is a group who is skeptical that this would be used only for the poor people's shelters and housing, leading to more social deprivation and unfairness. It is interesting to mention that the latter group of students does not incorporate municipal waste in their designs, but prefer to use building materials for their ADISA shelter.

Tutorials have been crucial to further understand ADISA; at the beginning it had been very hard for students to think about structures where the finishing layer might not be plaster and that piping and electrical wires would not be incorporated inside the walls. Examples of primitive architecture, and the work of Kahn (1973) and Triantafyllou (2010) have been put forward, as well as the lecturer's ADISA construction details (these proposed towards the last tutorials), so as to help them perceive materials that are used in structures in a different way. The space's ergonomics, as a technique of minimising the use of materials, as well as the consideration of sun and wind (which had also been a priority in their designs during the previous semester) and water savings are also put forward during the tutorials, as well as the aesthetics and the shelter's relationship with the urban space.

The presentation has also helped the students to put their ideas together and be able to justify them. During the presentation, a lot of comments have been made on how the materials and the elements are combined together and also on the aesthetics of the proposals, as well as on their incorporation in the urban fabric, so as not to end up in ghettos, on which the next tutorials after the presentation focus. Apart from that, some students whose assignments had not advanced that much up to the presentation day seemed to be inspired by the presentations of their colleagues; some of the ideas that had been discussed during tutorials and encouraged during the presentation have been implemented to the designs of groups which had not been so eager to participate in the tutorials.

In the assignments that have been handed in, 62% of the main materials that are used are structural materials while 38% reclaimed municipal waste. Most of the municipal waste is combined with structural materials (e.g. timber or steel frames), while 14% are more radical designs and use only municipal waste as their primary structural source, incorporating also fishing cords and nails to joint reclaimed municipal waste so as to form the shelter. In all designs, no gluing takes place between the different layers of materials; only nails and screws. Some designs have also used paper or clay to join together plastic or glass bottles and fewer cement, while other designs have left more air losses through the bottles, so as to make disassembly easier (Figure 1 a and b). No plastering is incorporated in any of the designs. The different layers of the structure are clearly separated (structural frame from walls, insulation from walls, or walls that need no insulation are used, separation of walls from windows, separation of drainage, piping and electrical wires from walls etc.), while some designs have used standard units to form the shelter.

The frequency with which the construction materials or the municipal waste are used is shown in Table 1. As can be observed in the following table, wooden pallets are the most frequently used municipal waste (25% when compared to other municipal waste, 9% when compared to all the main materials used). Students use them as flooring, wall and roof materials, insulating them with either paper waste or insulation of plant origin

(kenaf, cotton, cork or straw). A lot of the designs have used the wooden pallet as a standardised ADISA material (Figure 3b), the dimensions of which make up the structure (both floors and walls), making it possible to reuse these items either as pallets or as structural or furniture materials, after the shelter's demolition. Glass bottles are frequently used (19% when compared to municipal waste and 7% when compared to all the main materials used), many times in relation to wooden pallets as openings (for solar gains, cross ventilation and natural light) and also either joint together with paper pulp, cement or cob. Regarding structural materials, most students have preferred to use timber in their structure either as frames and / or as walls (23% when compared to other structural materials and 14% when compared to all the main materials used), while double-glazed, pure glass with aluminum or timber frame replaces the reclaimed bottles for solar gains and natural daylight (22% when compared to other structural materials and 14% when compared to all the main materials used). Some students also use cob / rammed earth as their main construction material (7% and 4%, respectively). Although cob as well as cement may not be the most prominent ADISA materials, students who have used the first one, argue that it can be easily demolished and decomposed. Students who use rammed earth, as well as students who use reclaimed materials are very sensitive about the costs of such a structure, making the decision, that with their design a low budget shelter can be created by the homeless themselves, while other students have decided that the Municipality of Patras or the Greek Authorities will provide the homeless with the appropriate budget to create a quite high-tech shelter, with photovoltaics and all the necessary facilities.

Table 1. Main materials used in the ADISA assignments and the percentage of their use (a) per all the main materials and (b) per construction materials and municipal waste, respectively.

	Materials used	Percentage of use of materials per total	Percentage of use of materials per construction materials or municipal waste, respectively
Construction materials	Cob / Rammed earth	4%	7%
	Paper	3%	5%
	Metal frame	9%	15%
	Cork	2%	3%
	Timber	14%	23%
	Thermal insulation (kenaf, cotton)	6%	9%
	OSB or SIP panels	3%	5%
	Straw and strawbales	2%	3%
	Metal parts (reused)	2%	3%
	Glass with aluminium or timber frame	14%	22%
	Paper	1%	1%
	Concrete	1%	1%
	Sand	1%	1%
Municipal waste	Plastic bottles	2%	6%
	Glass bottles	7%	19%
	Wooden pallets	9%	25%
	Plastic membranes	6%	15%
	Fabric	6%	15%
	Paper tubes, cartons and newspapers	4%	12%
	Metal tubes	3%	8%

The majority of the shelters (69%) are designed so as to be combined with other shelters and be connected to facilities buildings (existing municipal buildings or new ADISA buildings); where toilet and kitchen facilities are supplied, while 31% of the designs refer to stand-alone, autonomous shelters. The students who prefer the first solution follow the rationale that less materials should be used in the shelter and that waste should be treated centrally, while the students who prefer the second solution, put forward the idea that the new-homeless people should be able to survive independent from a central authority that might not finally work out. In many of the non-autonomous shelters, no shewing systems are necessary and in some no electricity facilities either; night light is provided through photovoltaic table lamps. In the autonomous shelters piping is either detached from the walls and is visible to the interior, while in other designs, more bold about the economic costs, timber frames cover piping and electrical wires. Many of the autonomous designs use rainwater harvesting to cover sanitary water needs, compost toilets for water savings, photovoltaic panels and solar panels for the production of electricity and sanitary hot water, respectively (Figure 1c).

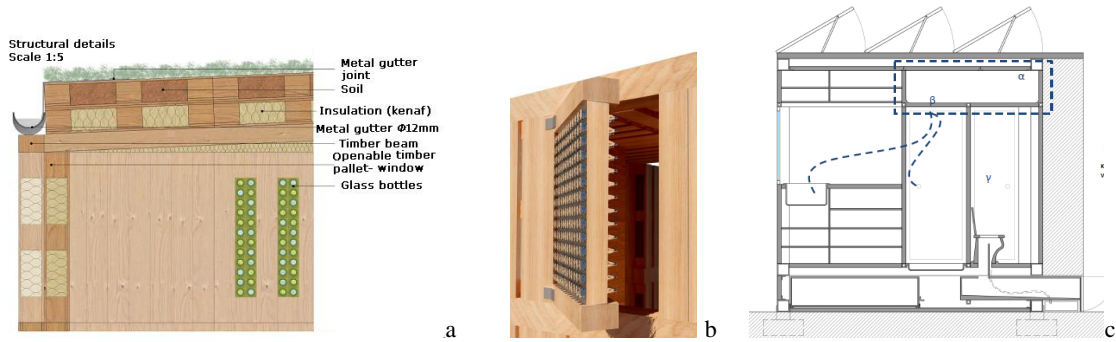


Figure 1. Structural details (a) of roof and walls, made of wooden pallets, openings made of glass bottles and water piping by the students V. Antonopoulos, A. Ioannou and V. Charalampopoulou (b) of a window, made of glass bottles and timber frame, which is nailed to the timber wall by the students F. Dimoglou, I. Theodosopoulou and S. Pavlidou and (c) rain water harvesting for sanitary water, compost toilet for water saving, photovoltaics for electricity production and solar panels for Sanitary Hot Water production in the project by the students G. Kourakos and Th. Svoronos.

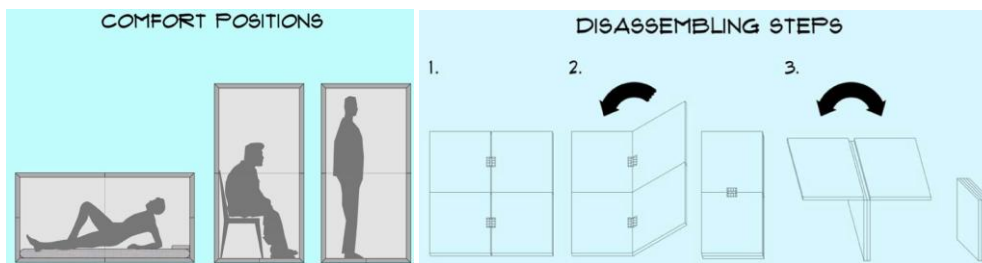


Figure 2. A transformable and movable minimal shelter by the students V. Paraskevopoulou and Z. Charalampous.

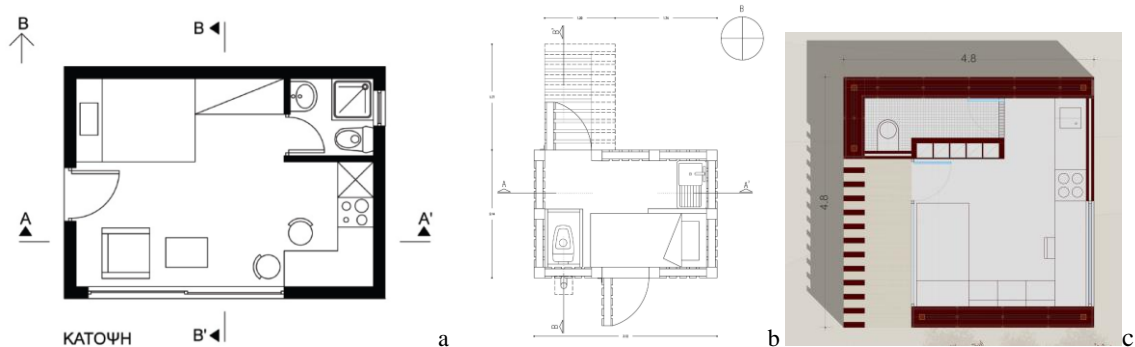


Figure 3. Stand-alone, fixed units by the students (a) A. Alafi-Andrikopoulou, N. Ioannidou, K. Papadioti and G. Tsantoulis (b) F. Dimoglou, I. Theodosopoulou and S. Pavlidou and (c) A.-P. Mourelatos and S.-P. Pandazopoulos.



Figure 4. Mobility and transformations of a shelter by the students E. Vlachaki, A.-P. Dogani and M. Lafazani.

The design of the shelter varies from very simplistic, movable boxes (Figure 2) to autonomous and fully equipped, ergonomic, little homes (Figure 3a, b, and c). Many students (43% of the assignments) have put forward the idea that apart from ADISA, these shelters should be easily disassembled so as to be moved to another place, either in the simplistic form shown in Figure 2, or in more sophisticated structures with openable and movable members, as the one presented in Figure 4.

Most of the designs have oriented the shelters to the south, so as to achieve solar gains either through direct gain or other passive solar systems, mostly Trombe wall. Eastern, western and northern openings are kept to a minimum in most of the designs, used for ventilation and day-light, if necessary. External shading devices, either movable or permanent, from fabric or timber are placed in the southern, eastern and western openings. Solar winter penetration and summer shading have been calculated for the geographical latitude of Patras (38°) (Figure 5a and b). Taking into consideration the wind speed and direction from the meteorological data of the city of Patras, the type of the occurring air flow is estimated, in relation to the proposed geometry. The ventilation of the occurring open and interior spaces is thus examined (Figure 5c). Most designs have incorporated night ventilation as the main cooling strategy, which is achieved through cross ventilation from the openings, which are either glass (structural or waste) or plain timber movable frames, while some have considered vertical ventilation from removable openings on the roof. 11% of the designs have also placed green roofs on the top of the shelter so that the microclimate around the shelter is altered in a positive way and also so that food production can occur within the shelter.

The aesthetics of the shelter and its relation to the urban environment have also been very crucial. Some students come up with more classic relationships between shelters and the open space, allowing for large areas between the shelters, where air can flow and people can move (Figure 5), while others have considered their shelters to be a living sculpture (Figure 6), adding up to the aesthetics of the urban space.

In most designs, photovoltaic panels are used for the production of electricity (45%), as shown in Table 2. Solar panels are also used for the production of sanitary hot water or for space heating (31%). Geothermal pipes for space heating and cooling is used only by 3% of the assignments, while rainwater harvesting, water recycling and compost toilets are used by the majority of the students (54%, 51% and 46%, respectively), especially in the stand-alone units.

Table 2. Technology for electricity, sanitary hot water, space heating / cooling (apart from solar energy and ventilation), water collection and savings used in the assignments.

Technology	Percentage of its use in the assignments
PV panels for electricity	45%
Solar panels for SHW and space heating	31%
Rainwater harvesting	54%
Water recycle	51%
Compost toilets	46%
Geothermal pipes	3%

3.1 Lessons Learnt

Through this process, it has been found out that the most important pedagogical tool for the achievement of learning ADISA, apart from lectures, has been the assignment and the respective tutorials. Students who have participated in all the tutorials, where their designs are thoroughly discussed and advice is given on how to improve their ideas have been able to hand in high quality work. Students who have been less eager to participate in the tutorials have come up with more simplistic ideas, some of which have also been presented in this paper. The mid-term presentation, acting also as a way of communicating ideas, seems to help students, especially those who have not worked their project so intensively up to then, to get engaged in the assignment and get inspired by the ideas their fellow-students had come up with. Lectures, notes, documentary show and class exercises have also been helpful, but not as much as asking the students to think and do it themselves through the assignment and the student-lecturer communication through the tutorials for the achievement of “thinking out of the box” ADISA designs.

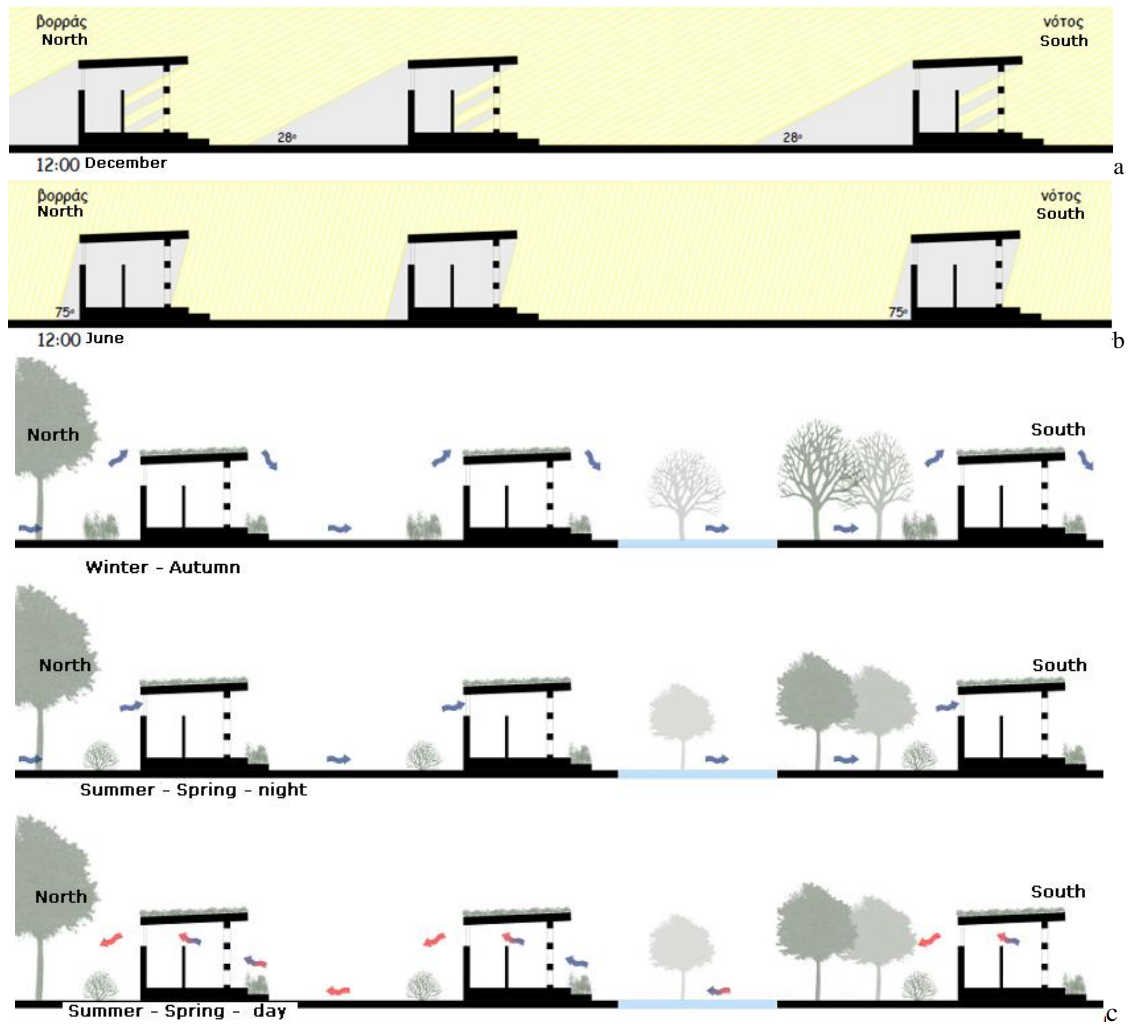


Figure 5. Noon sun at the southern façade of the shelter (a) in winter – solar gains and (b) in summer – external shading and (c) ventilation strategy and type of air flow during the different seasons by the students V. Antonopoulos, A. Ioannou and V. Charalampopoulou.



Figure 6. ADISA shelters placed so as to form a living sculpture in an urban park in the city of Patras by the students E. Bagianou and K. Papathanasopoulou.

4. CONCLUSION

Through the intensive tutorials on the assignment, the lectures, the class exercises and the presentation, the submitted work has been, in most cases, of high quality, especially those produced by students who participated throughout the whole process (lectures, class exercises, all the tutorials and presentation). The students have been given the freedom to choose the origin of the materials, either from typical structural materials or from municipal waste as well as the type of the design, from permanent to movable shelters, from simplistic to sophisticated designs. The assignment's marks range from 6 to 10 (out of 10) with an average of 8.11. Although it has been hard at the beginning for students to comprehend ADISA and to rethink about the structural details they had learned during their 3rd year of studies, through the collaboration of the lecturer and the students, as well as through their collective work, the majority manages to incorporate ADISA in their sustainable design, in both a comprehensional and operational level. After this experience, the students are able to both set the sustainability goals of their design and take the appropriate decisions and also to design the details that lead to the desirable result. One of the students, A.-P. Mourelatos, has won a national students competition for the visitor centre of the Stavros Niarchos Park (the design selected by Renzo Piano), designing a "recyclable" building (SNF, 2013).

As our educational system tends to lead to more standardised ways of thinking and designing, one of the hardest parts of this assignment has been to make students think out of the box and apply Assembly for Disassembly either with conventional building materials or with reclaimed municipal waste, making their own decisions, designs and structural details. As new environmental problems arise every day and the architects and the engineers of the future should be able to challenge them quickly, apart from ADISA, students should be asked more frequently to think out of the box through our pedagogical approach.

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SYSTEM-EVENTS TOOLBOX - ACTIVATING URBAN PLACES FOR SOCIAL COHESION THROUGH DESIGNING A SYSTEM OF EVENTS THAT RELIES ON LOCAL RESOURCES

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ABSTRACT

This paper is a reflection on the use of public spaces in towns and the development of a system-events toolbox to activate them towards social cohesion. It is the result of a 1 year action research developed together with POLIMI DESIS Lab of the Department of Design to develop design solutions to open up the public spaces of the campus to the neighbourhood. The results have been tested in an event format called "il Sabato della Bovisa" held at the "Durando Campus" of the Politecnico di Milano. It presents a series of initiatives to understand, observe, and to benefit from members of a public university triggering a process of knowledge exchange between residents and students in a climate of conviviality.

KEYWORDS

Social innovation, cohesion, public places, service design

1. INTRODUCTION

“Public spaces mirror the complexities of urban society” (Madinapour, 2010) and in the contemporary age public places become fluid spaces (Baumann, 2002) of exchange and participative action, not only as contexts but as scenarios able to embody new meanings, contributing to the creation of community identity (Borlini, Memo, 2008). The public space, forgotten for years by industrialized society, is reclaiming its importance due to consumer and service society. Below this layer of conformity something is moving in the opposite direction: public spaces are becoming places of social innovation, offering a context where creative communities act (Meroni, 2007) to bring original solutions to everyday problems that the current economic system is no longer able to provide¹.

The bottom-up actions of these active groups of citizens who find their own answers is combined with top-down actions of institutions (Mulgan, 2008). This creates opportunities for social transformation and sustainable growth that modify the current pattern, replacing the old individualistic values with a new sense of community, sharing, exchange of knowledge and information, and mutual support. The reclaiming of public spaces allows people to come together in an inclusive way - opening roads, squares, and the city itself for the free enjoyment of all, and this happens when people become fully aware of their rights and responsibilities, which open horizons to endless opportunities.

One of the design tools that suits this changing and fluid urban context is “the event”. When it is put together with strategic design and design for services, it becomes the system-events toolbox. This is composed of a set of toolkits combined together into a system that provides the opportunity to open up a public place through a series of actions and activities. It relies on local resources and on neighbourhood communities, such as associations, NGOs, groups of citizens, and public and private institutions, who want to actively collaborate in the initiative, and where the space becomes the background and context, open and accessible to everyone. The toolbox defines a system of events: an accelerator of synergies with the aim of:

¹It refers to distributed economy as a new economic model discussed by various professionals including J. Green, E. Manzini, R. Murray, C. Ryan, A. Johansson, P. Kisch, M. Mirata

generating cohesion; consolidating relationships among different groups and communities; creating social innovation and a new sense of belonging.

The system-events toolbox can be used in different contexts by local public institutions to activate a public space in unusual ways, such as schools, libraries, parks and public gardens, town squares, and streets. The main feature of the toolbox is to be an enabling tool for transforming a public space into an accessible public place and to trigger social innovation processes by starting collaborative actions in order to engage citizens in active participation and starting conversations with the local communities following a design process.

The toolbox project has already been tested in a public space which is related to the historical memory and no longer used: it is the Durando Campus of the Politecnico di Milano which was established at the beginning of the 90s in the suburban area of Bovisa in the north of Milan. These parts of the campus that cover 60,000 square meters were the old Ceretti & Tanfani Company's premises for manufacturing funicular railways, which employed most of the local residents until the 60s. The conversion of the industrial area by Politecnico di Milano broke an emotional attachment to the place for residents who considered the company as part of the neighbourhood.

Since 2010, the Department of Design with POLIMI Desis Lab (www.desis-network.org) began a process of opening the campus to the district of Bovisa through a series of initiatives which can lead people to discover the campus and to build a new dialogue between the two communities that, until now, had had little opportunity for interaction: the internal one comprises students, faculty and staff, and the external one, the inhabitants of the Bovisa neighbourhood. The event "C'è Spazio per Tutti" (There's room for all) in November 2011 and the subsequent one in October 2012, involved more than 50 international students from the M.Sc. in Product Service System Design who developed a set of toolkits presented through PAR (Participatory Action Research) with the aim of enabling local residents to reclaim what is, in all respects, a public space by testing the kits directly with the users on the same day.

Thus using the tool of scenario building, through a series of actions set up for the whole event, it has been possible to design periodic and structured occasions for opening the places on campus. These opportunities allow inhabitants into a continuous appropriation process and at the same give the possibility to generate the dynamics of social innovation.

The toolbox project for the specific case of the Campus Durando is "il Sabato della Bovisa". This explores opportunities, both within the university and in the local Bovisa district, to create a system able to reconnect the two communities using the potential of the campus' urban space as an incubator for social experiments that create new opportunities for dialogue. "Il Sabato della Bovisa" is a monthly social event at the Campus Durando of Politecnico di Milano, which proposes a series of initiatives to understand, observe and enjoy a public university space open to the citizens, thus triggering a process of knowledge exchange between residents and students in a friendly and relaxed atmosphere. Guided tours, book sharing with public readings in collaboration with the local library, sports activities organized by local associations, fashion design and product laboratories that can connect traditional know-how with innovation linked to university research. Opportunities to meet people, share skills, and places to forge new relationships that may have an impact not only in terms of personal connection, but also by creating a place to enhance the development of new micro-economies in the local context.

2. THE PROCESS

The process that led to the creation of the toolbox covered a period of twelve months and is still on-going. Traditional research is combined with an "in-context immersion" at the local level followed by a progressive abstraction to a format that could be applied to different contexts.

The preliminary stage of the research aims to outline the contemporary complex framework derived from historical memory and embedded in everyday life and that is made up of multiple variables with the main feature being its multidisciplinary, across different fields of research and action leading to a hybridization of characteristics with three principal directions of investigation:

- The public place and the neighbourhood as a small scale context. i.e. creative communities acting locally.

- The relationship between university and society and its projections on the urban landscape through the specific case of the toolbox prototyping in the Bovisa district.
- The design experience and its achievement through integration with strategic design and design for services.

The designer's point of view is developed by following the thread of public spaces in the city and their daily use, presenting scenarios for enhancing local resources that create multiple levels of opportunities. The reconstruction of the local community, especially through forms and content which can activate social dynamics that generate values, is preferred to the complexity of the issue covered.

The public place is understood as having two main features: the social aspect and the formal aspect. The social aspect is the true essence of society that affects aesthetics and form of the urban site. As pointed out by Manzini (Manzini, 2010) a contemporary designer must be able to interpret the city as "social laboratories where new ideas and new solutions are being invented and experimented within all fields of daily life", where culture leads to new forms of citizens' participation and a deeply renewed sense of community.

In the toolbox solution the potential of a single episode has been effectively amplified in effectively way by a system of events that aims to form micro-communities that are interconnected to the local context, and thus giving it its value. The toolbox provides all the elements needed for setting up actions in a place with the task of answering the new needs of sociability and conviviality, culture and community necessities. Through designing a 'box of possibilities' 'container of possibilities': it creates new relationships, gives new meaning to spaces, innovative relations are interwoven with the physical area, and builds a new language and new forms of expression that go beyond formal constraints.

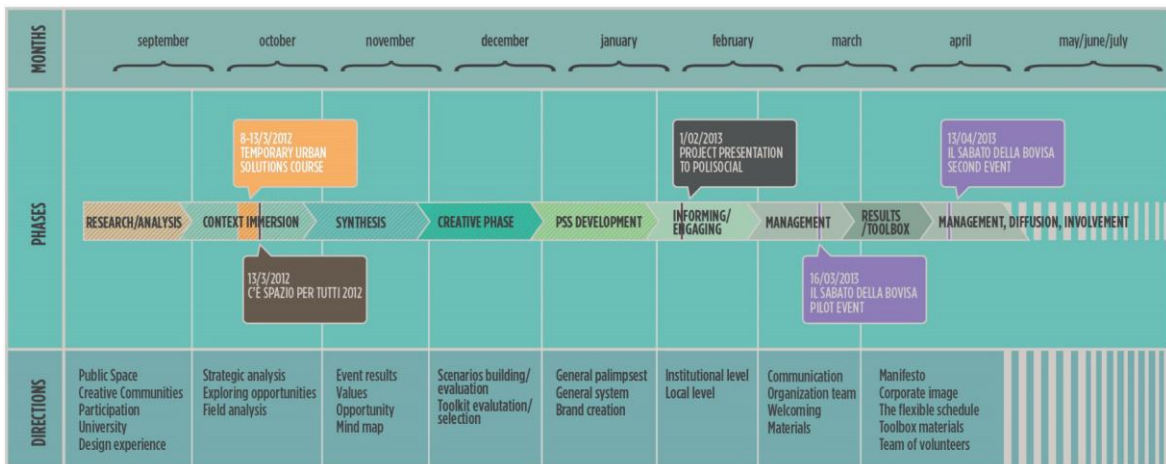


Figure 1. Timeline for the project process, September 2012/July 2013

3. DEFINITION OF THE TOOLBOX

The system-events toolbox has been defined as a useful series of tools for shaping events in the public space. It relies on local resources, dedicated to the inhabitants of a neighbourhood and participating communities, to assess the needs of various target groups, characterized by two levels: the progression of events and a series of actions which promote the emergence of opportunities in a structured way using multifaceted tools and methodologies.

It is a format that enables the immediate proposal of events in a public space and facilitates the understanding of the whole system's structure. Related to each contingent situation, the toolbox is composed of several elements designed to be adapted and further developed following the emerging trends of the events themselves:

- The manifesto with the primary and secondary objectives
- The programme with a flexible activity-box
- The materials for the implementation
- The team of volunteers

The core of the system, the programme that changes over time, will be discussed later, while the materials of the toolbox are organized in traditional forms of communication, such as postcards, posters, press releases and press kits, integrated with online media, such as a Facebook page, and a web invitation linked with mailing lists of participants, associations and local collaborators to the project. To facilitate the management of the system several tools have been created: a 'to do list', a Google map for promotion of the area of interest, and a list of requests for necessary organizational permissions.

The group of volunteers who participate in the dissemination and promotion of the project, as well as in the preparation and management of some activities can be made up of people from the neighbourhood, local associations or institutional staff. The administration of tasks is facilitated through meetings and the use of Google group.

The system-events toolbox provides a general framework and structure that can be applied in several contexts, especially in multicultural circumstances and environments where active participation and local resources work together, but the toolbox needs to be adapted from case to case by providing features relevant to each specific context of interest.

3.1 The Core of the System

The instrument used to define the event schedule is a flexible programme structured to assume various configuration and to be adapted to situations as they arise. Each activity that is involved in setting the schedule is developed as an activity that can be dedicated to a precise target during different events. For instance, a vegetable garden can organize an activity dedicated to children for the first event, while for the second event can be focused on the elderly but both the activities are linked through the same activity-box (the garden) and topic (the culture of food).

When the system was tested at “il Sabato della Bovisa” event, the programme was made up of four main activities that at each point of use proposed different activities dedicated to the different target groups to be involved:

- “Sveglia all’Ovale”: Qi Gong lesson offered by a local association of the Dergano-Bovisa neighbourhood.
- “Ricuciamo Bovisa”: knitting and sewing activities for adults and the seniors of the neighbourhood in collaboration with a B.Sc. student of Fashion Design at the Politecnico di Milano.
- “Coltivando, the convivial garden at Politecnico di Milano”: offers various activities for children and adults related to gardening and food culture.
- “Bo-Legge”: book-sharing in collaboration with the Dergano-Bovisa library, together with the exchange of books at a permanent point inside the campus, it offers lectures and workshops for children and for young adults / adults / older people.

Activities proposed by the internal university community, groups of active citizens and by other local actors can also be combined: there are many requests to join the initiative including a swapping activity, the multi-ethnic choir, yoga and tai chi, activities related to film and music, urban and collective regeneration projects, etc.

Within the large area of the campus the individual activities have appropriate sites with two central nodes: the “Ovale” considered by the internal community as the central square of the campus and the community vegetable garden, the other focal point for community gatherings.

3.2 Informing, Engaging and Managing

The creation of the toolbox is complemented by the need to involve and spread the initiative both at the institutional and local level in the area of interest - a critical step in building a dialogue with the district authorities. A fundamental step is, therefore, to identify possible partnerships between local associations, volunteers, groups of active citizens, and commercial activities that can actively take part in the organization both in the communication and spreading of the project and also in proposing activities for the event.

Schools, associations and local markets, as well as being potentially active partners are also channels for conveying information, promoting and disseminating the events, along with social networks (facebook, twitter, flickr) promotion on radios, newspapers, blogs, etc. In the case of “il Sabato della Bovisa” the project established the collaboration of Politecnico di Milano and its organizational areas with the Department of

Design. The initiative has become part of the Polimi Desis Lab, the Design Lab included in the international Desis Network and supported by Polisocial, the programme of engagement and social responsibility at the Politecnico di Milan. Support has been extended, therefore, to the laboratories and some faculty, e.g. professors of fashion design, who take an active part in the organization.

The municipality of Milan has also offered its patronage to the initiative. At the local level, several informal groups are collaborating with the neighbourhood: associations such as de.de.p., il Vaso di Pandora, territorial services such as the district library, urban renewal projects as ZUP (Zuppa Urban Project), ColtivAzioni Sociali, ASF (Architetti Senza Frontiere), etc.

3.3 Resources and Investment

The non-profit nature of the project led to a voluntary commitment on the part of the organizational team, the group of volunteers who support the project, associations and local authorities, and this constitutes the main resource for the success of the project.

Regarding other resources already invested in the project, they are mainly dedicated to the production of information and communication materials such as posters, flyers and postcards to be distributed throughout the neighbourhood, the cost of which is definitely low budget and covered by university funds. Further investment can be proposed that would introduce activities related to increased integration of different cultures, expand promotional activity by using more communication channels and other activities, without losing the non-profit nature of the project.

Further steps will be taken in the application of the system-events toolbox to a different context by public institutions. For instance to a school or public library in a multi-ethnic district for testing and meanwhile implementing the toolbox and starting the creation of a network of interconnected activities in local communities.

To start the application of the system-events toolbox in a different context we have to start creating a network of actors to be involved in the initiative in the area of interest, beginning with the public institution involved and expanding into the neighbourhood to connect the various actors and authorities within the system.

4. IL SABATO DELLA BOVISA AT THE POLITECNICO DI MILANO

“il Sabato della Bovisa” (Bovisa Social Saturday) is a monthly event launched as the result of this research on five occasions, from March to July 2013. The toolbox was tested directly in context and at the local scale with the first three events: the inauguration on March 16th, the second event on April 13th, and the third event on May 11th 2013 and implemented in the June and July events. This opportunity allowed the team to gather feedback and implement new ideas, by which the analysis cycle is overlaid on the traditional discovery, immersion, study, design, feedback collection with new reflections and rediscoveries, ranging from the generation of knowledge and critical reflection. These coordinated cycles are combined to optimize the understanding of the proposed solution and lead to an incremental improvement during the subsequent events.

The overall judgment on the system-events toolbox prototyping on the Bovisa district is extremely positive² with an incremental increase in attendance. The total number of visitors for the first three days was around 130-150 adults each day, including several target groups from the elderly to children and families.

During the days of the events some feedback was collected on the basic aspects of communication and organization, and on specific activities. A second request for feedback was made through the Facebook page inviting people to give comments, suggestions and proposals. The work is continuing through the identification of an appropriate communication channel that will disseminate and promote the initiative broadly to the different targets involved in the Bovisa and, more widely, in the city of Milan. This trial event started a process that is gradually establishing a dialogue between the organizations that launched “il Sabato della Bovisa” and the local community in a fertile ground for experimentation. It is a process that is able to

²Video of the opening of “il Sabato della Bovisa”: www.youtube.com/watch?v=412d5tFUICM

place the university within the district network, thus emphasizing the renewed interest of participation in a highly accessible initiative.

Several proposals have been proposed by associations and citizens groups as specific activities during the events and they helped the research team to understand which could be considered and developed later. The possibility to create micro-communities around certain activities, such as “Ricuciamo Bovisa”, or “Bo.Legge”, aimed to convince the university administration to let them become an ongoing activity by involving internal knitting and sewing groups, or just by setting up a permanent book exchange facility.



Figure 2. Photos of “il Sabato della Bovisa” activities inside the Durando campus of Politecnico di Milano, 16th March 2013 and 13th April 2013

5. SYSTEM-EVENTS TOOLBOX AS OPPORTUNITY

The objective of a project like the system-events toolbox is to activate urban places through guided actions that lead to social cohesion, integration and social innovation. The dynamics that can be generated through a series of events relies on there being numerous local resources that have a high potential for involvement: not only the reclaiming of a public space by its inhabitants, but deriving new meanings by creating unexpected forms of language and belonging.

This project has been developed through a strategic design process which combines traditional research with an in context immersion and a consequent abstraction for creating a model - the system-events toolbox. The experimental nature enhances opportunities for social innovation, where the system-events toolbox, organized in boxes with different levels of access that act in synergy to create opportunities, is thought to be as open as it possibly can be in order to be able to change during the course of the work. The toolbox is designed to be used mainly by public institutions, which with an appropriate contextualization can follow the guidelines and use this material, moreover, following a real example of opening up a public space. In this sense, the inclusion of the project in the Desis Network facilitates the international spread of the toolbox solution. The design of a system-events composed of activities is the tool that best suits the situation being able to create fixed nodes as well as variables together with the ambitious goal of building micro-communities that share multi-disciplinary and cross-generational interests, knowledge and collective values.

In this particular case, the toolbox applied to the Durando campus of the Politecnico di Milano as “il Sabato della Bovisa” is an opportunity to stimulate the processes of public and cultural renewal: prototyping space for students’ projects, a place for associations and local projects to be seen, an opportunity for university staff to promote and disseminate research projects, the context for active citizens to experience, discuss and propose. The university is not only the context, it becomes a promoter of active participation in finding its integration in the urban district and regaining renewed possession of its fundamental social function, opening up to the surrounding area in an active and practical way. It has to be pointed out how the nature of a space changes with the change of use. The development of the system-events toolbox, as demonstrated by the prototyping in the university campus spaces, is a successful method for rethinking public places, and merging processes of cohesion and sharing in particular for those public spaces that have a surplus of unused space.

The project is therefore moving in the direction of implementation within a different context regarding both destination and dimension, in order to test the performance of the existing toolbox and to make improvements to the toolbox design.

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Short Papers

A DESIGN AND DEVELOPMENT OF DISTANCE LEARNING SUPPORT ENVIRONMENT FOR COLLABORATIVE PROBLEM SOLVING IN GROUP LEARNERS

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ABSTRACT

The competency and curriculum for human resource development in knowledge based society are proposed in each country. We think the keywords are “collaborative problem solving” and “effective use of ICT”. In particular, the competency to perform the collaborative problem solving and learning with others on the network is requested in next generation. We have developed a learning environment in which multiple learning supporters support the learning process asynchronously from the remote site and have been performing educational practice. The advantage of distance learning support is that they are able to get more time to consider the goal and method of learning support and the role of each learning support. However, it was hard to grasp the state of group learner's learning activity and knowledge understanding, when there were few utterances to the learning activity of the learner on the learning environment. Therefore, the purpose of this study is to propose a Goal Setting-based Collaborative Problem Solving Learning Model (GoLaPS model), in which group learner performs the learning process of task-analysis and task-solving based on goal setting, and develop a tool to support the group learner in the model. In this paper, we explain the structure and the learning process of GoLaPS model and the function of the developed tool based on the model.

KEYWORDS

Goal Setting-based Collaborative Problem Solving Learning, Task Analysis and Solving, Learning Supporter (Distance Teaching Assistant), Collaborative Learning Support Strategy and Method, e-Pedagogy

1. INTRODUCTION

The competency and curriculum for human resource development in knowledge based society are proposed in each country. We think the keywords are “collaborative problem solving” and “effective use of ICT”. In particular, the competency to perform the collaborative problem solving and learning with others on the network is requested in next generation. The research of e-Pedagogy which explore the learning and education model of next generation in knowledge-based society have been developed. We have developed a learning environment in which multiple learning supporters support the learning process asynchronously from the remote site and have been performing educational practice. The advantage of distance learning support is that they are able to get more time to consider the goal and method of learning support and the role of each learning support. However, it was hard to grasp the state of group learner's learning activity and knowledge understanding, when there were few utterances to the learning activity of the learner on the learning environment.

Considering the background of our study, the purpose of this study is to propose a Goal Setting-based Collaborative Problem Solving Learning Model (GoLaPS model), in which group learner performs the learning process of task-analysis and task-solving based on goal setting, and develop a tool to support the group learner in the model. In this paper, we explain the structure and the learning process of GoLaPS model and the function of the developed tool based on the model.

2. GOAL SETTING-BASED COLLABORATIVE PROBLEM SOLVING IN GROUP LEARNING

Many Learning models to raise the ability for problem solving many solutions have already been designed and carried out in the world. In the problem solving, it is effective to get a solution while combining goal-driven backward reasoning with data-driven forward reasoning. In particular, it leads to an effective solution to the problem to make a task clear while learners perform a goal-task analysis and to share a role or solve collaboratively for the task in the case of the collaborative problem solving with group. Moreover, it's not easy to grasp the learning state and understanding state of learner or group when they asynchronously support the learning from a remote site. Therefore, the learning goal and the task of group and each learner, the item and state of the work and the role of learner are an important resource to support the learning process from a remote site on the Internet. In this study, we propose the GoLaPS model (Learning model to perform Goal Setting-based Collaborative Problem Solving, see Figure 1) as a learning model to make it easy to grasp the situation of the learning activity of the group learner who perform a problem solving in a face-to-face meeting or on the Internet collaboratively.

The GoLaPS model defines the problem solving structure and provides the activity process including task analysis and solving for each factor of the structure. The activity of the group learners is constructed from two phases (*Task-Analysis phase* and *Task-Solving phase*). In Task-Analysis phase, they extract some task items to achieve the learning goal given by the teacher and decide a task solution procedure by arranging the tasks in a turn to be settled. Moreover, they extract some work items to solve each task and decide a work procedure by arranging the works in a turn to be carried out. In Task-Solving phase, they advance the activity towards achievement of the learning goal by performing himself/herself or collaboratively each work in the work procedure of each subject item acquired in the Task-Analysis phase.

The characteristic of the GoLaPS model is that group learner progress with task or work solving effectively by sharing the task, the work and the task solving plan or the work procedure. We think that the problem solving ability of the learner improves by visualizing their information. On the other hand, we think it becomes easier for learning supporter to grasp the situation of the learning activity of the group learner by this model.

We need to prepare the following function to carry out the learning process based on GoLaPS model;

- + The function to explicitly display the task and work items provided in the Task-Analysis phase
- + The function to visualize the solving process for each task and work
- + The function to grasp the situation of the group learning activity
- + The function to activate the communication among learners and between learner and learning supporter

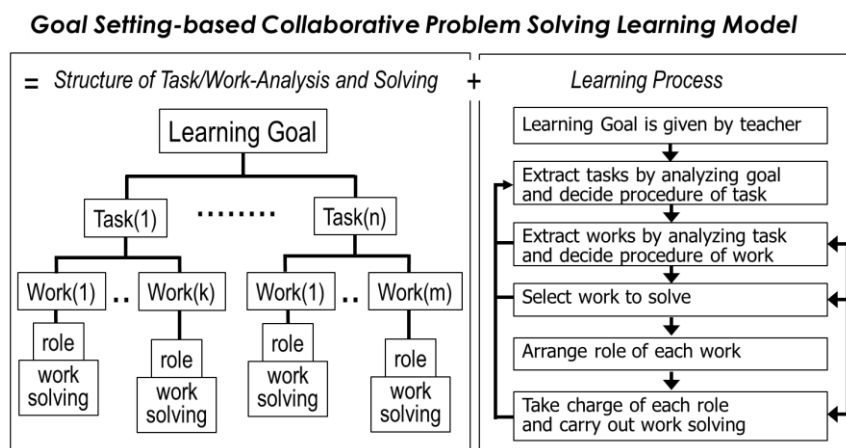


Figure 1. Structure and Learning Process of GoLaPS Learning Model

3. DEVELOPED SYSTEM BASED ON GOLAPS MODEL

We have designed and developed a system (GoLaPS system) which can carry out the task and work solving typed learning based on the GoLaPS model (See Figure 2). The system needs to prepare the individual workplace for each learner, the workplace where a group works and the workplace where learning supporters supports group and individual learning. Furthermore, the workplace of group activity requires the workplace where the group learner makes the learning plan (Task/Work-Analysis) to a learning goal, and the workplace where the group learner solves the extracted tasks and works. The design policy of this system is as follows;

[Design policy of system]

- We constitute a GoLaPS system so that each workplace may be classified as one Web page.
- Each learner who belongs to a group tackles activity on the Web page (“Group Page”) prepared for every group.
- We consider the constitution of the GoLaPS system in which the member of group can go back and forth from the Group Page (“hub page”) on which they has some activities to “spoke page” by adopting a "hub & spoke" method.
- In order to make group activity smooth, we change a communication function into the "talk form" which is easy to build the relation interaction from the "bulletin board form".
- We introduce the function to make the load which a learner and a learning supporter check various logs reduce, in order that they can join the problem solving of the group smoothly, even when they take part in it asynchronously.
- We constitute a GoLaPS system the learning supporter supports a group and each learner through “question / proposal thread (Question/Proposal Page)”.
- Since the learner is used to getting to know the information of a person from the individual page prepared in SNS, we offer a “Personal Page” in the same form.

Figure 2 shows the relation of all the pages in the GoLaPS system. A learner logs in to Personal Page first. She/he can describe private information such as self-introduction in Personal Page. Although the thread form was adopted as the description of self-introduction in the old system, it was not easy for learner to check the log with progress of time. So, Personal Page is offered in the same form as SNS in this system. Furthermore, Personal Page is provided with the WALL function for supporting a student individual. Then, the learner moves to Group Page which is Hub Page of this system. There are four phases in group activity. The learner uses "Task/work-analysis sharing tool" in the Task/Work-Analysis Sharing Phase. Furthermore, the learner uses "LINE typed communication tool based on utterance intention" in order to opt for the extraction and procedure of the task and the work in the Task/Work-Analysis Phase. The learner's question and the proposal and comment of the learning supporter use Question-Proposal Page in the Learning Support Phase. After identifying the item of task/work and determining the their order, the learner uses a Work-Solving Page in order to carry out each work in the Work-Solving Phase. The learner can ask learning supporter a question also in this phase, and the learning supporter supports work solving of the learner or group.

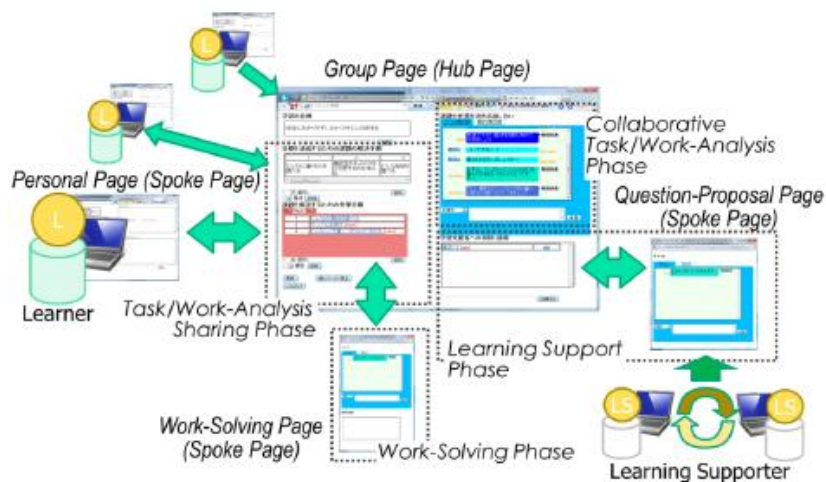


Figure 2. Relation of all the pages (including relation between Hub Page and Spoke Page) in GoLaPS system

We explain about the function of main tools or page in the following subsection.

3.1 Task/Work-Analysis Sharing Tool

It's important for each learner to recognize that what kind of procedure the group considers in order to attain the goal, what kind of task/work the group tries to solve, how the work solving of the group is and what the role of group member is in the collaborative task solving. The Task/Work-Analysis Sharing Tool has two functions which visualize the task/work analysis result and work solving process of a group based on these four important things. By utilizing this procedure analysis tool, a learner can experience the process of analyzing the task/work structurally. As a result, we expect the problem solving capability can be improved. Furthermore, we try to become for learning supporter easier to grasp the situation of learning activities by making the result of the task/work analysis of a group visualize.

Figure 3 shows the screen image of the Group Page. Procedure analysis is divided into three layers in the task/work-analysis sharing phase of the Group Page. The upper "learning goal" is the achievement standard which a group should realize through learning and problem solving; for example, "make a manual to master the smart phone new learners". The learner is able to revise the learning goal. The part of middle layer is that the group learner describes the solving procedure of the task for attaining the goal; as an example, "an item required for a manual is investigated", "the tool which new student uses is investigated". When a learner specifies the number of the work, the learner can add or delete it. The learner describes the work procedure for solving the task in the lower layer. Addition of a work solving procedure will also add the tab of the number of work procedure. The learner can add or delete the work. The workplace of work solving is linked as a Work-Solving Page to the title of each work. The learner can advance to the Work-Solving Page by pushing the work button. The Work-Solving Page has the chat function and the summarized function for solving a work, and the function of the question / proposal to a learning supporter.

3.2 LINE Typed Communication Tool Based On Utterance Intention

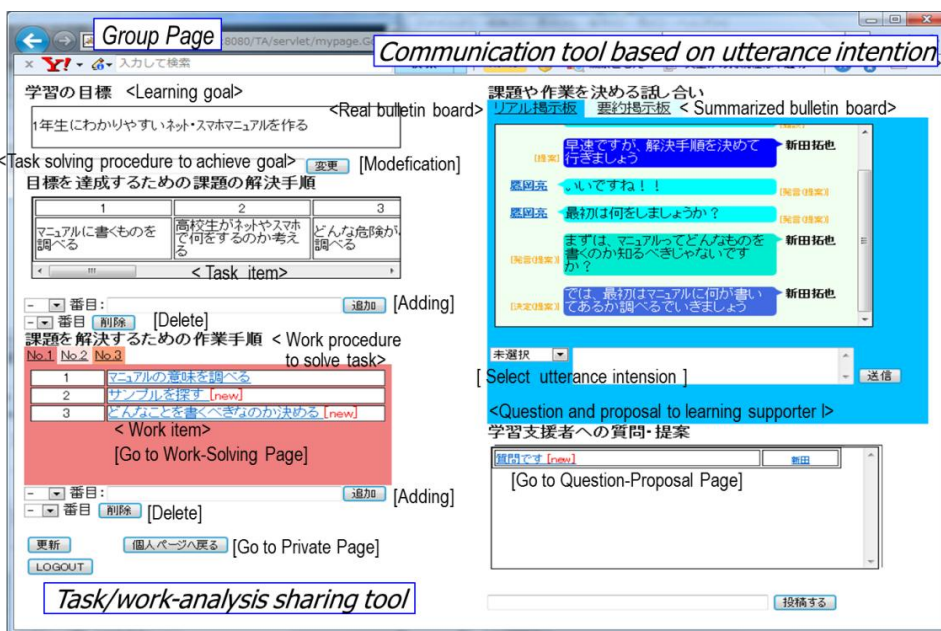


Figure 3. Interface Image of Group Page in GoLaPS system

The communication tool implemented in this system aims to display a user's utterance in the same talk form as LINE, and to impress conversation or discussion like actual utterance by displaying learner's name and blow-off. The real bulletin board and the summary bulletin board as a communication tool are prepared in Group Page, Question-Proposal Page and Work-Solving Page. In the real bulletin board, the learner's

utterance is displayed on a time series as a log. In the summary bulletin board, the learner's utterance is summarized and displayed on the time series.

When the learner speak in the real bulletin board, it is necessary to choose an utterance intention. We expect the effect of clear and logical argument, if the learner indicates an utterance intention clearly. Furthermore, we think this system can support group discussion or argument from the series of an utterance intention in the future. Now, we have eight utterance intentions.

- Proposal: this intention is selected when a learner has a proposal for the group.
- Reply (proposal): this intention is selected when a learner replies to a proposal.
- Conclusion (proposal): this intention is selected when a learner speaks a judgment and a conclusion to a proposal.
- Question: this intention is selected when a learner asks other member of group.
- Reply (question): this intention is selected when a learner answers a question.
- Solution (question): this intention is selected when a question has been solved.
- Summary: this intention is selected when a learner summarizes the old logs about commented content simply.
- Chitchat: this intention is selected when a learner has a chit-chat.

The summary bulletin board has a function which displays two or more utterances collectively in order to make the load of a log check reduce. The learner can make a list of the object to summarize by clicking one or more buttons prepared in the learner's utterance. Furthermore, the learner can attach a label to a series of utterances for a topic. The summarized contents are displayed under the label by clicking them. This summarized log can be used also for reflection. By this function, even when a learner participates asynchronously, we expect the learner advances various activities smoothly.

4. CONCLUSION

In this paper, we explained the structure and the learning process of GoLaPS model and the function of the developed tool. In the future, we will do sequentially the learning experiment and improve this model. Moreover, it is necessary to design and develop a collaborative learning support tool.

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ACADEMIC USE OF SOCIAL MEDIA TECHNOLOGIES AS AN INTEGRAL ELEMENT OF INFORMATICS PROGRAM DELIVERY IN MALAYSIA

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ABSTRACT

Higher education institutions are currently examining how the current emerging technologies and social media applications can be integrated with the appropriate teaching pedagogies adopted by higher education institutions to provide students with learning experiences that take advantage of these new affordances. Due to the continuous and pervasive exposure to emerging technologies, it is being claimed that students in this generation tend to behave and learn differently from the previous generations. The technologies used to support their learning must be able to help them to find the right content for their learning, connect them with the right people, and to motivate or incentivize them to learn (Vassileva, 2008). The study reported here sought to investigate the digital status of Informatics academics who teach in undergraduate programs in Malaysia, their engagement with Social Media Technologies (SMTs) for teaching and learning activities in class, and the challenges that they face in integrating SMTs into their classes. Informatics programs are technological-oriented in nature; hence students and academics themselves would arguably be quite adept at using SMTs. The study has indicated that the use of these technologies by Malaysian academics is very much focused on individual academic initiatives, with communication as the key use of the technologies and this use is very limited.

KEYWORDS

Social Media Technologies (SMTs), Social Media, Academics, Informatics Programs, Higher Education Institutions

1. INTRODUCTION

Higher Education in the 21st Century is heavily driven by digital technology as it plays the role as a catalyst for pedagogical change and engagement (Lim, Agostinho, Harper and Chicharo, 2013). A significant amount of literature is now appearing arguing that technology is changing learners with terms like 'digital natives' (Prensky 2001) gaining prominence, and authors such as Coates (2007) arguing that these 'millennial learners' learn in different ways to their predecessors. Most young people in modern societies, both Western and Eastern, make routine use of the Internet and email, text messaging and social software, we are seeing evidence that their familiarity with these forms of communication are being carried over into their learning. Personal web pages, blogs, podcasts, instant messaging, chat spaces, twitter and wikis are changing the creation of information. Social software, facilitated by Web 2.0 is allowing participation in online communities that define and share the information they need for themselves. Personal mobile and wireless devices are increasingly integrated with the global computer network to provide seamless, location-independent access to information services

This paper reports specifically on an investigation of the acceptance, exposure and engagement of social media technologies by academics teaching in Malaysia Undergraduate Informatics Programs. In essence the paper is one in a sequence of reports on a larger study. Aspects of this work on students' engagement with Social Media Technologies (SMTs) such as Twitter, Facebook, Ning, etc. for teaching and learning in Informatics undergraduate programs in Malaysia have previously been reported in (Lim 2013; Lim, Agostinho, Harper and Chicharo 2013; Lim, Agostinho, Harper and Chicharo 2014).

SMTs have great potential to create the learner-centered environments which fit the learning approaches of the digital natives in this 21st Century. Since students in this digital era have the advantage of having access to digital devices and digital content, the question then is how can they make full use of these advantages to support and enhance their learning experience.

Cullen, Hadjivassiliou, Hamilton, Kelleher, Sommerlad, and Stem (2002) cited by Harper, Lockyer, Bennett, Agostinho, and Jones (2011) argued, "Governments worldwide have started to implement policies within which learning has been explicitly identified as the main catalyst for economic competitiveness and growth" (p.12). They added that many countries have also moved towards supporting academics in incorporating digital technologies as part of the teaching and learning tools. The Malaysian government sees education as a major plank in the development of the country and has aspirations to become an education hub in South East Asia. This will require its education system to move toward modern pedagogies including the effective use of technology to support and supplement learning settings.

One of the current challenges facing higher education institutions is how social media can be used effectively to integrate the current teaching and learning pedagogies to give students a more effective learning experience. The subsequent challenge would be how to encourage and support academics to explore, consider and design their courses that make use of SMTs as a tool to enhance the teaching and learning activities in class. Most research reported to date has focused on the quantitative data collected from universities in United States and Australia (Deborah Lupton 2014, Babson Survey Research Group and Pearson 2013, JISC 2009) in which the use of SMTs in teaching and learning are more mature. In Malaysia, especially in the field of Informatics, very little research has been reported on educator's perception and usage of SMTs to support teaching and learning activities. Shittu, Madarsha and Tunku Ahmad (2011), have called for more research to examine how SMTs are perceived and accepted by both students and educators in Malaysia.

Walking into a classroom today, academics could see more than half of their students focusing on their use of smart-phones, tables, laptops and other digital devices. Asking students to put aside their gadgets and concentrate on direct instruction in the class is a real challenge to most educators. Many educators are now willing to embark on the use of social media software for their courses in order to enhance students' learning experiences. Minocha, Schroeder and Schneider (2011) have reported that educators play a vital role in determining the success of social media implementation in higher education institutions. In the Malaysian context, currently social media initiatives are educators' own initiatives instead of institution wide initiatives. However, as the education market becomes more competitive and higher education institutions become more aggressive in standing out among the others in adoption of innovative teaching and learning pedagogy, the question now is shall SMTs initiatives be made compulsory by institutions or shall it be left at the discretion of the educator's initiative and creativity?

2. RESEARCH STUDY METHODOLOGY AND CURRENT STATUS

This study sought to develop an understanding of the adoption and use of social media by academics to engage students in Informatics programs in Malaysian higher education contexts. This study employed a mixed-method research methodology with a significant survey research component. A Mixed-method research methodology was considered to be most appropriate for this study as it allowed the authors to gather multiple forms of data from diverse audiences such as educators, administrators and students. The area of study is relatively new and both empirical and descriptive data will be needed to address the research questions because of the lack of underlying understanding of the use of SMTs in higher education.

The study focused on collecting and analyzing qualitative and quantitative data to better understand this type of methodology will help to answer questions that cannot be answered by qualitative or quantitative methods alone (Creswell, 2003). For this study, a Mixed Method Sequential Transformative Research Strategy based on a QUAN → Qual model was used in the data collection process. This strategy has two distinct data collection phases in which the main priority or emphasis was given to the quantitative phase, while the results from the qualitative data collection will be used to further inform the secondary data collection (Creswell, 2003). The Transformative Research Strategy has a theoretical lens overlaying the sequential procedures to guide the study (Lim et. al., 2013). In this QUAN → Qual model, quantitative data collection of data involved anonymous online questionnaires which were collected from students, educators and administrators from both Informatics and non-informatics programs in Malaysia to investigate their exposure and use of social media technologies for engagement, teaching and learning.

Subsequently, the data collection process continued through collection of qualitative data in which the same voluntary Informatics educators, students and administrator of the institutions were interviewed to better understand their needs, usage and experiences in using social media technologies for their classes. Observations on the use of SMTs were also conducted based on the classes identified by the voluntary Informatics educators to better understand how social media technologies were being used for teaching and learning.

3. ANALYSIS OF THE RESULTS

In total, there were 38 Informatics educators and 33 Non-Informatics educators who responded to the online questionnaire. From the analysis, there was a slight difference in terms of the ownership and use of SMTs by educators from Informatics and non-Informatics background. Informatics respondent's ownership of smartphone and digital tablets was slightly higher (about 20%) compared to Non-Informatics respondents. In addition, the time spent to go on-line with the digital devices by the Informatics group was also 50% higher compared to the non-Informatics group. One explanation might be the age gap between the two groups of respondents (the majority of Informatics respondents belong to the age group of 31-40, while for non-Informatics respondents, the majority were from the age group of 41-50), in which the younger educators might be more receptive towards the exploring new technologies. In addition, it might be due to the disciplines involved by the Informatics group in which there are lots of involvement and exposures to technologies due to the nature of the evolving trend. Thus, the likelihood of Informatics educators spending longer hours (about 50% more) compared to the non-Informatics educators is justifiable since the preparation for teaching itself involves technologies and the Internet. Despite the differences in terms of the ownership and exposures, the percentage of respondents using SMTs for academic purpose and the categories of SMTs used are closely matched. The only difference was the ranking of the most preferred SMTs used and how SMTs were being used for teaching and learning activities with their students. 81.8% of the Informatics educators said they used SMTs for assignment or project collaboration and sharing of documents, while the non-Informatics educators said they were using it for knowledge or information sharing (90%). The most preferred SMTs used by Informatics educators for teaching and learning activities were Facebook, Dropbox, YouTube, Whats App, and Skype, while non-Informatics educators preferred YouTube, Facebook, Wikis, Blogs, and Dropbox. 21% of the respondents claimed that they have not been using SMTs for academic purpose in class. More than 50% of these respondents attributed this non-use to the concern about privacy issues as many academics would prefer to separate work from their personal context and 25% claimed that they were not interested in the use of SMTs, and they perceived SMTs as an informal interaction tool, thus not suitable for academic purposes.

In the qualitative data collection, 10 out of the 38 Informatics academics who responded to the online survey earlier participated in the semi-structured interview sessions. They were asked to describe the differences between students in pre-social media era with students who are highly exposed to social media now. All of them believed that Informatics students in this social media era tend to learn in a faster speed compared to students in the pre-social media era, arguing they could easily gain access to large amounts of resources online. They do not have to wait too long to get the answers to their problems as they could get it within a very short period of time after they posted their problem to the social networking websites. In addition, there are many free Massive Open Online Courses (MOOCS) which are made available via Coursera, edX, iversity, etc. that could help them to gain additional knowledge outside the classroom. This also leads to the fact that students in the social media era tend to rely more on Internet resources instead of reading from their textbooks. In the classroom, students appeared to expect more interesting learning environment from their instructors as their attention span is shorter and they easily get distracted by the social media.

All respondents were quite new to the use of social media for academic purpose. They mainly use social media as a communication tools to connect to their students and to provide additional consultation online. So far, none of them used social media for classroom activities that involve assessment. They prefer to use the official learning management system provided by their institution as a formal tool for teaching and learning activities and deemed social media to be too informal for that purpose.

When asked about their views on why social media is not popularly used by academics in Malaysia higher education institutions especially in the Informatics discipline, the reasons given were the use of social media in classes increase their workload as they have to re-design their activities to fit the use of social media, extension of their consultation hours beyond normal working time, unfamiliarity with the social media tools and how to incorporate it to teaching and learning activities, perception on social media tool as informal tool and the distraction that it will cause to students, and the issue of privacy and security when social media is used for academic purpose.

4. KEY FINDINGS AND CONCLUSION

Higher education in the 21st-Century is in the process of change. Students in this generation are heavily exposed to digital technologies and the Internet. The extensive use of the Internet and social media has the potential to offer new types of educational settings. The use of social media in higher education is essential as the use of these tools and technologies have been part and parcel of student's lifestyles. Higher education institutions should take this opportunity to harness these technologies that are already integrated into students' daily lives to design an innovative and creative education environment that will enhance and improve their learning experiences. However, this initiative should be taken one step at a time and should not be rushed into. It has to be properly planned as this initiative might have great impact on the educators. Educators play a very important role in ensuring the efficient and sustainable usage of the Social Media Technologies.

The study has reflected that many of the educators in Malaysia especially in the field of Informatics have not effectively used SMTs for teaching and learning activities in class. So far, they have been using SMTs just as a communication tool to connect to their students. From the study, the top three SMTs used by the Informatics academics are Facebook, Dropbox and YouTube. Surprisingly, Twitter, which is popularly used by many educators in other countries as an instructional tool (Yakin and Tinmaz, 2013; Lewis and Rush, 2013; Birnholtz, Hancock, and Retelny, 2013; Szapkiw and Szapkiw, 2011) was not used by educators in Malaysia. Many educators perceived SMTs as an informal tool and thus, not too appropriate for academic activities. In addition, the unfamiliarity with the tools might also contribute to the lack of confidence to integrate SMTs to the teaching and learning activities.

Embarking on SMTs for teaching and learning in class is a big decision to be made by educators as it involves many issues that need to be considered and resolved. Some of the issues include the increase in their workload in designing or integrating SMTs to the curriculum; familiarity with the various SMTs, its functionalities and applicability to the courses taught; possible extension of their consultation hour to beyond office hour; lack of control over SMTs in the public domain; technological related issues such availability of Wi-Fi and strong network bandwidth in the institution; student's active participation and engagement in the collaborative activities; and student's willingness to share resources in the virtual communities. It is therefore critical for higher education institutions to bear in mind that the initiative to integrate social media into teaching and learning should not be forced on educators but should be considered as an institution-wide initiative as it doesn't only involve the vast number of social media applications available that could be easily tapped, but also needs to accommodate the changing role of educators' in a broader context and the issues that surrounded them. In the end, educators will still be the driving force for determining the success of implementation.

This paper reports on academic use of SMTs in the teaching of Informatics programs in Malaysian higher education, one aspect of a broader study. The outcomes of this component of the study will inform the next phase of the study in the development a design framework for implementing social media as supporting tools for student engagement and teaching and learning in higher education institutions in Malaysia.

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DIGITAL STORYTELLING ACROSS CULTURES: CONNECTING CHINESE & AUSTRALIAN SCHOOLS

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ABSTRACT

This paper reflects on a 2013-2014 Australia-China Council project in which school students in Australia and China produced and shared digital stories about their everyday lives and local cultures, with students being invited to give feedback on the language and content of the stories produced by their overseas peers. The main lessons learned during the project involved the need to seek common ground between the expectations of the Chinese and Australian partners. These pertained to five main categories: motivation, educational culture, organisation, technology, and pedagogy. Despite the challenges, students engaged in some valuable language and cultural learning, teachers developed some insights into the learning possibilities at the intersection of pedagogy and technology, and the researchers are beginning to develop a list of key recommendations to consider when setting up such cross-cultural, technology-supported projects.

KEYWORDS

Digital storytelling, Language Learning, Culture, Cross-Cultural, Intercultural, Technology

1. INTRODUCTION

In an increasingly interconnected world, there is an ever greater need to build bridges across cultures to enable students to develop intercultural competence (or intercultural literacy), ideally accompanied by competence in key languages (Byram 1997; Dudeney et al. 2013). These competences can support the broad set of 21st century skills – often connected with ICTs – demanded in the global workplace, such as creativity, collaboration, problem-solving, and digital and multimedia literacies (Dudeney et al. 2013; Mishra & Kereluik 2011). Many of these points are recognised in both Australian and Chinese education. The Australian Curriculum, introduced in 2011, aims to produce a ‘successful learner, confident and creative individual, and active and informed citizen’, in part via seven general capabilities including ‘intercultural understanding’ and the ‘ICT capability’ (ACARA n.d.). ICT competency is also required of teachers in the *Australian Professional Standards for Teachers*, likewise introduced in 2011 (AITSL n.d.). Meanwhile, the 2012 *Australia in the Asian Century* white paper stresses Australia’s ‘need to broaden and deepen our understanding of Asian cultures and languages, to become more Asia literate’ (Commonwealth of Australia 2012, p.2), with Chinese (Mandarin) named as the first priority foreign language. China has long recognised the need to incorporate ICTs in education, with the 2000 *Popularising ICT Education in Primary and Secondary Schools* paper requesting all schools to offer a course on ICTs (Li 2003), and the *Ten Year Plan for the Development of Education Informatization (2011-2020)* (MOE 2011) focusing on improving technology-enhanced education. Meanwhile, the *Education Technology Capacity Building Plan for All Primary and Secondary Teachers* (MOE 2005), *A Promotion Project for Education Technology Capacity Building for All Primary and Secondary Teachers* (MOE 2013) and *The ICT Application Competency Standard for Primary and Secondary School Teachers (Trial)* (MOE 2014) target teachers’ ICT competency, with the last of these documents setting higher level goals for teachers in using ICTs to support student

autonomy, collaboration and inquiry-based learning. China has also recognised the need to foster English learning since at least the 1980s (Hu 2002), with a renewed emphasis in the new millennium ensuring children now learn it from kindergarten (Ward & Francis 2010).

This project, entitled *Multimodal Stories for Language and Cultural Exchange* and funded by the Australia-China Council from 2013-2014, involved the design and implementation of a mechanism for the exchange of multimodal (i.e., multimedia) digital stories created by middle school students in Australia and China. It sought to build co-operation and understanding between Chinese and Australian students, teachers and institutions; to support students in learning each other’s language; and to support them in learning about each other’s culture. The digital format of the stories offered the practical benefit of allowing their exchange online, and the pedagogical benefit of letting students express themselves in rich, multimodal ways while honing their digital literacies. The collaborative, creative story writing task supported the development of their 21st century skills.

2. IMPLEMENTATION

The project was overseen by the first and second authors, who recruited and liaised with the three participating schools in Western Australia, one each in Bunbury, Geraldton and Perth. The Chinese participation was facilitated by the fourth author, who worked with the participating school in Guilin, and the fifth author, who liaised with the three participating schools in Shanghai. Figure 1 shows the interrelationship of the components of the project: PD (professional development) seminars, story rounds, story collection, and data collection. Delays have led to an elongation of the planned time structure, but all these elements remain in place.



Figure 1. Time-based interrelationship between project components

PD seminars were held by the first and second authors in Perth in November 2013, and in China in April 2014, to give participants an overview of the project, discuss timelines, and showcase web 2.0 and app-based digital storytelling tools. For the duration of the project, interaction between participating teachers and students primarily took place on a password-protected wiki, *ACC-Digital*, set up with the Wikispaces service. Students in Western Australia were around 13-14 years old, while those in China were slightly older at 14-15 years.

The original plan comprised three rounds of digital storytelling. Each school was to be paired with a different partner school in the other country in each round (with two of the three Shanghai schools working together as one school). Students were invited to work in small groups to describe their daily lives, their schools, or their cities or towns, as a way of introducing themselves to students in the other country. To minimize technological difficulties, it was suggested that the Round 1 stories should be created as 1-2 minute PowerPoint presentations, ideally with audio voiceovers, and exported as videos. Most schools followed this procedure, though one Australian school opted to use an iPad app, Creative Book Builder, instead. Students took photos and videos, and added written and/or audio text. Students in Western Australia wrote and recorded in Mandarin; students in Guilin and Shanghai worked in English. Round 1 began in December 2013, but posting of the stories was delayed until February/March 2014 due to holidays in both Australia and China.

Once the Round 1 stories were available, students from the partner school were invited to make comments via a discussion board feature on the wiki. Though responses were sometimes considerably delayed, all of the videos posted did receive at least some feedback, which highlighted points of interest as well as including suggestions for improving language use, e.g., '*We really loved the number of pictures you've used and the music, which was highly moving. We could feel the enthusiasm in your video! There are some improvements you could make with the grammar. Sometimes you didn't put the 's' at the end of verbs in the third person, and some words weren't used correctly. Try to proofread carefully Overall we really enjoyed your presentation*'.

The structure planned for Rounds 2 and 3 was the same as for Round 1, with changing content and technology, and new pairings of partner schools. Students were to choose a traditional fairy tale or story from their own culture and translate it into the language they were learning, giving it a contemporary twist, i.e., it had to be set in modern times and reflect students' everyday life contexts. This made it more relevant to students and avoided possible issues with plagiarism. Any digital storytelling website or app could be used; those recommended in the PD seminars included Capzles, Glogster and VoiceThread (available in web and app versions) and Book Creator, Explain Everything and StoryMaker (apps), with further options suggested on a *Digital Storytelling* webpage (e-language.wikispaces.com/digital-storytelling). The Round 2 stories are due to be shared, somewhat belatedly, in late 2014. Meanwhile, teachers in at least one Chinese and one Australian school have started discussing with each other the possibility of a direct, ongoing collaborative relationship.

3. LESSONS LEARNED

Although the project is not yet completed at the time of writing, interim data have been collected through feedback obtained from participating facilitators, school principals and teachers at PD seminars in Australia and China, observations of and interactions with classes involved in digital storytelling in China, and analysis of students' completed stories. More systematic data collection, which will commence in late 2014, will include interviews with teachers and further observations of students.

The lessons learned to date have involved the need to find common ground between the expectations of the Chinese and Australian participants. Firstly, the *motivation* for taking part differed. The slight age gap between the Australian and Chinese students was compounded by the fact that most Chinese had been learning English since kindergarten, and by middle school were spending 7.5 hours a week on English lessons, while most Australians had been learning Mandarin for only 1-2 years and their lessons were limited to around 2 hours a week. As a result, the Chinese students' English was far more fluent than the Australian students' Mandarin. In general, Australian teachers and students were more motivated to focus on language improvement, while Chinese teachers were more concerned with opening up students' perspectives on other cultures, and students were focused on learning about daily life in Australia. Although our digital storytelling project differs in some ways from telecollaboration projects which promote intercultural learning through online conversation, it is striking that mismatches in student language proficiency, and differing motivations, are flagged up as problematic in studies of failed communication in such projects (e.g., Belz 2001; O'Dowd & Ritter 2006).

Secondly, differences in *educational culture* led to quite distinct structures of participation, with the decision to participate in the project being taken by Chinese principals on behalf of their schools, while Australian principals devolved the decision about whether to participate to individual teachers. Participation was thus better integrated as a whole-school endeavour in China as opposed to the more individualistic approach typical of Australia. While it is important to be wary of essentialism or oversimplification in cultural comparisons (Bowe et al. 2014), it is interesting to note some congruence between our experiences and past anthropological and sociological research which contrasts Confucian heritage cultures and Anglo-Saxon or Western cultures: countries in the former group, like China, are generally perceived as more hierarchical and collectivist, and those in the latter group, like Australia, as more egalitarian and individualistic (e.g., Hofstede & Bond 1988; *The Hofstede Centre* n.d.). But any underlying cultural differences are certainly compounded by practical considerations. In Australia, this project competed with many other enrichment activities and opportunities. Chinese principals and teachers were more proactive in seeking one-to-one relationships with Australian schools, and Chinese students were keen to engage in digital

'pen pal' relationships with Australian students, while Australian teachers and students struggled to find time for such engagement.

Thirdly, practical *organisation* proved problematic, echoing findings about factors such as calendar misalignment and differing contact hours in the telecollaboration literature (e.g., O'Dowd & Ritter 2006). In our project, differences in timetabling ranged from semester and holiday dates to the frequency and duration of language lessons, with Chinese teachers and students having far more class time to spend on the stories. Australian schools also followed a more prescriptive curriculum while Chinese schools were freer to shape their own content. The fact that there were far larger numbers of English learners in China than Mandarin learners in Australia dramatically increased the time commitment for Australian students in responding to the relatively large number of videos produced by their overseas peers. Moreover, language barriers between project co-ordinators and staff members sometimes made it difficult to broach and discuss these kinds of issues.

Fourthly, practical issues related to *technology* were perhaps most vexing of all. The amount of technology available, and whether it was school-owned or student-owned, varied both within and between countries, as did the kinds of hardware, which ranged from Apple through Samsung to more generic Android devices. This made it difficult to use the same apps and to find common output formats; hence the suggestion that all completed stories in Round 1 should be exported in video format. However, sharing the videos proved to be cumbersome. It is possible to either upload videos to a wiki, or embed them. However, the former does not allow the videos to be displayed within the wiki and was found to be a slow process in China. The latter, though preferable, requires the videos to be hosted first on a video sharing platform, from which an embed code can be obtained. It was difficult to find a platform that was accessible and acceptable in both Australia and China: Videobam, used in Australia in order to avoid students accessing inappropriate materials on YouTube, is not accessible in China; while YouTube's Chinese equivalent, Youku (优酷), though accessible in Australia, contains materials considered inappropriate by Australian schools. Following experimentation with filesharing services Dropbox, Pan Baidu (百度云) and SmartFile, it has been decided to explore a paid account with Youku, which should not contain unsuitable content, in Round 2. Views of the digital storytelling technology also varied, with Australian teachers and students perceiving it as challenging and Chinese students, by contrast, reporting that it was easy to use. This difference, however, turned out to have pedagogical underpinnings.

The fifth and final category consists of differences in *pedagogy*, or more precisely, pedagogical approaches. As regards language, the Australian students, while at a much lower level, were expected to engage in original composition in Chinese, while many Chinese students were observed composing texts first in Chinese and then translating them into English. As regards technology, Australian schools provided some encouragement to explore and learn about new tools, while Chinese schools tended to allow the repetitive use of PowerPoint (which may explain the contrasting views about whether the technology was challenging or easy to use). As regards digital content, Australian teachers insisted on the use of original student-generated material, while in China students were allowed to borrow web materials with little understanding of the copyright issues involved (though teachers were keen to learn about this in PD seminars). Again, the dangers of essentialism and oversimplification notwithstanding, it is interesting to note some congruence with past research into differences between Chinese/Confucian and Western education, with the former seen as emphasising more linear, systematic, accuracy-focused approaches and the latter more creative, critical, problem-solving approaches (e.g., Gu 2014; Yang et al. 2006). But once again, culture cannot explain everything: some Chinese schools are now trying out new digital storytelling tools, for instance. Moreover, there was common ground in teachers' initial inability to envisage the transformational potential in fusing appropriate pedagogy and technology for language and intercultural learning – but in both countries shifts occurred over time, resulting in promising suggestions. One Chinese school suggested that mixed groups of Australian and Chinese students might engage in collaborative digital storytelling. Another suggested moving to a bilingual story format, allowing Australian students to work at their lower language level and Chinese students at their higher level, while providing sufficiently rich content to engage the Chinese students' interest in exploring Australian culture. These suggestions indicate that exposure to such a project operating at the intersection of pedagogy and technology can lead teachers, over time, to gain a greater sense of the possible learning benefits.

4. CONCLUSION

In the upcoming systematic data collection phase, the five categories of lessons learned to date will be used to shape semi-structured interviews with teachers and, where relevant, conversations with students during class observations. Participants will also be prompted to suggest other lessons they feel have been learned through the project. The coding of this data may lead to an expansion or reconfiguration of the categories established thus far. The potential also exists to analyse stories to compare language use, cultural references, and digital literacies, and to analyse story feedback to evaluate aspects of language and intercultural skills development. But even before completion of the data collection and analysis, some conclusions have already been reached.

Despite disappointment on the part of some participants at various stages of the project, connected with mismatched expectations between partners, it has become evident that with enthusiasm, perseverance and goodwill it is possible to find common ground across cultures. Students were able to produce digital stories, practise language, gain some insight into each other's culture, and develop digital literacies. In time teachers were able to envisage expanded possibilities for active, collaborative, technology-supported intercultural learning. There are numerous barriers to overcome in such a project, and in this case the full potential remains unrealised as yet. However, the learning which has taken place to date – for students and for teachers – has made it worthwhile conducting the project. Furthermore, the lessons being learned – by the researchers – will serve as pointers for future projects in this territory. Despite the challenges, we believe there is much value to be drawn from such intercultural digital storytelling projects.

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A STUDY ON BUILDING AN EFFICIENT JOB SHADOWING MANAGEMENT METHODOLOGY FOR THE UNDERGRADUATE STUDENTS

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ABSTRACT

This paper describes heuristic knowledge through the job-shadowing project at the International University of Kagoshima, Japan. Job shadowing is one of the conventional in-house trainings given to the executive trainee cadets in North America and proved the effect of training in Leonard's paper for the conventional target such as the executive candidates. However, this project was introduced as a national policy in order to improve the employment rate of university graduates in Japan. This is because the decline of the employment rate of university graduates since the Lehman Shock became one of social problems. The students are provided with employment experience that accompany with the business owners' private secretary all day. From this experience, they are providing the daily business scene of decision-making and learn the business components of induction study through this project. They also gain customs to think issues in a PDCA cycle through this project. The job-shadowing project was started from 2010. The questionnaire has been taken to the student and the company since the project initiation. Each merit and effect were measured through this project. Moreover, students' evaluations were interviewed with the company. The gap of the evaluation measurement about the purpose and effect at the time of project initiation was found. The effect that could not be predicted in the design phase of the project was reported. Moreover, the side effects of the project were found through the research. In this paper, we provide the results of the research, the effect to local community and future assignment as our concluding remarks.

KEYWORDS

Job-hunting, Job Shadowing, Career Education, Working Training, University

1. INTRODUCTION

This paper describes the heuristic knowledge through the job-shadowing project at the International University of Kagoshima, Japan. This project provides the students the opportunities of the experiences and capability building in the job-hunting from 2010. We focus on three subjects of the omnibus lectures, the field works, and the excises train the students that can be expressed their thinking in their own words through this project. The following four issues were set up as the performance goal of this project. 1) Students' self-evaluation, 2) Evaluations to the project participating students, 3) Evaluations to the students from those who in charge of the corporate human resources, 4) Up rise the employment rate of the graduates. Based on the above configurations, this project is managed to build capabilities such as listing, speaking, and thinking. We pick up the job shadowing project; provide the evaluation of the project configurations and the implementation of the project. Besides, the general knowledge of the job-hunting reinforcement in the university from the viewpoint of project management knowledge is provided.

The rest of the paper is organized as follows: Section 2 gives related work and research backgrounds, Section 3 proposes the job shadowing procedure through this research, Section 4 gives the results of questionnaires and interviews, and Section 5 gives concluding remarks and future work.

2. BACKGROUNDS AND RELATED WORK

We describe the university students' employment environment in Japan at first. With the aggravation of the economic conditions after the Lehman shock, the university students' employment environment also got worse. An environment for new graduate's employment is still severe and the students to graduate employment remains undecided also emerged. According to the government survey, the employment rate was 93.9%, as of spring, 2013 [1], [2]. The employment rate mentioned here indicates the value of the division of the hired number by the graduation number. This number indicates the ratio of the number of people how much of whether the employment of the graduates of the school. Therefore, the student is provided with the necessary qualities capacity as a member of society at the university graduation time, to strengthen the efforts to promote the development of the power of student employment has become important. Based on this background, the implementation of the workforce improvement plan for the university has been specified (Cabinet decision on June 18, 2010) in new growth strategy from the Japanese Government [3].

This plan has the following features; 1) Enforcement of systems, such as "instruction (career guidance) about social and vocational independence, etc." which led the inside and outside of the curriculum. 2) The substantial measure for a student's employment ability training led inside and outside of the curriculum 3) Enhancement of the staff training function of the graduate school 4) Substantial employment support organization 5) Promotion of the industry-university cooperation concerning employment ability trainings.

This plan also aimed at common knowledge as a measure which should tackle intentionally in five years from 2010 to 2014, and various measures of the improvement in employment ability were implemented in each university. A university student's employment ability training support enterprise supports the measure of the educational reform of a university as a country so that social and vocational independence after a student's graduation may be planned. The outline of a plan is summarized as follows; 1) Instruction of the real study specialized education which are helpful after being employed. 2) Systematic instruction which led four years from admission to graduation. 3) The instruction organization built with the president's leadership (each faculty cooperates with the department specializing in employment).

In addition, as measures to support the university student employment, in conjunction with the Ministry of Economy, Trade and Industry and the Ministry of Education in April 2013, the Ministry of Health, Labor and Welfare, worked to support concentration of 2013 to not graduate employment. Even for graduates, so as to cut off the start as a member of society as well as job prospective employees, to carry out an individual support intensive job by supporters by the end of the June employment remains isn't determining [2]. Thus, we have been various initiatives related to employment for universities.

Next, the employment environment after graduation is observed. According to the research of the new graduates' unemployment rate from the Ministry of Health, Labor and Welfare, About one-third are turnover within three years after employment as shown in Table 1. Upon a very large number of unemployed graduates within three years cannot be overlooked also is employed [4], [5]. From the result of research, there need to be required for employment mismatch dissolution among the student and industry. It is considered to be an efficient method that the job shadowing is enabled to respond to the employment environment at the University so far. As for the background of the job shadowing can be summarized as follows; the job shadowing is one of the conventional in-house trainings given to the executive trainee cadets in North America and proved the effect of training in Leonard's paper in the conventional target such as the executive candidates [6]. An unemployment rate of young people to rise in the United States since the 1980s, it was feared to lead to a reduction in competitiveness and productivity in the United States in this state. The U.S. government was faced with the need to come up with some measures to strengthen cooperation with companies and schools, help a smooth transition from school to work for it. As a result, the Clinton administration was performed School-to-Work Opportunities Act of 1994 [7]. The School-to-Work Opportunities Act, and required to adopt the three elements of the core, the structure and content is a system that can be changed according to the circumstances of the provinces and regions.

The primary purpose of job shadowing is defined as to get the information and skills academic ability, related to labor market required for all students play a job or go on to high school education. One of the tools to migrate to the occupation from school is a job shadowing incorporating the three elements of learning to bind both learning and learning in 1) School, 2) Workplace, 3) Schools and Workplace.

Table 1. Number of the Employment and the Resigned as of March, 2013

Year	Employed	Resigned			
		Total	~1year	1~2years	2~3years
2008.3	446,208	133,792	54,241	42,557	36,994
2009.3	429,019	123,582	49,295	38,083	36,204
2010.3	365,500	113,390	45,864	36,508	31,018
2011.3	377,472	88,672	50,655	38,017	-
2012.3	397,687	51,792	51,792	-	-

3. JOB SHADOWING PROJECT OUTLINE

We have operated the faculty educational system reform with the job shadowing training project from 2010, this paper describes the evaluation of the project and students who joined. It is a recruitment staff's frank impression from the recruiters that our students were rejected in 2009 could not express their opinion of their own proactive in group discussions and job interviews. This is a candid impression of recruiters for university students were rejected in fiscal 2009. These impressions are similar to the student understanding of staff in charge of employment support in the university. According to the staff, there are many students who cannot write about the issues that the student worked hard as school days in the field of entry sheets. From these issues mentioned, beyond the differences to be "talk" and "write", there are few students who can express in their words in our university. Whether students can express in his words or not will affect the result of the selection directly. That is, the improvement of employment for our university is to be able to express in their own words. Then, the university administration established the committee for the recruiter to this situation as the prompt measures. Although it had been taught in our university that the students could express their thinking automatically through a university life, but it had not progressed as the administrators thought in practice.

Therefore, the intentional measures are needed about students' training which can be expressed in their words. Primary educational role in this assignment should play an important role in the undergraduate faculty. However, the present undergraduate educational system does not have the classes focused on students' training for expressing their words clearly. The necessity for reform of the conventional faculty educational system arose from a viewpoint of students' training which can be expressed in its words. Then, the university administrators set the priority project objective of employment training to train the students express the issues tackled school days in their own words through the reform of faculty educational system. Our educational system was reformed based on one of the faculty that scored 100% employment rate in 2009. It contains omnibus lecture, field work and exercise. The administrator considered to be results efforts these three subjects. The administrator made to restructure and reformed these three subjects to make use of the results to progress the effectiveness of the project. In order to ensure the students with capacity building and experience offers to focus three subjects of omnibus lecture, field work and exercises to address the restructuring and reform of the educational system in the university. The primary reason for focusing on the three subjects is described as follows: First, it is possible to provide significant opportunities such as addressing proactively through these three subjects. Second, it is considered that these three subjects can be formed effectively to the students' power of listening, speaking and thinking more than other lectures [8]-[13]. From the results of educational curriculum reforms, the standardized procedures of job shadowing are made on the basis of the project management knowledge [14]-[19]. Fig.1. indicates the prototype procedure of job shadowing. This flowchart indicates the phase of the carrier design to the job hunting in the university. We named this procedure as Job Shadowing Type Internship Standard Procedure Chart. A Job Shadowing Type Internship Standard Procedure is composed as 3 components such as a) Carrier Design, b) Job Shadowing Experience, and c) Application to Job Hunting. Each category has sub category. a) Carrier Design has 3 elements such as Omnibus lecture, Motivation Formation, and Matching and Application. b) Job Shadowing Experience has 3 elements such as, Preliminary Training, Shadowing, and the Internalization of Experience, and c) Application for Job Hunting has 3 elements such as Position Selection, Job Hunting Preparation, and Job Hunting Process, respectively. Each sub category contains following activities;

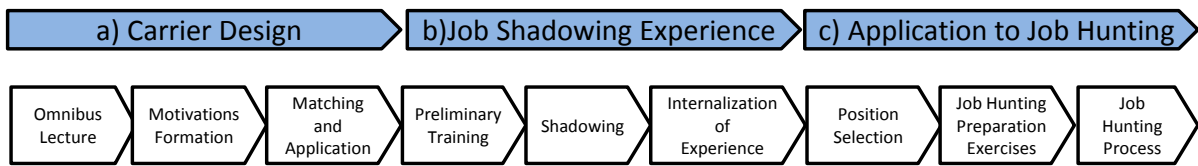


Figure 1. Job Shadowing Type Internship Standard Procedure Chart

- A) Omnibus Lecture: Learn tips on how to work with instructors in various fields.
 - B) Motivation Formation: Confirmation of occupation sense of the status quo, Anxiety confirmation to the job hunting, Obtain the motivations.
 - C) Matching and Application: Matching of job shadowing and destination motivations, Application.
 - D) Preliminary Training: Business manner, Industry Research, Company research, Business research
 - E) Shadowing: Observation and guidance from management.
 - F) Internalization of Experience: Understanding of enterprise-wide image, Management role model acquisition, the notice to the image gap, Employment motivation.
 - G) Position Selection: Acquisition of interest to a wide range of industries and companies and business, Wide range of industries and company research and business.
 - H) Job Hunting Preparation: PR self-re-examination, Self-examination of the use of PR job shadowing experience.
 - I) Job Hunting Process: Acquired by job shadowing, force you to listen, the power to speak, take advantage of the ability to think
- Employment which realized the request of the student based on social needs is realized. By taking the point of control for every procedure with consistency of progress, an acquisition of a job offer is certainly realizable. Moreover, it also becomes possible to prevent early unemployment.

4. ANALYTICS FROM THE RESULTS OF EMPLOYMENT TRAINING

The result of employment training project is measured by the evaluations from the company. Therefore, in order to evaluate the agenda-setting of the project, we do intensive research for the evaluation of the company through the paper and pencil. In order to verify the results of the project effects, we conducted an evaluation questionnaire to randomly select 167 companies focusing on companies that have appointed the students of our university in 2011. The questionnaire was mailed to the human resources professionals of the company. Anonymous answers were counting up 61 companies in 2011 and 58 companies in 2010, respectively. Table 2 shows the Questionnaire results. Among the six evaluation items, exceeded the reference value 4.3 in item (1) "greeting". And (3) "Consulted, Reported and Heard" and (6) "thinking" made the reference value 4.0., respectively. Next, we investigate the results of questioner in detail. Average evaluation item (1) of "greeting" is a 4.3, was the item most appreciated. The students who set the goals of the internship greeting there were many. Sometimes it was repeated practice of greeting in manners courses were conducted as prior learning, awareness of students was also high. Average rating of the item (4) "listen" is 4.3, self-assessment of students is high. However, it is considered that you do not understand even listening from the comments of "I did not understand that the world of" freedom of description are many that it might be there was. Average evaluation item (3) of "communication and consultation and reporting" is 4.0. There is a comment "in order to broaden the range of activities, was able to experience many to consult towards the employees" and to free description, and suggests the positive attitude of the students. Average evaluation item (5) of "Talking" is 3.9, which was an item to Lowest Score most. Received the impression that students sue the difficulty of inter- turn ship after the end, and "did not know (in the person of the company) and what I should speak", to speak in many cases.

Table 2. Questionnaire Results

Evaluation	Criteria	5	4	3	2	1	Ave.
Basic Point	Greetings	46.30%	40.74%	12.04%	0.93%	0.00%	4.3
	Wording	40.74%	37.96%	19.44%	0.93%	0.93%	4.2
	Consulted, Reported and Heard	31.48%	41.67%	21.30%	5.56%	0.00%	4.0
Employment Ability	Listen	44.44%	38.89%	14.81%	1.85%	0.00%	4.3
	Talk	26.85%	42.59%	27.78%	2.78%	0.00%	3.9
	Think	28.70%	43.52%	22.22%	5.56%	0.00%	4.0

5. CONCLUDING REMARKS AND FUTURE WORK

This paper presents the methodology of the job-hunting reinforcement for the university students through the job shadowing project. This project provides the student places both of the experiences opportunities and capability building in the job-hunting from 2010 through restructuring and reform of the university educational systems. From the result of the questionnaire and comments from the company, we made the job shadowing type internship standard procedure chart on the basis of the project management. And we made the paper and pencil study to the company to figure out the evaluation points in student recruitment.

Our Future work includes; Application for more students' job-hunting activities based on this proposed procedure, and makes evaluation and improvement of the proposed method. We are supposed to continue the job shadowing training in the university conjunction with the local business sector, the local government, and the chamber of commerce and industry. We would like to show our greatest appreciation to the affiliated companies on the job-shadowing project.

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USING TABLET PCS IN CLASSROOM FOR TEACHING HUMAN-COMPUTER INTERACTION: AN EXPERIENCE IN HIGH EDUCATION

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ABSTRACT

The use of computers in the teaching and learning process is investigated by many researches and, nowadays, due the available diversity of computing devices, tablets are become popular in classroom too. So what are the advantages and disadvantages to use tablets in classroom? How can we shape the teaching and learning activities to get the best of this technology? To try to answers these questions we offered a course in a classroom equipped with tablets and made some observations that are relevant in this context. We offered one pilot course about Human-Computer Interaction employing the Tablet PCs in classroom. This article presents this experience and some insights perceived after reflection on the action. We conclude the needs to change the teaching and learning activities when adopt tablets in classroom to get the advantages of this device and minimize the disadvantages: tablets can motivate students but can be a distract tool too.

KEYWORDS

Human-Computer Interaction, Informatics applied on Education, Teaching and learning activities, touch and pen device.

1. INTRODUCTION

Devices, such as smartphones and tablets, are becoming increasingly popular; most of them have touch screen displays, access to the Internet and enough computing power to process Web pages. The Tablet PC is a computing device designed to “imitate” a notebook, allowing the user interact with a pen. Due the increasing of tablet usage, it is important to study how to use this computing device in the teaching/learning process. In this work, we based on the Valente’s definition for Informatics applied on Education “refers to the integration of the computer into the process of teaching/learning of curriculum areas at all levels and education modalities.” (Valente, 1999). Valente discuss about the ways to use the computer in class: “computer based activities can be designed to continue transmitting information to the student and, therefore, reinforcing the instructionist process, as much as they can be designed to create conditions for the student to build his own knowledge.”

About the computer’s use for knowledge construction, Valente says, “In this case, open ended general-purpose software such programming languages and multimedia authoring systems can be used, as well as applications software such as word processors and software for the creation and maintenance of database. In each of these situations, the student uses the computer to solve problems or to accomplish tasks such as drawing, writing, calculating, etc. The construction of knowledge arises through the student’s search for new information within the subject matter, and for new strategies, in order to increase his already existing level of knowledge about the topic that is being treated using the computer.”

Based on the usage of the technology to create conditions for the student to build his own knowledge, in this work we present a study to explore the use of tablet equipped with touch and pen sensitive screen in a course. We chose the Design of Human-Computer Interface (HCI) course because we want to prepare professionals with sufficient knowledge to build interfaces not only for desktop computers, but also for emerging technologies such as touchscreen devices. Section 2 describes the HCI course’s structure, the used tools (general-purpose software as handwrite text editors for tablet) and the methods. In Section 3, we present some using examples of the tablet in classroom. In Section 4, we describe some perceptions and some considerations based on this experience.

2. STRUCTURE OF THE COURSE, MATERIALS AND METHODS

The Design of Human-Computer Interface course - MC750 (Institute of Computing, 2014) covers the main topics of the Human-Computer Interaction (HCI) field in a total workload of 120 hours, distributed in four classes per week. ACM SIGCHI (1992) describes, “HCI is a discipline concerned with the design, evaluation and implementation of interactive computing systems for human use and with the study of major phenomena surrounding them”. Barbosa and da Silva (2010) describe, “The HCI field is interested in the quality of use of these ‘interactive’ systems and their impact on the lives of their users”. They complement “according to Hewett and his colleagues (1992), the HCI’s objects of study can be grouped into five interrelated topics: the nature of human-computer interaction; the use and context of computers; human characteristics; computer system and interface architecture; and development process”. According to Barbosa and Silva (2010) claim, “knowing these technologies and devices is critical to be able to propose, compare, evaluate and make decisions about alternative ways of interaction with computer systems”.

Emphasize the rapid technological developments related to the peripheral interaction of computing devices. Preece et al. (1994) have pointed these problems: “how to deal with rapid technological change? How to ensure that the design provide good HCI while functionality and exploring potential new technology?”. However, what was 'new technology' in current times? Hayes (2008), supported by reports from the Gartner group, which describes one of the major challenges for the field of Information Technology and Communication (ICT) over the next 25 years are natural and non-tactile interfaces and automatic speech translation. Kugler (2008) points out for the tendency to replace gradually the mouse by emerging alternative interfaces that work with facial recognition, motion and gestures, and Shneiderman (2006, p. 10) points out for “the new computing technologies would include wall-sized displays, palmtop appliances, and tiny jewel-like medical sensors and fingertips computers that change your sensory experiences and ways of thinking”.

In 2006 and 2007, we given special attention to unconventional devices such as Tablet PCs, PDAs and mobile phones in our courses, using examples and including expository lectures interspersed with the achievement of individual and group activities about them. Analyzing the market at that time, we realized the need to prepare professionals with sufficient knowledge to build interfaces for these devices, which materialized if we analyze the high number of mobile devices manufactured and sold today. Aiming to introduce HCI concepts that would allow undergraduate students to know and explore new interaction technologies and IT infrastructure advantage acquired by a HP awarded project, we offered the MC750 – Design of Human-Computer Interfaces course in the second half of 2007 for students of Computer Science and Computer Engineering, UNICAMP, using Tablet PCs in the classroom. This experience was not shared in the scientific or educational HCI, and considering the current employment landscape of tablets and other computing devices interact with the pen, some insights and learnings, reported in this article, become even interesting to share.

The Tablet PC is a computing device designed to “imitate” a notebook, allowing the user interact with a pen. Resuming, the Tablet PC has the following hardware characteristics: (i) pen sensitive screen; (ii) screen that allows different positions; (iii) wireless network access by WLAN and bluetooth technology; (iv) microphones and embedded loudspeakers; (v) keyboard (some models the keyboard are detachable); (vi) batteries. In this work, we used tablet of the HP TouchSmart TX2-1040br model, a 2.2 GHz dual-core processor computer with 3 GB RAM and a 12” touchscreen. The installed operation system was Windows Vista with Portuguese manuscript recognizer. This model has the design similar to HP laptops but it is equipped with the described hardware for Tablet PC.

One tool used in classroom was the Classroom Presenter, a “Tablet PC-based interaction system that supports the sharing of digital ink on slides between instructors and students” (Anderson et al., 2006) and “making it possible to combine the advantages of whiteboard style and slide based presentation. The ability to link the instructor and student devices, and to send information back and forth provides a mechanism for introducing active learning into the classroom and creates additional feedback channels” (UW Classroom Presenter, 2014). The version adopted, developed by Caceffo et al. (2009), had modifications to compare students’ answers and dispose them in spiral form, turning easily to compare the answers and choose which one to discuss.

Another tool used was the Windows Journal, a software that allow users to do manuscript annotations and some functions to change the width and color of the ink, highlight, select and erase annotations, and insert figures. The Windows Journal Viewer software is necessary to view the file in a desktop computer.

3. USING THE TABLET ON TEACHING AND LEARNING ACTIVITIES

The first use we want to highlight is the use of the Tablet PC with Classroom Presenter to collect and build a common understanding of concepts before formal definitions of exposure. In this use case, we put a question on top of the slide asking the student to define the concept that were being worked on, which should be handwrite by the student in the appropriate space and sent to the teacher after do it. The teacher can analyze the responses as she receives, separating the answers she want to discuss with the students. For example, this technique was used to know what students understand about the term usability.

The second use we want to highlight is related to the features in the Caceffo et al. (2009) version of Classroom Presenter. During the classes about the Nielsen’s heuristics, the material was divided into two parts: the first part shows each one of the ten heuristics, explaining them and give one or two examples of violations. The second part consisted of an activity where students need to look for violations of the heuristics. In previous semesters, we applied the same exercise but, since the teacher does not use the Tablet PC, the teacher projected the user interface to be analyzed using a projector. After a time for the students do the identification of the violations, the teacher asks for the students pointing out the found violations for each heuristic, discuss them and do a mark in the user interface. This activity was adapted for the Tablet PC with Classroom Presenter, repeating the user interface to be evaluated in 10 slides; each slide would be for the student mark the violations of the heuristic described on the top. After a time to do the evaluation for the heuristic, students sent their marks to the teacher's tablet, so the Classroom Presenter compares the marks made by a student with the teacher answer, previously registered. Considering the feedback of the teacher as the correct answer, students' answers were distributed in a spiral form; the teacher’s answer is in the center and the students answer as disposed in the spiral placed: as more similarity the student’s answer is for the teacher’s answer, closer the student’s answer will be of the center. This enables the teacher to have an overview of the answers (how many are far from her answer) and analyze the answers that are from the center, discussing them.

The third use we want to highlight is the use of the Tablet PC with Windows Journal to produce a report using the heuristic evaluation method. In a second class about Nielsen’s heuristics, students were grouped up to five students, each group would have only a Tablet PC to identify violations of the heuristics in a user interface. In this activity, students inserted images from the user interface and marking the violations (and justifications) using the Windows Journal. Figure 1 shows, in a partial way, the report done by a group where it is possible to see how the students organized their response: in the left, they put some rationale about violation, and, in the right, the user interface with the marks. In red are the considerations done by the teacher after analyze the activity. It is important to highlight that one of the groups chose to enter the answer instead of handwrite it, delivering a text file without images and only textually describing the violated points.

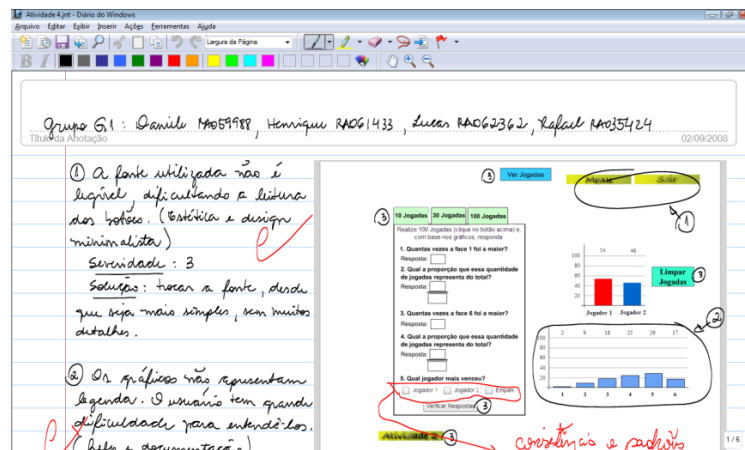


Figure 1. Answers of a student group for an exercise to find violations of usability heuristics and corrected by the teacher. In the left there is the evaluated user interface, and in the right the students reasoning. In red, the teacher annotations.

The fourth point we want to highlight is a homework where the students had to develop a user interface for a mobile phone or tablet application; each group could define the scope to work. It was suggested to the students to do artifacts such as personas and scenarios and to do an initial design, evaluated using the heuristic evaluation method, before presenting and discuss with the teachers and other students about the designed interfaces. This activity was important to understand the relationship between the two key stages to develop the interface of an interactive system: the design and evaluation; and consider their impressions about tablet and mobile devices in the design of a user interface for these devices.

During the course, a discussion forum was used for the students to put their impressions. In the middle of the course, some students posted their impressions that disagree with their first impressions and expectations. One negative point described by the students was the distraction of using the Tablet PC in the classroom; the teachers observed it and pointing out in their reports. This feedback was important to motivate teachers to change the teaching methodology trying to get a greater student's participation, e.g., collect examples or definitions on the internet related with the subject.

At the end of the course, the students and teachers answered a questionnaire to understand the impact of using the Tablet PC in the classroom (da Rocha et al., 2008). The students were questioned about the habit of taking notes about the content of the subjects during class, 66% of respondents said they rarely take notes in class, 11% response that take notes, and 23% say that did not take notes. May be this is related to the profile of the students, but the equipment will probably not change the students' habit, as perceived by the teachers. Teachers and students were questioned about the importance of students to have contact with Tablet PC technology in the course. About it, 100% of teachers and 58% of students believed that this contact was important.

Teachers also asked about the main differences observed by them in a class with the Tablet PC and a class without using the Tablet PC. One of the teachers argued, "the main difference is the interactive participation of students through the tablet. Not that the traditional classroom does not allow student participation; however, the tablet facilitates the teacher to show everyone what the students produced. However, the teacher needs to plan and prepare the students' participation and what will be done with the participation. This planning is not easy at first, because it requires a change in how the professor prepares its class". Another teacher commented about the impact of using the tablet to solve exercises in the classroom "it is possible to allow students participated in different way when do exercises ... the teacher can choose some resolutions to comment ... or discuss in a more general way. Without the support of Tablet PC, there is need volunteers to write their resolutions on the board; when I use the Tablet the resolutions do not need to be rewritten, which reduces the time spent in an exercise. For now, I observed that the students performed few annotations. The better advantage was the possibility previously said". A third teacher pointing a negative impact "...a class with Tablet (and Classroom Presenter) generally takes longer to start because everyone needs to pick up the Tablets, plug them in, log in, connect to the Presenter and wait for the slides transfer". This teacher points out the importance of planning different classes "there are also a need to change the preparation and conduction of the lesson to encompass equity/student interactions via Tablet".

In this exploratory study, a learning environment (TelEduc) was used to support the course; so participants used multiple devices to access it (tablet, desktop computers and mobile devices). In some classes, students accessed the environment using Tablet PCs; this allowed students perceive the nuances of software designed for mouse and keyboard, and the impact of trying to use another interaction style, in this case, the pen. Therefore, the environment itself is also an object of study and discussion in the discipline.

4. PERCEPTIONS AND FINAL CONSIDERATIONS

In this paper, we described an exploratory use of Tablet PC in a Human-Computer Interaction course based on the usage of the technology to create conditions for the student to build his own knowledge. Despite the attractive role of technology, especially in students of computing courses, which makes the students go to the classroom to know and use the Tablet PC, we emphasize the importance of developing support materials considering the usage of this technology in classroom. In the described experience, students made few annotations in theoretical slide-based lectures (as expected by the researchers), then the device turn into a distraction tool in these lectures, corroborated by the testimonies collected by the students.

In this study, the technology could not change the habit of the students, as they answered that do not usually take annotations in classes.

It is noteworthy that, despite the existence of applications for classroom to explore the potential of pen, as mentioned in the previous section, we realized the lack of tools that enable other dynamics in classroom, such as conducting activities in peer-review style, in which one a student examines the work of another student. In the case of the Classroom Presenter application, only the teacher received the students' responses, making it impossible for students to evaluate the work of another student without the mediation of the teacher's device.

About the importance of the contact of new technology, just 58% of the students believed that is important. Maybe some of them found the Tablet PC a distract tool or the content explaining this device plus the content for how to design for this device maybe enough for their purposes. Further investigation must be done to answer it.

In this study, the students could not take the Tablet PC for your home or another location outside of the classroom. Therefore, it was necessary that the contents built by students and the teacher in classroom be accessible on devices that students have, such desktop computers, enabling them to review and study the content taught outside the classroom. Reflecting about the current state of technology, where tablets, smartphones, digital whiteboards, and other conventional devices are found in the market, we believe that it is necessary to go beyond than provide the access to ICT tools using any device or any means. It is necessary to consider that the number of peripherals is increasing over the years and these peripherals allow users to interact with applications differently than usual.

As future work, we plan further to explore the use of different devices in the Human-Computer Interaction course in the first half of 2015 on the Federal Institute of São Paulo Campus Hortolândia using a variety of equipment based on pen interaction, such as smartphones and tablets.

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TECHNOLOGY AND MOTOR ABILITY DEVELOPMENT

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ABSTRACT

As a new member joining the technology family, active video games have been developed to promote physical exercise. This working-in-progress paper shares an ongoing project on examining the basic motor abilities that are enhanced through participating in commercially available active video games.

KEYWORDS

Active Video Games, Motor Abilities, Physical Exercise

1. INTRODUCTION

Active video games (exergames), as the latest wave of video games, have not been around long. However, they have already exerted a huge behavioral impact on consumers and attracted devotees of all ages, from toddlers to grade schoolers to grown-ups.

Active video games have been introduced as a technology tool that has health benefits (Staiano & Calvert, 2011). By combining videogames playing and being physically active, motivation of participants have been reported to steady high for both relaxation and achievement (Pasch, Bianchi-Berthouze, van Dijk, & Nijholt, 2009). Mimicry of movements, proprioceptive feedback, as well as physical challenge, was recommended by researchers to make the commercial product more welcoming. It is the purpose of this pilot study to examine the true impact of active video game playing on basic motor abilities.

Are movements required to complete active video games participation serving the purpose of being physically active at the same time advancing motor skill development? Few studies in the current research literature have examined the efficacy of the solution provided by the game industry. With the available exergames out in the market, no evaluation, to our knowledge, has been conducted on the physical abilities these games were designed to promote.

Nintendo Wii was one of the first company to introduce exergame concept in the 80's (Bumham, 2001), then the PlayStation and Kinect game consoles advanced the physical involvement in playing the games by using user's own body as the controlled (Witherspoon & Manning, 2012). What fundamental motor skills have been improved by playing active video games remains unanswered. To be able to make the best out of the games handy to young consumers, knowing how much and what improvement that active game playing can have in fundamental motor skills, is the impetus for an evaluation system to be in place. This piece of information is also critical to teachers and parents to have when designing the best curriculum in school for students and/or setting up an environment at home that is most beneficial for children and youth at a particular developmental stage.

Purpose of this project was to examine the different physical abilities that can be enhanced by active video games out on the market. More specifically, perception from users will be collected to answer the research question of what physical abilities are enhanced by the exergames commercially available.

2. LITERATURE REVIEW

Current literature presents evidence in supporting and against the use of technology in promoting physical activeness. Supporting research emphasizes the inclusion of all age group and performance level by technology, as well as the valiance of weather condition, geological location, a buddy to play with, and so on. Benefits for kids from playing active video games have been reported in improving eye-hand coordination (Hotz, 2012), visual and attentional skills such as memory (Boot, Kramer, Simons, Fabiani, & Gratton, 2008), and tactics and strategy (Glass, Maddox, & Love, 2013 and Queen Mary, 2013). Active video games are also found to help increase energy expenditure and movement for children (average of 12 years old) (Lanningham-Foster, Foster, McCrady, Jensen, Mitre, & Levine, 2009). Energy expenditure is significantly higher for those users who are engaged lower body movement compare to upper body engagement (Biddiss & Irwin, 2010). Moreover, over-weight children (10-14 years of age) can benefit from participating in active video games (Maddison, Foley, Mhurchu, Jiang, Jull, Praparessis, Hohepa, & Rolgers, 2011).

Contrarily, arguments can be found in the current research literature against the use of video games since they are associated with the inappropriate use of games, such as, one of the video games that engages killing (Salbella, 2013). Virtual games presents the user a special conditioning to be desensitized from less physiological aroused by real violence prone to getting into violent behavior as a result (Carnagey, Anderson & Bushman, 2007; Anderson & Dill, 2000). Moreover, participants (11 year olds) of active video games reported to have increased energy expenditure not at the level of recommended standard of 60 minutes of daily moderator (White, Schofield, & Kilding, 2011).

Divergent to the cognitive enhancement by playing video games and active video games, studies to examine how motor skills are enhanced are scarce (Delgado-Mata, Ruvalcaba-Manzano, Quezada-Patino, & Gomez-Pimentel, 2009). The limited effort has been put in the area of game designing to foster gross and fine motor skill development. Impact of commercially available exergames on the motor skill development has not been studied.

3. METHDOLOGY

In evaluating active video games, very limited literature can be found to have probed into the exact physical abilities enhanced from participation. As a remedy for this absence, this pilot survey study is designed to include basic physical abilities and see if any of the abilities are strengthened by exergames commercially available in the market.

Eleven fundamental motor skills recommended by the Department of Education from Victoria were used for survey development for this project. Specifically, the fundamental motor skills included are catch, kick, run, vertical jump, overhand throw, ball bounce, leap, dodge, punt, forehand strike, and two-hand side-arm strike.

Participants, a voluntary convenience sample, were college students with junior or senior status majoring in Kinesiology and have had at least one course of training in movement evaluation. They were asked to self-report and comment on the motor abilities built by engaging in active video games from their own experiences.

4. FINDINGS AND DISCUSSIONS

Fifty-eight active video games (AVG) were evaluated by 25 participants (15 male; 9 female). Each participant was asked to pick the active video games that they were familiar to play with. Out of the 58 active video games reported, 12 were eliminated at the final evaluation due to either a non-active in nature, i.e. NBA 2K12; a mobile application such as Julian Michael Fitness; or a hand-held DS such as Winter Sports Feel the Spirit.

Forty-six of the different AVG came from three main manufactures, Wii (Nintendo), X-Box (Microsoft), and PlayStation (Sony). Of the 46, 19 were Wii games, 14 X-box 360, and 5 PlayStation games. At the same time, there were 5 that were double dipped in either Wii and X-box or X-Box and Playstation. 4 games were triple dipped in all three forms.

Of the 11 evaluated basic motor skills, 19 Wii games had a range of 1-11 and an average of 4.157 inclusion of the basic motor skills. The games that are with the best inclusion was Wii Fit.

X-box had a smaller product pool evaluated with a range of 0-10 and an average of 4.785 basic motor skill inclusion. The game that had the highest rate in basic motor skills covered was Kinect Sports.

Playstation had only 5 games and a range of 0-6 and an average of 2.8 basic motor skills covered of the 11 basic motor skill mentioned.

Four double dipped games had a range of 2-5 and an average of 3.75 of the basic motor skills included, while 4 tripped dipped games had a range of 3-10 and an average of 6.25 inclusion of the 11 basic motor skills. See Table 1 below for detailed statistical description.

Table 1. AVG Information And Evaluation

AVG	Number of Games	Evaluation		
		Range	Ave # of Basic Motor Skills Included	Highest # Covered
Wii	19	1-11	4.157	Wii Fit (11)
X-Box	14	0-10	4.785	Kinect Sport 10)
PlayStation	5	0-6	2.8	Mortal Kobat (6)
Double Dipped	4	2-5	3.75	Fifa2014 (5)
Triple Dipped (10)	4	3-10	6.25	NFL training camp

Development of a particular basic motor skill was also evaluated. Leap, dodge, and over hand throw were included in a little over half of all evaluated commercially available active video games with 56.5%, 54.3%, and 50% respectively. Ball balance and forehand strike were evaluated to be included in 45.7% of all games while run and two-hand strike were included in 43.5%. Catch, kick, vertical jump, and punt were found to be at the lowest rates of inclusion, 26%, 21.8%, 39.1%, and 23.9% respectively. Table 2 presents the inclusion percentage of the basic motor skill in AVG.

Table 2. Inclusion percentage of the basic motor skills in AVG

Basic Motor Skills	Inclusion Percentage in the 46 AVG (%)
Catch	26
Kick	21.8
Run	43.5
Vertical Jump	39.1
Overhand Throw	50
Ball Balance	45.7
Leap	56.5
Dodge	54.3
Punt	23.9
Forehand Strike	45.7
Two-hand Strike	43.5

It is interesting to notice that Wii Fit has showed an inclusion of all 11 basic motor skills in designing of the game. The commercial market definitely needs a push in the direction of including all basic motor skills to enhance a true benefit from a balanced basic motor skill design to correct the current impact of temporary energy expenditure that do not sustain due to drop out of the participants (Barnett, Certain, & Baranowski, 2011).

5. CONCLUSIONS

The findings from this pilot study have shown trends of basic motor abilities enhancement through active video games playing. This pilot study is an initial effort of an on-going project to study the impact of commercially available active games, and sport specific video games on the learning of that sport skill. As a final product of this project, an evaluation system for commercially available active video games to foster effective learning/practicing of a particular skill in active game users will be designed and developed.

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THE INTEGRATED FRAMEWORK OF COLLEGE CLASS ACTIVITIES—USING LEARN MODE WITH THE INTRODUCTION OF EDUCATIONAL TECHNOLOGY AS AN EXAMPLE

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ABSTRACT

This paper takes the undergraduate course “The Introduction of Educational Technology” as an example, and carries out the practice based on the application of Learn Mode. In Taiwan, there were plenty of attempts for the implementation of mobile learning on both elementary and high schools; yet, it has not been extended to the higher education level. As the partnership of the Faith Hope & Love Foundation, HTC Corporation, we made use of the Learn Mode application and conducted the first practice of mobile learning in university.

In this study, a design-based research model and the instructional design of the Learn Mode class activities were both pre-developed before the formal implementation. The questionnaires were empirically tested against data collected from 71 undergraduate students. We surveyed the relationship between user satisfaction (via classroom management, software, hardware) and acceptance (via Technology Acceptance Model) for mobile learning, figuring out the enhancement of motivation of learning as well. Through designing and developing class activities with the functions of Learn Mode application, we provide some mobile learning references and suggestions for other higher education institutions and universities.

KEYWORDS

Mobile learning, Mobile device, Technology Acceptance Model, HTC Learn Mode application, The Introduction of Educational Technology.

1. INTRODUCTION

The trend of the rapid development of information technology and the common wireless high-bandwidth network have resulted in the high penetration of mobile devices. In recent years, with the popularity of internet technology and mobile devices, mobile learning plays an important role in our education. (Motiwalla, 2007; Virvou & Alepis, 2005; Sung, Zhang and Yu, 2006; Xu & Luo, 2007)

There were many practical mobile learning cases internationally, including Africa, Middle-East, Asia, Europe, Latin America, and North America. (UNESCO, 2012) Now, innovative ways of mobile learning is a trend in Taiwan. To enhance the country’s economic development in order to respond to new century challenges and promote the country’s overall development, developing excellent mobile learning is an important education policy for the Government and Administrative Ministry; the “M-Taiwan program” was in the New 10 Infrastructure Developing Program. (Wang, 2004; Wu, 2003; Lee et al, 2004)

The Ministry of Education (2014) implemented the 4 year E-learning program, and one of the programs, The Mobile Learning of Secondary and Elementary School Program, has been implemented and promoted in approximately 74 junior high and elementary schools; 39 senior high and vocational high schools. Besides, to develop and build models of Taiwanese experience of mobile learning, the Ministry of Education collaborated with Faith Hope & Love Foundation, HTC Corporation; Yonglin Charity Foundation and Wistron Foundation. With the support of Faith Hope & Love Foundation, over a hundred of schools, including elementary and high schools in Taiwan are able to make use of the Learn Mode application, a built-in platform to create interactions between teachers and students in classroom learning.

As the first university to implement the program, the purpose of this research is to design and develop classroom activities that integrates the several functions of Learn Mode application into the undergraduates' course "The Introduction of Educational Technology".

A design-based research model were pre-developed and empirically tested against data collected from 71 undergraduate students. We surveyed the relationship between user satisfaction questionnaire (via classroom management, software, hardware) and acceptance questionnaire (via Technology Acceptance Model) for mobile learning, figuring out the enhancement of motivation of learning as well. With the collected data from the questionnaires, we analyzed the data and interviewed with our targeted audiences personally. Consequently, by designing and developing class activities with the functions of Learn Mode application, we provide some mobile learning references and suggestions for other higher education institutions and universities.

2. LITERATURE REVIEW

Recently, teachers have recognized that the Mobile Learning (or M-Learning) is a trend which plays an important role in education nowadays. It is a type of e-learning that delivers educational contents and learning support materials through wireless communication devices. The role that communication and interaction plays in the learning process is a critical success factor. It is within this context that m-learning can contribute to the quality of education. (Brown, T.H, 2005)

Kumar (2011) pointed out that smart phones or mobile devices will become the dominant computing platform for humanity. M-Learning happens anywhere and anytime with the assistance of a mobile device presenting the content of learning and provides a wireless two-way communication channel between teachers and students. (Ruchter, Klar and Geiger, 2010)

Moreover, Traxler (2005) interpreted mobile learning as a personalized, connected, and interactive use of handheld computers in classrooms, in collaborative learning during fieldwork, and in counseling and guidance. According to the above, in this study, as the Learn Mode interactive activities were designed in a classroom environment, mobile learning is depicted as the learning process and communication between students, peers and teachers using the tablets in a ubiquitous learning environment.

While cases of elementary and high schools have implemented the Learn Mode application into their m-learning, the Learn Mode application could also be an attempt to engage and motivate student learning in higher education.

Since 2009, the Ministry of Education had selected Zhongyi and Dahu Elementary School in Taipei City; Jian-An Elementary School, New Taipei City; Chang-Chiau Elementary School, Hualien County; and Tzu-Ying Elementary School, Kaohsiung, these five elementary schools as the pilot schools of mobile device learning. The Taipei Education Bureau also said that, in order to encourage teaching teams using information technology equipment to improve the curriculum and instructions, a "Mobile Learning Experiment Project" launched in the year 2012 with budget of NT 24,840,800, total granted 30 schools. (Department of Education, Taipei City Government, 2012)

In other countries, for example, South Korea announced the completion of a paperless engineering teaching project in 2015 from the elementary schools to high schools; in Japan, more than 10 million students will be provided with an electronic backpack by 2015; and the United States will entirely transform their textbooks into electronic textbook before year 2017. These all indicates that not only Taiwan, mobile learning and mobile teaching are even more quickly carrying out around the world. Mobile learning and teaching resulted in instructional models for ubiquitous learning, and activated lots of technological and innovative teaching models. It has become the main direction of educational researches in recent years, and a collection and brief analysis is as follows:

Firstly, Wang (2012) studied "A gamification approach to developing Mobile Insect Learning System for improving the learning motivation and achievements." This study used gamification in a context-aware learning environment; students used the Mobile Insect Learning System (MILS), which combines with game elements, and used it on their mobile smartphones for learning science courses in outdoors in the learning process. The questionnaire results indicated that students' thinking through the smartphone can be of help.

Furthermore, with the combination of mobile technology and gamification techniques, mobile learning showed better learning efficiency than traditional non-gaming oriented mobile learning and traditional teaching methods. Also, a positive influence between the relationships of learning and motivation were further noted.

Secondly, Yang (2012) studied "Effects Of The English Vocabulary Learning With Mobility Device: A Case Study In Second Grade Students." the research integrates QR Code barcode technology into the English vocabulary learning system for the study of 59 persons. Research showed that the experimental group of English vocabulary listening were higher than the traditional education group in learning efficiency. Besides, students hold a positive view of using mobile devices for learning English vocabulary teaching, and said they would continue using mobile devices for learning and teaching. Above is shown that students had high interest in mobile-learning and teaching.

Thirdly, Hsu (2011) studied "An E-learning System Design of Math Remedial Programs in Elementary Schools by Using Android Mobile Devices." This study transformed boring academic learning into challenges, entertainment, special lighting and visual effects in math games. For remedial instructions, the investigation pointed out experimental group of students who used the remedial learning platform were better than those who did not use it; high information capacity of students showed better learning efficiency than low information capacity of students. The results indicated that up to 83% of the students believed that this type of learning improved learning motivation, and brought in diverse, convenient learning, and more frequent interaction.

According to the above summaries, in contrast to traditional learning which emphasizes direct instruction and lectures, mobile learning has more interactive stimulus such as the mobility, sounds and lightening effects, and videos. Students tend to prefer learning with mobile devices and generally have better performance than the traditional ways. Teachers and students also hold a positive attitude towards mobile device learning.

3. METHOD

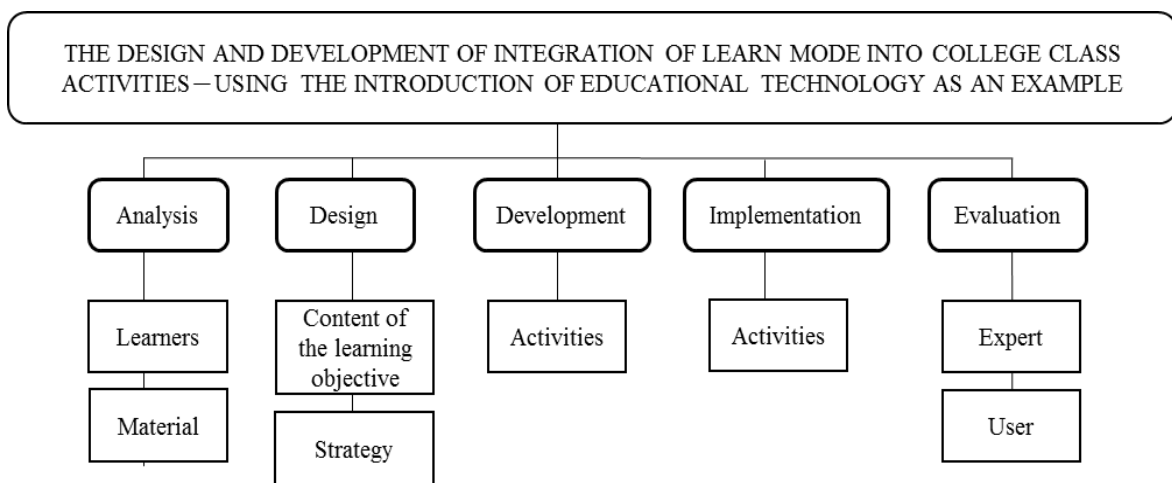


Figure 1. The Design-based Research Model Framework

The figure above is a design-based research model study conducted through structured questionnaires. The target population of this study consisted of 71 undergraduate students. We gave out 2 questionnaires, namely the satisfaction questionnaire (via specific items: classroom management, software, hardware) and the acceptance questionnaire (via Technology Acceptance Model) of mobile learning.

A four point Likert Scale with strongly agree; agree; disagree; and strongly disagree, is used from the main items. To study the attitudes and perception of students on the use of mobile learning, the questionnaires were developed and designed to measure students' attitudes and perception on the use of mobile learning.

By surveying through the questionnaires, we analyzed the relationship between user satisfaction (via classroom management, software, hardware) and acceptance (via Technology Acceptance Model) for mobile learning, figuring out the enhancement of motivation of learning as well. After collecting data from the questionnaires, invitations also sent to targeted students for interview.

4. CONCLUSION

This study was done to analyze learners' perception and satisfaction on the use of mobile learning and its instructional design of the course. We proposed the framework, designed and implemented a mobile learning model for higher education level; however, as a preliminary study, several expected and unexpected limitations would occur to different circumstances in real class scenario.

Hence, we could merely hypothesize for about 3 circumstances that will happen in a mobile learning class:

A. The result could not be used in other fields of courses.

B. We mainly focus on the design of Learn Mode activities, so student's whole learning efficacy would not be seen.

C. The learning activity takes place in class, so we could not track students' status of learning outside of class.

Thanks to the Faith Hope and Love Foundation, HTC Corporation, we took advantage of the donated tablets: HTC Flyer, and made use of its Learn Mode application to create interactive activities in class. Via conducting experiment on the college class, we found improvements in software, hardware, and classroom management; whether it is for user adoption or for satisfaction for the intention of mobile learning.

While processing the mobile learning program, qualitative data could be collected for the future promotion of mobile learning in universities. All in all, our study could provide references and suggestions for other universities and higher education institutions.

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TRAINING PRE-SERVICE CHINESE LANGUAGE TEACHERS TO CREATE INSTRUCTIONAL VIDEO TO ENHANCE CLASSROOM INSTRUCTION

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ABSTRACT

Foreign language instruction is a complex and challenging task made even more so by situations in which the learner's native language is radically different from the foreign language being mastered. Nowhere is this more evident than in the case of native English speakers seeking to learn Mandarin Chinese. The rapid increase in the availability and sophistication of video editing has made it possible for classroom teachers to create their own instructional video materials to assist their students' learning process. The presentation will explain the advantages of doing so, and will describe the activities of one program that trains pre-service Chinese language teachers to create their own instructional video materials as part of their teaching licensure program, as well as discussing the reactions of the teachers to these activities. Samples of student-created video materials will be shared.

KEYWORDS

Instructional video, teacher training, foreign language instruction, Chinese, curriculum

1. INTRODUCTION

Learning a foreign language is a challenging task made easier by a variety of technological tools. Teachers have always created their own tools from whatever materials are at hand – paper, ink, manipulatives – but 21st century video technology enables teachers to create an entirely different set of learning tools accessible to students in any location. Teacher-created video files allow teachers to preserve brief key lessons for re-use at any time. The creation of these lessons is easily done on personal computers using readily mastered skills. The presenters will discuss their experiences teaching these skills to pre-service Chinese teachers, and the reactions of these teachers when given the opportunity to use these skills and the resulting materials in their own classrooms. This is practitioner-based rather than a research-based presentation.

2. CONTEXT

With the increasing power of personal computers and a corresponding increase in the availability of consumer level video-editing tools has come a rise in the use of individually created video content for instructional purposes. Probably the best known example of this is Khan Academy (<https://www.khanacademy.org/>), but individual teachers in all subjects and disciplines have recognized the potential of this approach to teaching. As Berk (2009) observed, “video clips are a major resource for teaching the Net Generation and for drawing on their multiple intelligences and learning styles to increase the success of every student...The research on videos and multimedia learning provides an empirical foundation for their use in teaching, especially with introductory courses and novice learners, to increase memory, comprehension, understanding, and deeper learning.”

In fact, Berk went on to summarize 20 different positive aspects of using instructional video clips, including motivational and affective components as well as improved retention of content. Donkor (2011) found that students are highly satisfied with the video-based instructional materials. And when it comes to the teaching of foreign languages, Winke, Gass, & Sydorenko (2010) have pointed out the natural match – “Videos are a good resource for presenting native speaker voices in foreign language instruction.”

Given these advantages it seems like an obvious next step for teachers of foreign languages to be able to create their own video clips for instructional purposes. Doing so allows them to closely tailor the content and the length of the video clips to their instructional needs, and frees them from the necessity of finding the perfect content for their lessons in the midst of the massive collection of materials that is the Internet. As long ago as 2002, Hampton noted that “video editing...is a relative simple process and... it is good enough to clearly demonstrate the steps and stages for the processes required to perform the practical skill. It is relatively low cost and can be produced fairly quickly and easily.” Hampton went on to make the point that video was particularly well placed for activities requiring practice and rehearsal on the part of students, and learning a foreign language is positioned squarely in that area.

Several years ago the lead author became aware that K-12 schools in the United State of America were beginning to seek qualified teachers to teach Mandarin Chinese to their students as a foreign language. At that time, very few such teachers were available. She was instrumental in creating and securing approval for such a program. In Spring semester 2011 the program enrolled its first students. This program provides candidates with an Ohio state teaching license in Chinese. It comprises 34 credits and can be completed in four semesters. The program is one of very few initiatives in the United States that include both an M.Ed degree and licensure program, which provides a PreK-12 teaching credential. To date this degree program has a near-perfect job placement record for its graduates.

The lead author’s discipline is educational technology, which means that she spends much of her professional time preparing teachers to integrate technology into their K-12 classrooms. A central question in this field is that of how best to integrate various technologies most effectively and efficiently into learning activities and school structures, and the rate of ongoing change in information technologies means that pre-service teachers must continually update and enhance their technology skills in order to remain current and effective. She teaches pre-service Chinese teachers how to use technology to teach Chinese to native English speakers.

Students in this Chinese language teaching licensure program are trained to produce their own instructional video clips and required to make use of these clips in their field training experiences. One required course in the degree program is called “Technology in the Classroom”, and it focuses on integrating a variety of instructional technologies into pedagogical practice. Among these technologies is instructional video. The instructional video curriculum includes the instructions on how to plan, shoot, edit, and upload a brief instructional video to YouTube. The reason for the use of YouTube is that “YouTube offers fast and fun access to language and culture-based videos and instruction from all over the globe. It provides an outlet for student and teacher-created videos, and most importantly, YouTube videos provide students with an opportunity to engage meaningfully in the target language” (Terantino, 2011).

In terms of hardware used in shooting the video clip, the pre-service Chinese teachers are allowed to choose to use any digital video device to which they have access, including smartphones, iPads, Android tablets, digital video cameras, and so on. They are told that the chosen device must be capable of transferring the resulting digital file to their computers. In terms of software used in editing, the pre-service Chinese teachers are allowed to use any video editing software to which they have access, including iMovie, Windows Movie Maker, and so on. They are told that software selected should have the capability to create a file suitable for uploading to YouTube.

In addition, they were told that the final, edited video clip should successfully teach non-native Chinese speakers some specific skill or item of content. They should have a clear description of the video and a description of what the video is intended to teach. The video should contain an appropriate title slide (with a title for the video and the full name of the author) and transitions between different shots. The maximum length of the final edited video is three minutes. This echoes Hampton’s suggestion that segments of less than three minutes are ideal (Hampton, 2002).

Examples of teacher-created videos will be provided during the presentation. One teaches about Chinese New Year by accompanying a sing-along audio track of a song about New Year with video of the Chinese characters being sung. The second one teaches the characters and pronunciations of the Chinese days of the week, and the third one provides cultural information and vocabulary connected to the Chinese mid-Autumn festival.

The teachers who have completed this training have spoken very positively about the experience. One student stated "...the process made me realize how easy it is to create a video and then use it in class to help educate students on a topic." Another noted "with this video, I got a taste of what it's like to produce educational materials that can be used in a real life situation." A third observed "...this activity has been the most meaningful to me in all of my courses including undergrad and my first master's degree. I look forward to making more movies like this for my students."

3. CONCLUSION

Teacher-produced instructional video has many clear advantages for the foreign language classroom. The video component is motivational, appeals to multiple learning styles, and provides an easy means to expose students to the sound, structure, and content of a language as spoken by native speakers. The fact that the materials are produced by the individual teacher means that the content can be selected as a perfect fit for a given individual's curriculum, and the length of the video clips can be tailored as well. One size need not fit all.

In the area of disadvantages, it's true that producing such video clips requires a modest amount of skill and training, as well as access to video editing facilities – but all of these are increasingly common in today's world. Perhaps the more significant disadvantage is that the production values of individual classroom teachers are unlikely to be at the video professional level, and most of their productions are likely to be visibly the work of amateur producers. Perhaps this is part of their charm.

However, since this is such a promising area for further work, we would be remiss if we did not acknowledge that one limitation of this presentation is the absence of formal research data. This is fertile ground, and it is our hope that additional work in this area will allow us to refine the pedagogical details of best practices for the use of such videos.

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USING PROJECT-BASED LEARNING AND GOOGLE DOCS TO SUPPORT DIVERSITY

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ABSTRACT

A graduate course, ETEC543 (*Technology and Learning I*), was revised to better serve increasing new student population, international students, in an academic program. Project-based learning, Google Docs, and instructional strategies fostering diversity and critical thinking were incorporated into the course redesign. Observations, surveys, and instructor's reflective journaling were used to collect data for the project evaluation. The results indicated that the course redesign was beneficial for student learning and reduced distance between native speakers and students born in foreign countries.

KEYWORDS

Project-based Learning, Google Docs, Diversity

1. INTRODUCTION

The author has been teaching at a four-year university at Southern California in the USA for more than 15 years. One of the university strategic plans is to increase the number of international students at the university. Following the university strategic plan on increasing international student enrollment, the number of international students has been increasing in the author's Instructional Technology program. However, the international students were often viewed by native speakers as a burden of a group when conducting team work. International students also often feel intimidated when conducting team work with native speakers due to their language barriers. During 2013, the author redesigned a course, ETEC543 Technology and Learning I, and taught the course during Fall 2013. The purpose of the course redesign was to support diversity and to prepare a pleasant learning environment for both native speakers and international students. The course redesign included the use of a variety of teaching strategies and technologies. The paper contributes to the professional community by providing teaching strategies that support diversity and student learning.

2. BODY OF PAPER

The project took place during Fall 2013. Below illustrates the teaching strategies employed and research conducted in the course, including data collection, analysis, and preliminary results.

2.1 Teaching Strategies

In the course, the author employed project-based learning, technology use (especially the use of Google Docs), and strategies fostering diversity and critical thinking.

2.1.1 Diversity

In one of the assignments in ETEC543, each student made a presentation on the education system of his/her own country, its strengths, and its weaknesses of the education systems. For example, a student from Saudi Arabia talked about K-12 and higher education in Saudi Arabia, its strengths and weaknesses. This assignment allowed students to better understand education systems in a variety of countries.

The purpose of the assignment was to help students realize that not a single education system would be perfect and that they all could learn from each other. It was hoped that, through this exercise, students would learn respect and diversity.

2.1.2 Project-Based Learning

One of the goals of ETEC543 was for students to understand educational research. One of the assignments of the course required students to conduct a team research project by applying what they learned from the textbook/instructional materials to an actual research project they would conduct. Each team should consist of native speakers and students born in foreign countries. The research project required students to identify a specific issue concerning education of two countries that they were interested in exploring, for example, pressure of entrance examination on students in Japan, extra curriculum activities in Korea. The project was designed in a way that students who were born in foreign countries were valuable resources for the team project because of their connections to and experiences with foreign countries.

2.1.3 Integration of Google Docs into Class

For the team research project, students were required to share literature review, co-construct research instruments (e.g., survey or questionnaire), and co-author the research paper with their team members using Google Docs. Prior to conducting the team project, Google Docs were introduced to the students as tools for collaborating on the project. The Google Docs introduced included the use of word, spreadsheet, and online form.

2.1.4 Pedagogies for Critical Thinking

To make sure that each team's research instruments were well-developed, each team needed to present their research instruments to other classmates for feedback before they actually conducted data collection. Classmates needed to critique the instruments by explaining the strengths of the instruments and by offering suggestions on the instrument improvement.

2.2 Research Study

The research was conducted throughout the entire quarter, lasting 10 weeks. The author was interested in finding if the course redesign would support student learning, both native speakers and students born in foreign countries. In another words, foreign students would not feel intimidated when working with native speakers; native speakers would appreciate the experience working with foreign students and would not view them as a burden to the team project. There were a total of 21 students in the course.

The author used both quantitative and qualitative research methods for the study. Survey, observations, and instructor journaling were used to collect data. Throughout the quarter, the author observed student behaviors in class as well as online. She documented students' noted behaviors in her journal on a regular basis. She distributed a survey that consisted of eight Likert scale questions (1 being least agreeing to a statement while 5 being strongly agreeing to a statement) and one open-ended question to her students toward the end of quarter. Numerical data were analyzed using descriptive statistics. Qualitative text data were analyzed using content analysis.

The data from the observations and instructor journaling indicated that the course redesign fostered student learning and reduced the distance between native speakers and foreign students. The instructor often heard the following statements from students during discussions on their team project: "Interesting!! I didn't know that you spent so much time in schools;" "I heard about those things happening in that country. Now, the information becomes real to me when I heard from my classmates describing their experiences with their education in their countries." It was also observed that foreign students become valuable resources for the team project rather than being viewed as a burden in the author's previous courses. Inquiry, clarifying information among students, smiling, and aha moments often were observed when student working on their team projects. Several students clearly told the author that they greatly enjoyed the team project assignment and that the assignment opened their eyes to different education systems in the world.

The student survey data also indicated positive impact of the course redesign on student learning. Fifteen out of twenty one students responded to the survey. The majority of the students agreed that the project helped them better understand education systems of other countries, better understand diverse cultures, and better communicate with people from diverse backgrounds. The team project also increased their knowledge of some countries/cultures, confidence of working with people from different countries, and appreciation of other cultures as well as their own cultures and backgrounds. The table 1 below showed the impact of the course redesign (team research project) on student learning.

Table 1. Impact of the Course Redesign on Student Learning

	Mean
1. The Diversity project in ETEC543 helped me better understand education systems of other countries.	4.55
2. The Diversity project in ETEC543 helped me better understand diverse cultures.	4.64
3. The Diversity project in ETEC543 helped me better communicate with people from diverse backgrounds.	4.09
4. The Diversity project in ETEC543 increased my knowledge of some countries and cultures.	3.82
5. The Diversity project in ETEC543 increased my confidence of working with people from different countries.	4.00
6. The Diversity project in ETEC543 increased my appreciation of other cultures.	4.45
7. The Diversity project in ETEC543 increased my appreciation of my own culture and background.	4.82
8. I greatly enjoyed working on the diversity project in ETEC543.	4.18

The open-ended question asked students to describe what they liked and disliked about the team research project. Below were quotations from some of the students:

“I liked to work with classmates. It has improved my ability how I can collaborate and communicate with teammates appropriately. Also, I could learn about educational systems of Taiwan and Saudi Arabia. And I earned a lot through this diversity work, but it was a bit stressful and overwhelming to me because teammates were not cooperative.”

“I like the interaction with had with people from different backgrounds. It was interesting to learn how different my educational background is from others.”

“What I liked most about this project was getting to know another person in the group and the ability of asking them questions that I wanted to learn without appearing to be nosy. One thing that I disliked was the hardship of accommodating everyones schedules to complete the project.”

Although the results indicated that the course redesign (team research project) had a positive impact on student learning, a team exhibited some challenges working together. Challenges expressed by the students included, but were not limited to: (1) foreign students were not responsive, and the team project was delayed; (2) foreign students’ English was not proficient enough for communication; (3) native speakers dropped the ball at the last moment.

3. CONCLUSION

The project incorporated project-based learning, Google Docs, and instructional strategies fostering diversity and critical thinking in redesigning a course. It had several advantages based on students’ input: the students (1) better understood education systems of other countries and diverse cultures, (2) better communicated with people from diverse backgrounds, (3) enhanced their knowledge of some countries/cultures, (4) increased their confidence of working with people from different countries, and (5) had a greater appreciation of other cultures as well as their own cultures and backgrounds. The project is limited because the student survey data relied on student self reports. In addition, the project lasted only for 10 weeks. Repeating the research in several quarters (semesters) and collecting non-student-self-report data will be beneficial and strengthen the current study.

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EXPLORING SOCIAL EQUITY ASPECTS IN INTEGRATING TECHNOLOGY IN PRIMARY MATHEMATICS EDUCATION

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ABSTRACT

This research focus on aspects of equity related to the introduction of using technology in classrooms. Technology has the potential to support mathematics pedagogy with visual representations and offer modelling and simulation facilities, increasing the creativity of the learning and teaching processes (Kaput, Ness, & Hoyles, 2008; Stoilescu 2008). Introducing technology in mathematics is not always helpful. Sometimes it improves the instruction and equity and sometimes it increase inequity and the earning knowledge gap. For instance, by introducing ICT in classrooms, mathematics pedagogy is changed, as the devices involved can be used to explain, to test, and to give feedback to students. This is because ICT offers an environment that allows a dynamic context and lets instruction become more engaging and interactive. As well, technology could be used in non-creative ways in which students are only kept busy so that the knowledge accumulated is at minimum. This qualitative research study will select four exemplary teachers to discuss ways of improving technology in classrooms. Situations where introducing technology in mathematics classrooms will be discusses to see their relevance and whether they are helpful and fair or not.

KEYWORDS

Computer Technology in Classrooms; Equity and Technology, Mathematics and Technology, Teacher Education.

1. INTRODUCTION

There is increasing concern in Australia (Atweh, 2011; Valero & Zevenbergen, 2004) and internationally (Apple, 1992; Ernest, 2002) over questions of equity involved in integrating ICT into mathematics education. This project will investigate dimensions of equity (gender, ethnicity, socio-economic status, ability) involved in integrating ICT in primary mathematics education of four caring teachers from two Greater Western Sydney (GWS) primary schools using qualitative research (case studies) methodologies, in order to identify challenges as well as the productive potential of diverse contexts. There are two major aims to this study. The first is to investigate primary teachers' views on the importance of using digital technologies in mathematics education in relation to social equity. The second is to explore the equity challenges when implementing ICT technologies in mathematics classrooms in multicultural, low socioeconomic status schools in Greater Western Sydney. Through interviews, observations in classrooms and documentary analysis the project will: 1)- Analyze teachers' views of integrating technology in mathematics education to reveal their challenges and professional needs;2) Document existing ways of using digital technologies in mathematics education classrooms in a multicultural school with low economics status to identify strategies and potential;3) Identify how gender, ethnicity, low SES, ability intersects with patterns of integrating technology in primary school contexts;4) Identify systemic aspects and structures, including policies, pedagogies and practices that shape processes of inclusion.

2. BODY OF PAPER

The significance of bringing relevant pedagogy into classrooms has been appraised by numerous researchers (Ladson-Billings, 1995; Apple 1992), and its principles were largely accepted by educators to help them guide in achieving an adequate balance between wellbeing and knowledge for all of participants of the

educational processes. However there are numerous barriers in implementing effective pedagogies in mathematics education as this area of education was traditionally oriented toward intellectual elite. As Ernest (2004) put it: “Many people have come to feel that mathematics is cold, hard, uncaring, impersonal, rule-driven, fixed and stereotypically masculine. Evidently, there is a strong parallel between the absolutist conception of mathematics, the negative popular view of mathematics, and separated values” (para. 38). . Presently, due to the increasing number of years of schooling, mathematics education no longer targets just the intellectual elite. In addition, the quantity and complexity of mathematical problems have increased in real life and in practical settings. At the same time, technological needs in everyday life have grown exponentially. However, there are few studies that focus on the equity aspects of integrating ICT in mathematics classrooms.

Technology has the potential to support mathematics pedagogy with visual representations and offer modelling and simulation facilities, increasing the creativity of the learning and teaching processes (Kaput, Ness, & Hoyles, 2008; Stoilescu 2008, under review). By introducing ICT in classrooms, mathematics pedagogy is changed, as the devices involved can be used to explain, to test, and to give feedback to students. This is because ICT offers an environment that allows a dynamic context and lets instruction become more engaging and interactive (Kaput, Hoyles, & Noss, 2008).

In terms of socio-economic status and pedagogy Kaput et al. (2008) asserted that “changes in representational infrastructure are intimately linked to learnability and to the democratization of the intellectual power” (p. 713). Introducing technology in mathematics education becomes essential to include students from diverse backgrounds. Several studies revealed the importance of equity in mathematics education (Gutstein, 2006) and that there is a need to mentor mathematics teachers support integrating ICT in an equitable way (Gates & Jorgensen 2009). The integration of technology in studying mathematics reveals important multiple facets of equity to access and instructions (Atweh, 2011; Forgasz, 2009; Stoilescu, 2009): curriculum, teacher professional development, educational policies, textbooks, and ICT tools. In the last years, various aspects of equity in curricula, textbooks, and technologies in mathematics classrooms were explored (Gutstein, 2006; Herbel-Eisenmann, 2007; Tutak, Bondy, & Adams, 2011). However, the number of studies exploring aspects of equity in integrating technology in mathematics education remains very low, as this topic requires adequate expertise and attitude in all three main research areas: mathematics education, social justice, and educational technology.

Actual practices of equity of integrating ICT in mathematics classrooms have received mixed reviews. On the one hand, researchers saw integrating technology as an opportunity to make mathematics more accessible for various social categories of students (Kaput, Hegedus & Lesh., 2007; Aggarwal, 2011). On the other hand, studies have shown that ICT can also amplify social pre-existing inequities (Apple, 1992; Gates & Jorgensen. 2009) in mathematics classrooms. By way of example, researchers found that often teachers from poor neighbourhood schools are not adequately trained and are often marginalized because they are minorities themselves (Atweh, 2011). Becker and Ravitz (2001) revealed that the quality and the nature of instruction received by educational technology are affected by students’ socioeconomic status. In mathematics instruction, classrooms from poor schools received ICT instruction more as drill-and-practice, and not as a way to improve higher-order thinking skills. In addition, technology was introduced only in a perfunctory way, without adequately adapting ICT to specific class requirements. Other studies showed that ICT in poor communities was often obsolete or adequate educational software was missing from these schools (Becker & Ravitz, 2001). On the contrary, some research shows that often, in affluent schools, ICT used in classrooms has resourceful roles and is creatively used by educators and students. For instance, Jorgensen, Gates and Roper (2013) explained that, in affluent neighbourhoods, students experience and engage in mathematical activities with habits that had already been shaped during their early socialisation in their families, and this shapes the way they act and value experiences in schools.

Maintaining a façade of objectivity and equity may have a negative impact on teachers’ productivity, causing many conflicts or disappointments; impacts on teachers’ abilities to interact effectively with students, colleagues, and administration; and decrease the probability to see teachers’ desire or ability to stay in a particular school or in teaching, more generally. A major challenge in using ICT in mathematics classrooms is the limited availability of the software and hardware equipment, as the updates require consistent financial commitments. As Jorgensen, Gates and Roper (2013) pointed out, in mathematics classrooms “it is therefore important to consider not only the concepts but also the medium of instruction. In many disadvantaged communities, the clash between the culture of school and the culture of learners contributes significantly to the failure to experience success of many learners” (p. 8).

2.1 Method & Techniques

This study is a qualitative study, and, in particular, multiple case studies (Merriam, 1998). Data will be collected from observations in classrooms, document analysis, and interviews. The case studies involve four teachers from two primary schools. The main criteria for selecting the schools and the teachers are that they represent a community with ethnic diversity and low socio economic status from the Greater Western Sydney. The other important criteria of selecting the teachers are: persistent involvement in school community, being viewed by community as exemplary teachers, experience in teaching in primary schools, positive view toward using technology in classrooms, frequent use of technology in mathematics.

Observations will be collected for a period of approximately two months, at least five hours per week for each teacher. Observations will be done in the classrooms. The role of the technology in place will be discussed. As well, how the technology is used in classrooms will be noticed and how the students and the teachers' interact through ICT and appreciate it. Field notes from observations about the integration of ICT in classrooms will be recorded.

In regard to document analysis, initially stage of analysis will be started by considering curricular documents on primary school mathematics, equity policies, and educational technology curricula from the Department of Education and Training from the New South Wales. During this study, teachers' handouts and digital artefacts will be collected in order to acknowledge teachers' ways of designing mathematics curriculum and ways of using technology in teaching mathematics. Also, some students' assignments and projects will be examined. After these documents will be analyzed, individually discussions with teachers will take place for debriefing. The notes about curriculum in primary school and antipoverty policies in place in the New South Wales will be reviewed and compared with the field notes from observations. The differences, similarities and challenges will be noted and discussed.

The CI obtained already references and recommendations to locate the four caring teachers from the two schools. Next, ethics approvals will be obtained. Each teacher will have two individual interviews designed to explore their attitudes and views about the use of technology in classrooms. The interviews will provide data on the teachers' background and previous educational and technological experiences. Teachers will be asked about their overarching reasons for adopting technology in the class, their opinions about their students, their personal reasons for integrating technology in mathematics, the personal motivation that made them choose to teach at that specific school, and their perspectives on the integration of technology in mathematics classrooms. Also, questions about recent events that were observed in classrooms will included, in order to identify how these events were perceived by them and eventually to discuss eventual differences. The teachers will be asked to reflect on what they thought was specific to equity issues in teaching mathematics with technology. They will be asked to reflect on ways their technology in place and teaching practices of integrating technology in classrooms is suitable or not for their students. Teachers will be asked to reflect on what they perceive their students' expectations are and describe difficulties (coming from SES or gender disadvantages) encountered by their students in classrooms when they tried to integrate technology in the mathematics curriculum. Also, they will be asked to reflect on ways their teaching practices could help or deter their students' efforts. These interviews will be semi-structured. The protocol for each interview will be designed to explore experiences, attitudes, and insights of the teachers. At the end, they will be asked about what could be modified in their approaches in order to improve instruction in mathematics. Their views on integrating technology in mathematic classrooms will be described. In addition the CI will discuss with their teachers their ways of providing justice to see how they actually performed in their classrooms in order, eventually, to compare and explain any differences between teachers' appreciations. Follow-up discussion and debriefing will be carried out with each participant. Interviews will be audiotaped. The time and place will be negotiated with the participants at a mutually convenient time using an informal, semi-structural approach. Several key questions will be asked including:

- What is their opinion about the use of technology in mathematics classrooms
- if and how they use technology in mathematics education in their classrooms?
- What is the social role (if they think it has one) of technology in mathematics education? Is technology neutral? (or) Is technology a factor for equality/inequality in promoting progress in mathematics education?

If the technology influences equity of mathematics education in general:

- How do experience the use of technology in equity in their mathematics classes?

- What are examples when the technology helps students (through social equity)?
- What are examples when the technology negatively affects social equity?
- What cases (positive and negative) can they provide about the use of technology in equitable ways in their classrooms?
- How can they influence with their teaching (positive or negative)? What are the limits?

Data will be collected from interviews and observations will be coded and analysed with NVIVO. For credibility and validity, Lincoln and Guba (1985) recommend pursuing the following main aspects: prolonged engagement, persistent observations, structural corroboration, referential adequacy, member check, and triangulations. Prolonged engagement were attempting to overcome possible distortions presented by the researchers' presence and to test their perceptions, biases as well as those of their participants. By extending my presence in the researched classrooms, teachers will become used to my presence and confident that this study was not critical of their teaching approaches and classroom interactions. Persistent observations will be also used to identify pervasive characteristics from atypical ones in order to eliminate from analysis irrelevant aspects, while continuing to observe key aspects of social equity in technology in teaching mathematics. In particular, observations and interpretations between researchers will be checked to see whether these are consistent with participants' intents.

In this research, triangulation processes is very important. Two distinct types of triangulation recommended by Patton (2005) will be used: data triangulation and triangulation through multiple analysts. For data triangulation, the accuracy of the data will be checked by comparing data from different sources (interviews, meetings, field observations, paper and electronic documents) confirmed each other. For multiple analyst triangulation, the CI will discuss the analysis of data and the findings with research assistants, as they will help him analyze the data or will be asked to co-authored some articles and conferences linked with this research. The accuracy of the data will be analyzed as a preliminary step. As with any qualitative research, the process of analysis will be on-going (Bogdan & Biklen, 2003). The transcripts from initial interviews and observations will be collected. The process of coding will be initiated in order to create a set of codes based on concrete findings.

3. CONCLUSION

There is a need to examine the equity aspects of the locations in which the teachers are positioned, in order to see how they are impacted upon by various subjects and how they impact themselves their ICT choices in students' preparations. Consequently, the discourses in which the integration technology in primary mathematics takes place will be explored in terms of mathematical approaches, technological pedagogical discourses, and equity. An analysis of the discourses that operate in relation to teachers' professional experiences will also be undertaken to develop an understanding from the participants' perspectives the degree of visibility and challenges in digital technological issues in in primary mathematics settings. Foucault's (1997) framework will be applied to explore how power shifts is contextually located and how this persuades on the types of power educators have at different moments and contexts. This project is significant and opportune in the context of Australia's concern about decreasing capabilities in mathematics education and the desire to close the gap between results for low SES students (Cobbold, 2010). Ascertainning whether integrating ICT in mathematical education contexts is perceived as more problematic because of the social construction of technology and mathematics in today's educational context, or whether this apparent objectivity renders educators perceptions as totally insignificant and unproblematic, allowing them to be honest and open about their own challenges, views, would provide a significant discussion to research. Furthermore, it will extend in relation to choosing the technology and the adequate ways of using it. Primary teachers in various situations are required to implement adequate strategies to integrate ICT in mathematics education and equity of implementing ICT in classrooms is essential.

In this case, comparisons, contrasts and links could be developed between the experiences of mathematics education, educational technology and social justice aspects. By drawing on the voices of experienced caring primary teachers living and working in a multicultural Australian community, these much needed case studies of professional experiences of primary mathematics educators will be ascertained. The intersection between social justice, pedagogy in primary mathematics and technology is a timely research niche that

offers many opportunities. More exactly, a foundation on which further critical research may be conducted on linking teaching professional development with social justice issues will be provided. This experience will help the CI attempting further research projects, for instance, conducted via an ARC Discovery Early Career Research Award. Further studies would be conducted on a greater scale in different school contexts and using a variety of ICT opportunities in order to understand educators' challenges and support them with adequate information, perspectives and strategies.

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CHINESE FANTASY NOVEL: EMPIRICAL STUDY ON NEW WORD TEACHING FOR NON-NATIVE LEARNERS

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ABSTRACT

Giving additional learning materials such as Chinese fantasy novel to non-native learners can be strenuous. This study seeks to render empirical support on the usefulness of the use of new words in Chinese fantasy novel to enhance vocabulary learning among the non-native learners of Chinese. In general, the students agreed that they like to learn new words of Chinese fantasy novel with the mean of 4.01. The students agreed that learning new words from Chinese fantasy novel can help them to improve their Mandarin level with a mean of 3.95. Students were also positive on the helpfulness of the use of these Chinese new words in supporting their Mandarin learning. Students agreed that the Chinese new word learning materials were able to support their Mandarin learning with a mean of 3.979. Thus, this will give a hand in ensuring non-native learners might gain positive outcomes in the instruction process. Instructors who are interested in teaching new words from Chinese fantasy novel in specific to support additional learning might be able to get insights from this article.

KEYWORDS

Chinese Fantasy Novel; New Word Teaching; Non-Native Learners; Cognitive Theory; Bloom.

1. INTRODUCTION

Chinese fantasy novels are popular in the internet since the 90's as a new style of novel. Neologisms are especially useful in identifying newness, new phenomena, and cultural background or take on new ideas from the old and original words (Zhang, 2008). The productivity of coin words are generally found in Chinese fantasy novels, especially the web-based novels (Song, 2011). It can be said to be quite a striking feature of today's Chinese new words. These coin words however can be very much cultural bounded (Zhu, 2009; Long, 2011; Bai, 2012; Tang & Jiang, 2011). Vocabulary instruction for the teaching of Chinese as a foreign language has to be systematic and well-planned (Hu, 2010; Yu, 2011). The definitions of different levels of reading ability have rarely been operationalized for reading assessment in China, as well as in other countries teaching Chinese as a second or foreign language, whether it be a high-stakes large-scale test or a classroom assessment (Mi & Hyun, 2014). In order to use Chinese fantasy novel as reading materials for the learning of Chinese as a foreign language, reading support such as online dictionary skill, reading software use and module of teaching this reading skill has to be given to the students (Goh, 2010a; 2010b) prior to the introduction of Chinese fantasy novels in the Chinese classrooms. Students of learning Chinese as a foreign language need to have vocabulary support in the reading process (Goh & Saiful, 2013a; 2013b; Goh, Saiful, Hasiah & Norlina, 2012). The teaching approach has not to be arbitrary but systematic instructional approach has to be employed for effective instruction (Goh, 2013). Cognitive load theory (CLT) (Lee & Kalyuga, 2011) is an instructional theory that starts from the idea that the working memory of the students is limited with respect to the amount of information that students can take. Hence, the instructors who are keen to introduce new words from Chinese fantasy novel have to take specific attention in this aspect to yield positive gain of the new word instruction.

2. LITERATURE REVIEW

Making sure that vocabulary acquisition occurs in the new word instruction is something that should not be ignorable. The cognitive domain involves knowledge and the development of intellectual skills. In vocabulary acquisition from the cognitive view ropes in the knowledge pertaining to the new word, as well as the intellectual understanding of how the new word can be used. Cognitive theories that related to vocabulary instruction thus have to be comprehended. Learning theory cannot be apart from motivational learning theory. Non-native learners have to be strongly motivated in ensuring that they are keen in vocabulary acquisition process (Lee & Wang, 2013). For new word cognitive instruction theory in Chinese fantasy novel, this is typically relevant. Studies have explored the effects of the potentially inefficient strategy on motivation (Platten, 2010). Another important related theory is affective theory in learning (Yan, 2013). Instructors have to understand the cognitive factor related to the affective aspect for effective vocabulary instruction. Second language vocabulary learning strategies have to be arranged in accordance to affective state of the learners (Zhang & Li, 2011).

3. METHODOLOGY

The study was carried out with 210 MARA university students as participants. Data collected from the third and fourth semester students of Office Management Faculty. The learning instrument used in this study is a set of self-developed learning materials which encompasses around 70 new words of Chinese fantasy novels. Students accessed these learning materials which are uploaded in a management system called i-learn - <http://i-learn.uitm.edu.my/v2/>. In order to gather students' responses on the usefulness of the use of these learning materials, students were to answer an online questionnaire at https://docs.google.com/forms/d/1MqNMWDqk3swM4voVKedED_jETBnkTWwEt9Rwczv6X8Q/viewform. First stage of the study was instructional phase. The research materials include slides of power point containing seventy Chinese fantasy novel new words. Second phase of the study was the assessment phase. Students were to answer 4 multiple-choice tests as to gauge their cognitive understanding of the new words learned. The purpose is to test students' cognitive understanding of the new words learned.

4. RESULTS

These were the results of respondents during the diploma semester. There were 114 (54.5%) of respondents taking Mandarin level 1 and 96 (45.5%) of respondents taking Mandarin level 2. As a whole, the students agreed that they like to learn new words in Chinese fantasy novel (mean = 4.01). They also agreed that learning Chinese new word in fantasy novel can help them to improve their Mandarin (mean = 3.95). Table below depicted aspects related to the helpfulness of the Chinese new word learning materials to support Mandarin learning. For all the 10 aspects, students were positive on the helpfulness of the use of these Chinese new word learning materials. As a whole, students agreed that the Chinese new word learning materials were able to support their Mandarin learning (mean = 3.979).

Table 1. The helpfulness of the Chinese new word learning materials to support Mandarin learning

No.	Statements	Mean	SD
1	I understand more about Chinese culture.	3.97	0.688
2	I increase Chinese learning motivation.	3.94	0.672
3	I read more in Chinese.	3.93	0.650
4	I improve writing skill.	3.94	0.201
5	I improve reading skill.	3.97	0.851
6	I expand vocabulary amounts.	4.01	0.121
7	I improve learning of Chinese in this course.	4.00	0.491
8	I recognize more Chinese characters.	4.03	0.162
9	I learn vocabulary more independently.	4.00	0.158
10	I carry out wide independent reading on my own.	4.00	0.170

The respondents were from level 1 and level 2. The students of different levels of Mandarin learning might have differing perceptions on the keenness and helpfulness of the use of new word learning materials to support their Mandarin learning. Students of level 1 were keener to learn new word (mean = 3.93) compared to students of level 2 (mean = 3.81). It was also found that students of level 1 were more agreeable ((mean = 4.01)) that learning new word in Chinese fantasy novel can help them to learn Chinese better compared to students from level 2 (mean = 3.90).

Table 2. Group statistics of two level Mandarin Language

Item	Mandarin level	Language	N	Mean	SD	Std. Error Mean
Helpfulness	1		108	4.01	0.588	0.057
	2		91	3.90	0.790	0.083
Keeness	1		108	3.93	0.622	0.060
	2		91	3.81	0.906	0.095

By running t-test, it was found that for both helpfulness ($t = 1.106$, sig. value = $.0270 < 0.05$) and keenness ($t = 1.036$, sig. value = $.0302 < 0.05$), they were significant. These showed that students of level 1 were keener to learn new word in Chinese fantasy novel and agreed that by learning new words in Chinese fantasy novel can assist them to learn Chinese better.

Table 3. t-test for Equality of Means

Item	Equal variances assumes	t	Df.	Sig.(2-tailed)	Mean Difference	Std. Error
Helpfulness		1.106	197	0.0270	0.108	0.098
Keeness		1.036	197	0.0302	0.113	0.109

Students of level 2 were agreeable that the Chinese new words learning materials helped them to understand more about Chinese culture (mean = 4.02) compared to level 1 students (mean = 4.02). It was found significant ($t = -2.042$, sig. value = $.042 < .05$).

Table 4. Group statistics

Item	Gender	N	Mean	SD	Std. Error Mean
Understand more about Chinese culture	1	108	3.86	0.538	0.052
	2	91	4.05	0.794	0.083

Table 5. t-test for Equality of Means

Item	Equal variances assumes	t	Df.	Sig.(2-tailed)
Understand more about Chinese culture		-2.042	197	0.042

5. DISCUSSION

The results of the questionnaires showed that students were affirmative on the use of new word learning materials in the Chinese fantasy novel to support their Chinese learning. It is agreeable with the view of Hu (2010) that various Chinese learning materials can be utilized to support Chinese vocabulary acquisition and expansion. However, the results of the test data showed students' new word cognitive of Chinese fantasy novel was above average (64.27%). Although this figure cannot be considered low, however, it implies that various learning activities using new word learning materials can be utilized in order to enhance the cognitive level of the learned new words.

Furthermore, the findings showed that students of level 1 were keener to learn new words in Chinese fantasy novel. Hence the use of new words in Chinese fantasy novel can be introduced in level 1. The result of this study also revealed that students of level 1 found that learning new word in Chinese fantasy novel was more helpful compared to level 2 students. Hence instructors have to find ways to improve the instruction process in order to make the learning materials more attractive and appealing to the level 2 students. All of these activities are designed and can be utilized as to encourage the students to manipulate the information and vocabulary gleaned from the learning materials. Focusing on meaning and doing something with the new words learned cognitively will certainly help reinforce vocabulary acquisition. Learner tracking is another area for the betterment of this study. We need to look more closely, as a step toward the use of students to the improvements of their learning outcomes. The IP (Internet protocol) numbers of learners' most often used computers and begin to track the learning tracking can assist us to understand the relationships between the active use of learning materials and the support of the learning gains. Better testing is another aspect that we can do for the betterment of the study. There appears to be no suitable standard instrument available for assessing gains in additional vocabulary acquisition. We plan to test changes in levels of partial vocabulary knowledge; measures that are sensitive to incremental growth may register acquisition at the level and pace of learners' self-study. Since the research finding was affirmative that in the learning of new word in Chinese fantasy novel, students were able to learn Chinese culture as well. Hence for the improvement of the learning materials as to render more comprehensive of Chinese culture, it is recommended that additional and systematic development and enriching of learning materials can be done. These include the introduction and presentation of Chinese weapons, Chinese traditional building, Chinese traditional costume, and etc.

6. CONCLUSION

The major objective in discussing the theories of new word acquisition among non-native learners is to come out with a theoretical framework to support the use of new word in Chinese fantasy novel in the teaching of Chinese as a foreign language (see figure below). Thus, this will give a hand in ensuring non-native learners might gain positive outcomes in the instruction process. Instructors who are interested in expanding the vocabulary command to support additional learning as well as new word cognitive instruction might be able to get insights from this article. Many supplementary tools can be used along to make use of the instructional materials in a more positive manner. Instructor can use pinyin text to speech system (Goh, Saiful Nizam, Aileen Farida, & Mohd Suhaimi, 2013), for instance, to practice the sentences they have made using new word that they have learned in these instructional materials. This may espouse their productive learning skills such as speaking instead of enhancing their receptive skill through reading merely. Studies have to be carried out on the effectiveness for usability evaluation (Norlina, Hasiah, Goh & Yau'Mee, 2013). Hence, quantitative study on the usability of the instructional materials in supporting new word cognitive instruction has to be implemented. It serves as guidance for effective and systematic additional vocabulary instruction to support non-native learners in expanding their learning capacity.

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BUILDING OF A DISASTER RECOVERY FRAMEWORK FOR E-LEARNING ENVIRONMENT USING PRIVATE CLOUD COLLABORATION

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ABSTRACT

In this research, we have built a framework of disaster recovery such as against earthquake, tsunami disaster and a heavy floods for e-Learning environment. Especially, our proposed framework is based on private cloud collaboration. We build a prototype system based on IaaS architecture, and this prototype system is constructed by several private cloud fabrics. These private cloud fabrics are operated as a large private cloud fabric. The distributed storage system builds on each private cloud fabric; that is handled almost like same block device. For LMS (Learning Management System) to work, we need to boot up virtual machines which installed LMS. The virtual disk images of each virtual machines are stored into the distributed storage system. The distributed storage system will be able to keep running as a large file system. We can control the virtual machines' status and virtual machines positioning on the private cloud fabrics by the private cloud collaboration controller with a smartphone communication. The private cloud collaboration controller is able to grasp disaster alert notifications. The disaster alert notification can be caught by a cellphone carrier via smartphone function. We think that our private cloud collaboration framework can continue working for e-Learning environment under the post-disaster situation. In this paper, we show our private cloud collaboration framework. And next, we show the experimental results on the prototype configuration.

KEYWORDS

Disaster Recovery, e-Learning Environment, Private Cloud Collaboration, Disaster Alert Notification

1. INTRODUCTION

On March 11, 2011, a major earthquake attacked to Eastern Japan. Especially, the east coast of Eastern Japan had severely damaged by the tsunami attacking. In Shikoku area including our universities in Western Japan, it is predicted that Nankai earthquake will happen in the near future. There is an interval theory that Nankai earthquake occurs every 100 to 150 years on the Pacific side in Western Japan. It is expected to have Nankai earthquake in the next 30 years, and its occurrence rate is between 70% and 80%. We have to prepare the disaster for the major earthquake.

In addition, we have a lot of experience which is the record rainfall in a short period last few years. There are not uncommon story which the huge flood is caused by a short period rainfall. Especially, we had a heavy record rainfall and heavy floods, it attacked to Western Japan area at August 2014. We had heavy damage by these disaster. It is no longer special for us to suffer from disasters very often. We think the preparing for the disaster is very important for keeping our life, also it is very important for the information system's field.

On the other hand, the informatization of educational environment on universities is rapidly progressed by evolutionary information technology in Japan. Current educational environment cannot be realized without educational assistance system, such as LMS (Learning Management System), learning/teaching ePortfolio and so on. The learning history of students is stored by these educational assistance system. The fact is that awareness of the importance of learning data such as learning histories and teaching histories. The assistance systems are important same as learning data. Today's educational environment on universities depends on educational assistance system with information technology infrastructure. If the educational assistance system including students learning history is lost by these disasters, we think it become equivalent to lost sustainability for educational activity.

In addition, an integrated authentication framework of inter-organization is used to share the course materials. For example, Shibboleth Federations such as GakuNin [1] is used to authenticate other organization's user for sharing the course materials within consortium of universities. Today's universities educational activity cannot continue smoothly without those learning data and assistance system.

We can find applications for constructing information system infrastructure by the private cloud technology for academic field such as Yokoyama's study [2]. The target of these study is to provide massively parallel computing such as Apache Hadoop environment [3]. Their aims are to provide effective use of computer hardware resources, and providing a centralized control of computer hardware resources. It is different purpose for disaster recovery and the reduction of damage by large-scale disasters.

In this research, we have built a framework of disaster recovery from large-scale disaster such as earthquake and tsunami for e-Learning environment. We build a private cloud computing environment based on IaaS (Infrastructure as a Service) technology, and our target is to build the private cloud collaboration framework. This private cloud environment and private cloud collaboration framework are constructed from any private cloud fabrics with the distributed storage system into several organizations. The Learning Management System such as Moodle [4] build on several private cloud fabrics. Each VM (Virtual Machine) has a LMS and the related data with a SQL database. General IaaS platform such as Linux KVM (Kernel-based Virtual Machine) [5] has a live-migration function with network shared storage and Virtual Machine Manager [6]. General network shared storage is constructed by iSCSI, NFS and usual network attached storage system. These network shared storage systems are bound to any physical storages on the each organizations. Therefore, it is difficult to do the live-migration of VMs between inter-organizations.

Our prototype platform is built with distributed storage system and KVM based IaaS architecture on a lot of usual server machines with network interfaces. It is able to handle many VMs including LMS and the data with enough redundancy. And, this prototype platform will operate inter-organizations. Thus, our prototype platform will be able to operate integrative each organization's private cloud fabric. If one organization's e-Learning environment on the private fabric is lost by some disaster, it will be able to keep running same environment on other organizations environment. In addition, our prototype platform can get emergency earthquake alert by smartphone via cell-phone carrier in Japan. Japanese cell-phone carrier is able to send emergency alert message when major earthquake generated cooperating with Japan Meteorological Agency. Our prototype platform make live-migration function when earthquake alert grasped.

In this paper, we propose a private cloud collaboration framework between private cloud fabrics on several organizations, and we show a configuration of the prototype system. And, we show the results of experimental use and examine these results.

2. ASSISTING THE DISASTER RECOVERY FOR LMS

In this section, we describe the private cloud collaboration framework for e-Learning environment. Especially, the purpose of this framework is a disaster recovery for LMS and to keep running LMS including related data.

Figure 1. shows a proposed framework of disaster recovery assistance for e-Learning environment. Each organization such as university has own private cloud fabric. Own private cloud fabric has several node machines at least four machines to get enough fabric's redundancy. Each node hardware does not independent other node hardware on the same private cloud fabric. The computing resources and the data store resources are provided via VMs, and the resources are changed adaptively by the request from the administrators. The VM can migrate between other private cloud fabrics, and it is able to continue to keep running. A live migration function needs a shared file system to process the VM's live-migration. The distributed storage system supplied by Sheepdog Project [7] does not have meta-data server, it means this distributed storage system does not have single point of failure. Because, this distributed storage model is the pure distribution architecture.

Each private cloud fabric has private cloud collaboration controller. A private cloud collaboration controller is constructed live-migration function with customized smartphone and Libvirt Virtualization Toolkit. Today's general smartphone such as Android has a function which get the earthquake alert notification such as ETWS (Earthquake and Tsunami Warning System) [8].

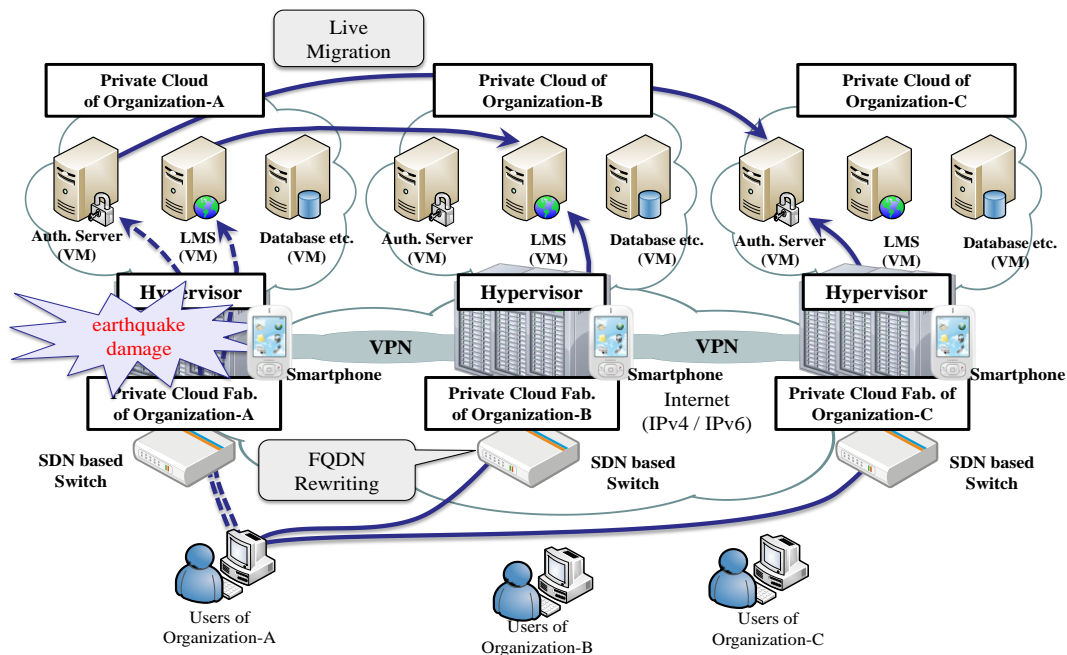


Figure 1. Framework of disaster recovery for e-Learning environment

The private cloud controller which received alert notification makes live-migration command for controlled VMs. We apply IP address rewriting after VMs live-migration function by Software Defined Network based switches, and FQDN (Fully Qualified Domain Name) is rewritten by the private cloud controller triggered this operation. As a result, we think we can assist to provide this inter-cloud framework against the disasters for e-Learning environment.

3. SYSTEM CONFIGURATION

This section describes a system configuration of prototype system which based on our disaster recovery framework. The configuration of prototype system is shown in Figure 2.

This prototype system has four components. The first one of the components is the node cluster for an Infrastructure as a Service function built by multiple node machines. This is a core component of our prototype system. There are constructed by eight node machines as shown node1 to node8. The cluster which is constructed from node1 to node4 is included same private cloud fabric. The other cluster which is constructed from node5 to node8 is included other same private cloud fabric. These private cloud fabrics are placed different organization physically. The node machine which is organized by private cloud fabric is based on usual Intel architecture including three gigabit network interfaces. Each node has the function of KVM hypervisor such as virtualization API and Sheepdog distributed storage API. Each node can be used for the VM execution infrastructure, and it is also to use the composing element of Sheepdog distributed storage system. As a result, it is realized sharing the hardware resources to use VM executing infrastructure, and it is implemented a reliability and a scalability of the storage.

The second component is Layer 2 VPN connection. Layer2 VPN such as EtherIP technology makes connection between both private cloud fabrics. And, the IPsec technology is used to make a secure tunnel connection for Layer2 VPN. As a result, both private cloud fabrics are organized same cluster logically.

The third component is a SDN (Software Defined Network) controller based on OpenFlow architecture [9]. These nodes which compose the VM execution infrastructure have the function of Open Flow switch. This function is used for making optimum path dynamically between several private cloud fabrics.

The fourth component is the private cloud collaboration controller. This cloud collaboration controller has functions, there are catching earthquake alert notification via cell-phone carrier using smartphone function. Then, cloud collaboration controller makes live-migration command for target node machine, and sending

command to the target node machine. And the private cloud collaboration controller has each VMs status on private cloud fabrics, it was caught from Libvirt Virtualization Toolkit and Virtual Machine Manager. When the private cloud collaboration controller makes live-migration command to target VMs, it was planned adaptively based on managed VMs status. As a result, any alert system of earthquake will control VMs live-migration and saving the learning history via Libvirt interface on this prototype system.

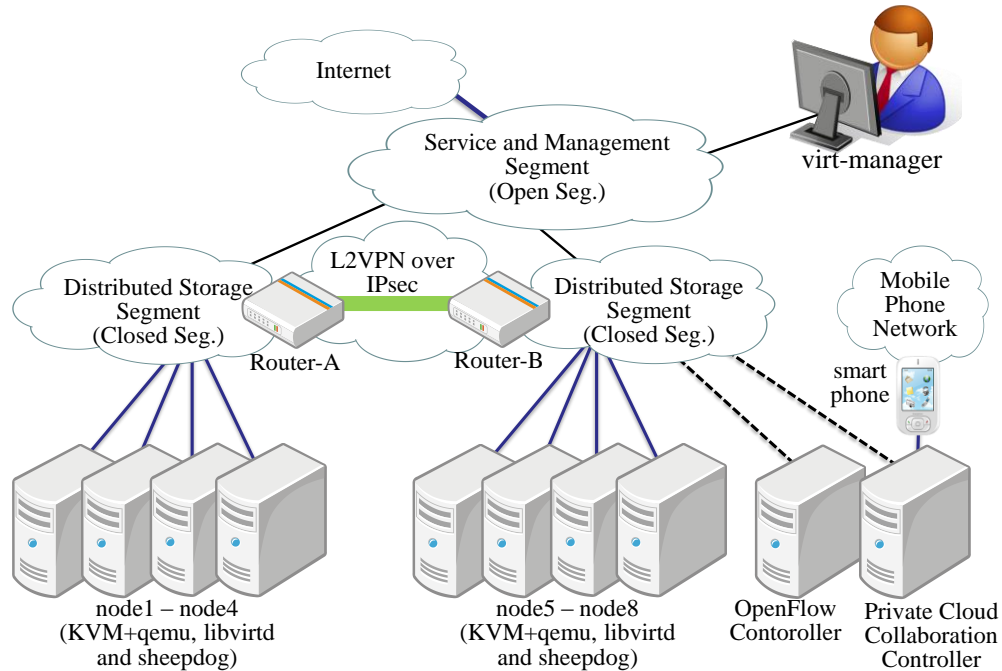


Figure 2. The configuration of prototype system

4. EXPERIMENTAL USE AND RESULTS

This framework system was tested to confirm its effectiveness. We made prototype system for this experimental use. Table 1 shows the specification of the private cloud node machine and the cloud collaboration controller.

Table 1. Specification of the private cloud node machine and the cloud collaboration controller

CPU Specification	AMD Opteron 3250HE (Quad Core)
System Memory Capacity	16.0Gbytes
HDD Capacity	250Gbytes with SATA600 interface
Operating System	Ubuntu Server 14.04.1 LTS 64bit ed.

We made the virtual disk images and virtual machines on the private cloud node machine. And several VMs was installed LMS such as Moodle. Each size of the virtual disk images is 10GB, and each size of allocated VM's memory is 4GB on this experimental use. The prototype of the private cloud fabrics are constructed by eight node machines, and each node hardware has 250Gbytes capacity HDD. The total amount of physical HDD capacity is about 2.0Tbytes. Each clustered node uses about 4Gbytes capacities for the hypervisor function with a base operating system. We think this amount is ignorable small capacity. Because, the distributed storage system have to use triple redundancy function for this test. Therefore, we can use about 700Mbytes storage capacity with enough redundancy. The total capacity of the distributed storage system can extend capacity to add other node machines, or exchange to larger HDDs, and taking both solutions. We can take enough scalability and redundancy by this distributed storage system.

We tried to do a live-migration on our prototype system. We make the test with two cases. One of the case is to do live-migration in the same private cloud fabric. This case is targeted making live-migration in same private cloud fabric. The other one is to do live-migration between private cloud fabrics. This case is targeted making live-migration for inter-cloud situation.

Table 2. Time of live migration

Same private cloud fabric	27.3 sec
Inter private cloud fabrics	28.4 sec

Table 2. shows the time of live-migration for experimental usage. We used the operate VM's live-migration by the interface of Virtual Machine Manager triggered from cloud collaboration controller. The time of live-migration for same private cloud fabric is needed 27.3 seconds. On the other hand, the time of live-migration for inter-private cloud fabrics is needed 28.4 seconds. Each private fabric is connected with Layer2 VPN connection. We think that both experimental result is enough live-migration time for disaster reduction of provided VMs. And, we could get a complete successful result with active condition.

In addition, the live-migration of these experimental use is operated by the cloud collaboration controller, and this live-migration function was triggered by customized Android based smartphone. We think this experimental use is pretty good, the time requirement for VMs migrating was a short period. However, the results were getting under the initial condition. The VM which are made heavy use of LMS has large size of virtual disk image. Therefore, the time of live-migration will need more than initial condition. We think we have to make the experimental use under the actual condition.

5. CONCLUSION

In this paper, we proposed a framework of disaster recovery for e-Learning environment. Especially, we described an assistance to use our proposed framework, and we show the importance of an against the earthquake and tsunami disaster for e-Learning environment. We built the prototype system based on our proposed framework, and we described the results of experimental use and examine.

For the future, we are going to implement our disaster recovery framework on the cloud computing orchestration framework such as OpenStack [10]. And, we are going to try to experiment confirming its effectiveness under the inter-organization environment with multipoint organizations. In addition, we think it is needed reconfiguring an OpenFlow controlling method to become shortened for live-migration time.

ACKNOWLEDGEMENT

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- [6] Virtual Machine Manager Official Web site, <http://virt-manager.org/>
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- [10] OpenStack Official Web site, <http://www.openstack.org/>

Reflection Papers

STOIC BEHAVIOR HYPOTHESIS IN HINT SEEKING AND DEVELOPMENT OF REVERSI LEARNING ENVIRONMENT AS WORK BENCH FOR INVESTIGATION

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ABSTRACT

Tutoring systems provide students with various types of on-demand and context-sensitive hints. Students are required to consciously adapt their help-seeking behavior, proactively seek help in some situations, and solve problems independently without supports in other situations. We define the latter behavior as stoic behavior in hint seeking. In this paper, we propose the “Stoic Behavior Hypothesis,” which posits that withholding hints achieves large learning outcomes. We consider this hypothesis from four perspectives: assistance dilemma, cognitive disuse atrophy, cognitive load theory, and goal achievement theory. In the latter part, we propose an experimental environment for investigating the stoic behavior hypothesis.

KEYWORDS

Hint seeking, Stoic behavior, Assistance dilemma, Disuse atrophy, Cognitive load theory, Goal achievement theory.

1. INTRODUCTION

Interactivity has become a crucial element of intelligent tutoring systems (Shute, 2008). Tutoring systems provide students with various types of on-demand and context-sensitive hints. At any stage of their learning, students can request computer-based assistance or tackle the problem independently. The nature of students’ help seeking is crucial in understanding their rational learning behavior. In deciding whether to accept or decline help, students must monitor their own cognitive states and regulate their own behavior. In this sense, help seeking is related to meta-cognitive activities.

Help seeking is generally considered to maximize learning gains, but rational help-seeking behavior might also promote the acquisition of meta-cognitive skills. Several researchers have already constructed learning environments that teach meta-cognitive activities through help-seeking behavior (Roll, et al., 2011). In the initial decade of cognitive tutor development, it was optimistically proposed that students recognize their assistance needs more accurately than tutoring systems. However, according to empirical studies on students’ meta-cognitive capabilities, students are less sophisticated at evaluating their learning needs than originally thought. Indeed, numerous studies have shown that students frequently adopt irrational behaviors such as “hint abuse,” in which they request more help than required (Aleven, et al., 2000). They often demanded maximum hints, that is, requested direct answers to solvable questions. The opposite case is “hint avoidance” in which students refuse help when genuinely needed (Aleven, et al., 2004).

In the early history of computer supported learning, rich and thorough assistance appeared to benefit learning progress. More recently, however, students have been required to control their help-seeking behavior, proactively seeking help when required, but declining help and solving problems independently when not required. We define the latter behavior as stoic behavior in hint seeking.

In this paper, we propose the “Stoic Behavior Hypothesis,” which posits that withholding of hints greatly facilitates learning in certain cases. We view the hypothesis from four perspectives: assistance dilemma, cognitive disuse atrophy, cognitive load theory, and goal achievement theory. The latter part of the paper proposes an experimental environment for investigating the stoic behavior hypothesis.

2. FOUR PERSPECTIVES

2.1 Assistance Dilemma Perspective

The assistance dilemma issue is a critical consideration in computer learning support. Koedinger and Alevan (2007) posed a crucial question: how should learning environments balance assistance and withholding in order to optimize the learning process? While high assistance provides useful scaffolding that sometimes facilitates learning, it also elicits superficial responses without consideration. On the other hand, low assistance encourages self-learning in students, but may introduce enormous errors and sometimes impedes effective learning. To solve this dilemma, the support levels in tutoring systems must be adaptively controlled. The assistance dilemma is regarded as a primary problem in recent intelligent tutoring systems with high interactivity.

Much of help information promotes students' problem solving in the learning phase by reducing errors and preventing time-consuming trial and error behavior. However, such high assistance does not necessarily correlate with high learning gains. This discrepancy may result from the duality of cognitive processing, i.e., task performance and learning require different cognitive activities (Sweller, 1988). According to the assistance dilemma perspective, reduced assistance promotes learning under certain circumstances. Stoic behavior is expected to increase learning effects, even while incurring a partial loss of problem solving performance.

2.2 Cognitive Disuse Atrophy Perspective

The stoic behavior hypothesis was also motivated by human factor studies on automated systems. Automated systems are valuable supplements that greatly enhance human abilities in a range of working environments (Parasuraman & Riley, 1997). However, the convenience of such systems has negatively impacted some aspects of human society. A majority of people may already be experiencing the effects of these technologies. For example, daily usage of car navigation systems and word processors with spell check software remove the need to memorize maps and word spellings, respectively. Consequently, these everyday skills may be lost. Human factor studies have reported that the continuous use of automated systems decreases users' manipulation abilities (Sarter & Woods, 200). More seriously, complacency induced by automated device use has caused aircraft accidents (Wiener & Curry, 1980).

Miwa and Terai have proposed a concept called cognitive disuse atrophy to describe the loss of cognitive ability by lack of use (Miwa & Terai, 2014). The term "disuse atrophy" is generally applied to physical body atrophy, such as muscle wasting. Muscles that are no longer used slowly weaken. The body can also become weakened by continuous physical support that minimizes its use. We extend the bodily concept of disuse atrophy to cognitive abilities. Automated systems provide extremely high levels of support during problem solving tasks. Cognitive disuse atrophy occurs when performance skills and knowledge are diminished or lost under such assistance, even when a task is performed well. Maintaining control and providing less excessive help may be important for skill acquisition and learning knowledge, implying the validity of stoic behavior in hint seeking.

2.3 Cognitive Load Theory Perspective

Cognitive load theory has provided informative perspectives for designing learning environments constrained by cognitive architecture (Sweller, 1988). The cognitive load theory distinguishes three types of cognitive loads: intrinsic, extraneous, and germane (Sweller, van Merriënboer, & Paas, 1998). The intrinsic load is the basic cognitive load required to perform a task. The intrinsic load increases with increasing difficulty of a task and decreasing expertise of the performer. The extraneous load is the wasted cognitive load that is unrelated to learning activities, and is reluctantly processed. One source of extraneous load is inappropriately designed learning material. Extraneous load can also be increased by lack of related knowledge and problem solving skills. Finally, the germane load is the cognitive load for learning, such as constructing schemata.

Large assistance decreases the extraneous load by presenting related information for problem solving. Many design principles for reducing the extraneous load have been proposed. However, it should be noted that decreasing the extraneous load by providing high-level assistance does not necessarily increase the germane load, because the learning is reduced with superficial problem solving without deliberate thinking. The germane load is presumably increased by the so-called variability effect, a principle by which learners investigate a single topic with multiple representations and under various contexts. The low assistance imposed by stoic behavior may guide students toward reflective thinking and deeper consideration, activating their cognitive efforts in generalizing knowledge and developing schema, thereby increasing their germane load (Paas & van Gog, 2006; Ayres & van Gog, 2009).

2.4 Goal Achievement Theory Perspective

Another theory relevant to the stoic behavior hypothesis is the goal achievement theory (Elliot & Dweck, 1988). This theory has provided theoretical perspectives on the relationships between students' goals and their learning activities. It has also accumulated a vast amount of empirical findings. In goal achievement theory, student goals are divided into mastery and performance goals. The former motivates students to develop their own abilities, whereas the latter motivates them to seek higher social evaluation rather than their own development. In the early stages of goal achievement theory, the mastery goal was found to be superior to the performance goal (Utman, 1997). When learners set up the mastery goal, they become challenged and exhibit higher independence in task performance. Meanwhile, if learners set up the performance goal, they tend not to challenge them to new missions, and abandon tasks when faced with difficult requirements despite being relatively proactive when receiving high evaluation.

The relationship between students' goals and their help-seeking behavior was investigated in a recent study. According to this study, mastery-goal-oriented students tend to seek abstract (i.e., low level) hints first, and then move to more specific (i.e., high level) hints, whereas performance-goal-oriented students consult quick and direct help during the initial stage (Vaessen, Prins, & Jeuring, 2014). This implies that mastery-oriented-students who prefer learning to performing adopt a stoic approach to help seeking, again supporting the stoic behavior hypothesis.

3. REVERSI LEARNING ENVIRONMENT AS WORK BENCH

We are developing a Reversi-based learning environment as a workbench for investigating the stoic behavior hypothesis.

In our learning environment, a participant plays 8 by 8 Reversi games against an opponent computer agent. A partner agent assists the participant in selecting winning moves. Both agents are equipped with a Reversi engine, Edax, that suggests the best move by assessing future states in the game. The partner agent recommends candidate moves among valid squares before the participant makes a move. The competence of each agent is controllable by setting the maximum depth to which Edax searches the future game states. The Edax-incorporated agents are exceptionally competent Reversi players that cannot be defeated by human participants. To lower the strength of the opponent agent to a level compatible with human participants, the agents are set to randomly miss the best move four times in each of the initial, middle, and final stages. Support levels from the partner agent were controlled by presenting the candidate with the best, two, three, or four moves.

To predict the degree of winning by human participants in this environment, we conducted preliminary simulations. The simulated participant randomly selected one of the candidate moves. In the no-support condition, it randomly selected one of the possible moves.

Figure 1 shows the ratio of wins of the simulated participant against the opponent agent in 20 simulated games. The figure implies that the winning ratio of human novices increases as the support level increases. However, the stoic behavior hypothesis predicts that consistently presenting the best move to participants would inhibit their skill mastery compared to mid-range support such as the best two or three moves.

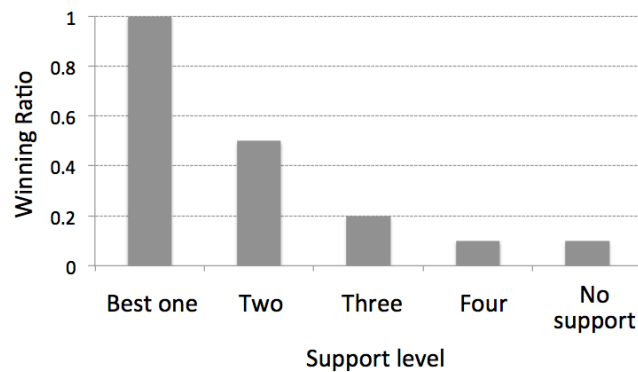


Figure 1. The winning ratio of the simulated participant as a function of support level in 20 preliminary simulations of a Reversi game.

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ALTERNATIVE ASSESSMENT METHODS BASED ON CATEGORIZATIONS, SUPPORTING TECHNOLOGIES, AND A MODEL FOR BETTERMENT

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ABSTRACT

This paper explores alternative assessment methods from the perspective of categorizations. It addresses the technologies that support assessment. It discusses initial, formative, and summative assessment, as well as objective and subjective assessment, and formal and informal assessment. It approaches each category of assessment from the perspective of its goals. It describes the capabilities of the popular technologies that facilitate assessment. It then maps out a strategy for improved self-assessment that is based on the concepts of mathematical modeling and reverse mathematics.

KEYWORDS

Assessment, Technology, Mathematical Modeling, Reverse Mathematics

1. INTRODUCTION

Assessment is an integral component of improved education on the part of faculty, students, and programs. It provides feedback from which those involved can learn and make the necessary changes to enhance the learning environment. Technology can support and facilitate the process of assessment. This paper discusses the delineation of different categorizations of assessment, the technology that can facilitate assessment, and a model based on mathematics concepts that can be easily and directly applied to improve self-assessment.

2. ASSESSMENT

Often assessment is classified by types. The first category is divided into initial, formative, and summative. Initial assessment is the amount of knowledge and skill level exhibited at the beginning of a learning environment. It is used as a benchmark for the progress made in the educational process. Formative assessment is the measurement of progress made along the way. The goal of formative assessment is to provide ongoing feedback that can be used by instructors to improve their teaching and by students to improve their learning. Summative assessment measures the progress made at the end of the class or time period allotted. It is used for evaluation purposes.

It should be noted that among academics there is considerable dialogue as to whether the emphasis should be placed on formative or summative assessment in a college or university level course. This manifests itself in a core course as to the importance or percentages allotted to quizzes, short papers, and interim projects as opposed to that allotted to term papers, cumulative final exams and term projects.

Assessment is also delineated by objective and subjective. The simplest determination is that objective assessment has one answer and subjective more than one. Objective question types include true/false, multiple choice, and multiples response, etc. Subjective questions included extended-response questions and essays.

There is also formal versus informal assessment. Informal assessment is based on observation and discussion whereas formal assessment encourages a written evaluation. Formal assessment uses supporting data on which to base conclusions. The data comes from the tests that have been previously used and statistics such as percentiles or standard scores, often termed standardized measures, against which present outcomes are compared. On the other hand, informal assessments are content and performance based. One might give a student a short story to read and evaluate the numbers of tested words correctly read. A score of five out of ten words might be the result of this type of informal assessment (Weaver, 2013). One can also ask student to do an oral presentation with or without a PowerPoint presentation or develop and present a digital story. Digital storytelling is the use of computer based tools to relay information; the presentation employs some type of multimedia (Robin, 2014).

Independent of the type of assessment used, the goals are similar if not the same. Betterment or improvement is the ultimate target (Palomba & Banta, 1999). Success can be demonstrated in different ways, including higher grades on exams, improved writing skills on papers and essays, and more cogent verbal discussion on the part of the student. From a pedagogical perspective, success of assessment can be gauged by changes in teaching styles, assignments and projects that enhance the outcomes of student learning.

3. TECHNOLOGY

Technological tools have been developed to support evaluation techniques as well. One of the more popular ones is the use of clickers in the classroom. A question can be posed to the class by the professor with multiple choices. Each student has his own personal clicker with possible answers and corresponding numbers or letters, depending on the option choices. With a countdown timer students must respond in a timely fashion not allowing for any outliers such as looking up answers in a book, etc. Following completion of the countdown the results appear with a distribution of percentages across the board per the choices. The professor can assess the class as a whole, and each student can individually assess himself based on his class standings as well. Each clicker has a special ID code and only one ID is code connected to each of the user's account. The mean, median, and mode can be calculated per student compared to that of the class ("Iclicker," 2011).

Blackboard, a popular platform for teaching online, has tools built in for assessment. It is also compatible with the use of clickers. Blackboard offers many options such as uploading exams or assignments that will be graded right away. provided for such a survey. *Blackboard* allows for grading of discussion postings; comments on the part of the instructor can be entered as well. *SafeAssign*, a plagiarism prevention tool, is compatible with *Blackboard* as well. *SafeAssign* is integrated within *Blackboard* and prevents plagiarism by detecting unoriginal content in students' papers within the course. In addition to locating plagiarized material, *SafeAssign* can be used to illustrate proper citations for students. ("Blackboard," 2011).

4. MATHEMATICS

In addition to statistics, the mathematics concepts of reverse mathematics and mathematical modeling can be applied to self-assessment. Generally speaking, mathematical proofs are derived from hypotheses or certain axioms that are accepted as true. Logical implications are formed based on the accepted truth of the axioms. Reverse mathematics seeks to determine which truisms are required to prove theorems (Cobb, 2009).

Another applicable mathematical concept that we need to consider is that of mathematical modeling. Mathematical modeling describes a system or environment or situation using mathematical terminology. Certain assumptions for the model which may or may not be true are made. After the model is developed, the assumptions can be changed, developing a more accurate model. Mathematical modeling is used in different disciplines to help explain an entire environment, to determine the status of its components, and to make predictions ("Business," 2013).

5. SELF-ASSESSMENT

Students are always questioning how to perform better in a course and improve their grades. Initially, one could itemize the characteristics of a successful student: 1) Determine the grade for which to strive (2) Attend all classes (3) Pay attention to lectures/discussion (4) Ask questions in class (5) Visit professor during office hours if extra help is needed (6) Do all homework assignments in a timely fashion (7) Get tutoring from help/learning center (8) Watch videos about subject matter (9) Take practice quizzes to measure self-progress (10) Do extra practice in a lab manual.

Applying the concept of mathematical modeling, we reiterate the fact when designing a self-assessment plan, we usually do so optimistically. Its purpose as with other models is to promote productivity. The assumptions or axioms can be altered for a given conclusion.

6. COURSE ASSESSMENT

Course assessment is either done by an individual faculty member for the class he is teaching or by a group of faculty. If the latter is true, generic guidelines for a rubric may be designed and each professor can tweak them to suit his perspective and class. The rubric developed is dependent on the subject matter as well. We will discuss a basic freshmen mathematics course a basic freshman English course for the sake of comparison. Mathematics is a universal language and not a subjective discipline. An answer to a problem is correct or incorrect. The process of algorithm used in solving a problem is critical as it should work for all problems of the same ilk.

Assessment on the part of the instructor is based on percentage allotment, i.e. how much credit toward the final grade should be based on a midterm or final exam. Our contention is that even if one believes strongly in formative assessment, significant emphasis needs to be placed on a final exam. Quiz grades can let students know which topics they have mastered and what they still need to review, but if one does not retain the information from a basic math course at the end of the semester, it will be difficult to succeed in the next course. Mathematics builds on itself content-wise. Assessment in a basic English course is more subjective. The usual components include comprehension, grammar and expression of thought. Given a specific rubric, the students can achieve higher grades, knowing where to emphasize their work, i.e. on their weaker areas.

Again, consideration has to be given to focusing on summative or formative assessment. Perhaps, the institution wants to see how far the students can improve as it is a basic course. Even if this is true, we believe that a certain benchmark must be achieved by the end of the semester, i.e. summative assessment is important as well. Independent of one's major, a student needs to be able to write in a clear, grammatical way in order to succeed in advanced studies and in a profession.

7. CONCLUSION

The goal of this paper is to bring to light the importance of assessment in the academic environment and some of the technologies that facilitate it. Student self-assessment and rubrics for assessing the performances of students are fundamental for academic success. Assessment can be instituted via quizzes and exams, and via projects that included oral presentations, written papers, PowerPoint presentations and digital storytelling. The approach presented in this paper can only help charter the course for enhanced academic performance.

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WIKI-ENHANCED SCAFFOLDING TO ENCOURAGE STUDENT PARTICIPATION IN A CONTENT AND LANGUAGE INTEGRATED LEARNING (CLIL) CLASSROOM

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ABSTRACT

Given the fact that more and more universities stress on using English as medium to teach students with diverse backgrounds, the content and language integrated learning approach (CLIL) is now frequently introduced to faculty to support effective instruction and learning. Inspired by a CLIL workshop I attended, in which the instructor offered an overview of the framework and guidelines, this reflection paper discusses perceived local challenges in Taiwan (e.g., cultural barriers, limited time and resources for planning and assessment). To resolve these challenges, this paper proposes a scaffolding design of using wikis (in light of their collaborative and evolving nature to support participatory, constructive, and self-directed learning) in a local classroom. The findings from an initial implementation will be discussed in the presentation.

KEYWORDS

CLIL, wikis, participatory learning, collaborative learning, scaffolding

1. BACKGROUND

As a junior faculty member, the author prepared this reflection paper not only for presenting at the ICEduTech conference, but also for sketching an adventurous plan for the incoming teaching. Universities in Taiwan have changed rapidly for the past decade – with a decreasing local student population, universities looked for enrolling more international students. In order to recruit international students, as well as to help all students become globally competitive by exposing them to knowledge with diverse sources and perspectives, offering a certain number of undergraduate and graduate courses in English is necessary. This paper presents how the content and language integrated learning approach (CLIL) provides a framework to support such instructional design, discusses what local challenges faculty faces in classrooms, and proposes the strategies to enhance learning through students' active participation by uses of a wiki in a local CLIL classroom. Table 1 presents a summary of the key ideas.

Given to the institutions' goals of recruitment and students' needs for cognitive development, more and more university faculty members have started teaching in English, mostly as a foreign or the second language, but meanwhile facing a number of challenges. Common challenges include students' difficulties in understanding the content in English, lack of motivation or confidence to enroll in such courses, lack of active participation in discussions, and instructors' lack of support in re-designing instruction to reflect learning difficulties.

Fortunately, my university started introducing the CLIL approach to faculty by offering talks and workshops. CLIL, established in Europe for more than two decades, is "a dual-focused educational approach in which an additional language is used for the learning and teaching of both content and language." (Coyle, Hood, & Marsh, 2010 p.1)" My personal take-away from the one-week intensive workshop offered by an oversee Australian CLIL expert was the three pillars CLIL framework (i.e., content-related learning, language-related learning, and learning styles and skills). Given the good experience with CLIL, which offers instructional considerations for my future teaching in English, I really want to implement it in the local contexts, while some CLIL-related challenges are expected. In light of my research interest in technology

integration, a design to implement wiki-enhanced participatory learning is proposed to address challenges in local CLIL classrooms. The rationales for the design are explained, whereas the actual initial implementation is in an on-going process and the preliminary results will be shared at the presentation.

2. WIKI TO ENHANCE PARTICIPATION

2.1 The CLIL Approach

Responding to the need for instructional scaffolding, the CLIL framework, based on several learning theories, aims to offer faculty guidelines in regard to effective instruction. The learning theories related include Vygotsky's socio-cultural perspective of zone of proximal development, Bloom's taxonomy thinking skills for cognitive engagement, and Mohan's view of acquiring new areas of knowledge as acquiring new areas of language and meaning. In brief, the CLIL approach places an emphasis on content, communication, cognition, as well as culture in learning contexts (Coyle et al., 2010). Despite of the culture element to be interwoven in curriculum, the other three elements are compatible with the *three CLIL pillars* — *content, language, learning skills* — in supporting effective instruction. An example of key strategies for each includes:

2.1.1 Content-Related Learning

To help students become progressive in gaining new knowledge, skills, and understanding, the reading materials require instructors to carefully review, evaluate, select, annotate, and even recreate at the planning stage prior to classes.

2.1.2 Language-Related Learning/ Communication

Interaction through class participation is crucial in CLIL classrooms. Thus, the design of activities should create opportunities for learners to use the target language expressing and creating meanings. In this way, they will gain not only receptive competence (i.e. reading and listening), but also productive competence (i.e. speaking and writing).

2.1.3 Learning Skills/ Cognition

Formative assessment is critical to support development of cognition and learning skills (Coyle et al., 2010) due to the fact that individual students may present various kinds of evidences of learning at different points of time, allowing instructors to provide timely guidance. In CLIL classrooms, other assessment methods to foster the acquisition of learning skills include peer-assessment and self-assessment.

3. CHALLENGES IN LOCAL CONTEXTS

In addition to instructional strategies to guide practice, recent research investigates how CLIL supports students' competence development in both the content and the language areas. A number of empirical research found that students in CLIL classrooms gained in both flexible cognition, receptive linguistic competence (Dalton-Puffer, 2008) and motivation in learning (Burston & Kyprianou, 2009). From the language learning perspective, Lasagabaster and Sierra (2009) state, "Language is best learned in authentic situations and, if traditional FL [foreign language] learning is compared with good CLIL practice, the latter is clearly far ahead (p.13)" in respect to more meaningful opportunities to use the target language in authentic settings.

However, from the content learning perspective, it may be reasonable to question its disadvantages, such as lower student participation and less developed understanding in complex concepts, compared with content taught and learned in one's mother tongue. Here, I list the expected practical challenges when implementing CLIL in local settings (Taiwan), responding to the strategies discussed in the earlier section 2.1 respectively:

3.1 Neither Efficient nor Effective to Recreate Materials (Content Learning)

It could be inefficient and ineffective for instructors to re-create or annotate reading materials for every class given that the task itself is time-consuming and, most importantly, may not meet students' needs. For instance, local undergraduate or graduate classes consist of students with diverse cultural backgrounds and language skills: Although annotated or re-created considerate reading materials may help some students, native speakers and students competent in English do not rely on instructors' help with vocabulary. Meanwhile, re-created materials sometimes sacrifice professionalism in the original written language. Therefore not all students would find re-created materials suitable for learning.

3.2 Cultural Barrier and Lack of Confidence Hinder Class Participation (Language Learning)

While interaction is desired in CLIL settings, the traditional classroom culture of Taiwan (with a tendency of sit and listening) may hinder local students' active participation in activities. According to a recent survey study conducted by Fwu and Wang (2012), a large percentage of Taiwanese college students are unwilling to participate in discussion or asking questions in class. Students are shy and worried about "losing face," according to their study, in regular classroom settings. Not to say when using English, students, especially who have low confidence in their language skills, might hesitate to verbally express their thoughts.

3.3 Less Possible to Track Individuals' Learning Progress (Learning Skills/Cognition)

Although formative assessment plays a critical role in CLIL settings to collect evidences of learning and support personalized learning, to many instructors, this kind of assessments could be challenging. Compared to common practice of mid-term and final exams, or named summative assessments, formative assessments could be difficult for instructors who expect considerable time and effort to track individuals' progress throughout the process, especially for large classes.

4. WIKI STRATEGIES FOR ENHANCING PARTICIPATION IN LOCAL CLIL CLASSROOMS

This section presents an opportunity to meet the challenges of implementing CLIL in local classrooms by integrating *wikis* for enhancing students' participation in all the three aspects. Wikis, known for knowledge co-creation by massive online users on Wikipedia, offer features to support collaboration: from editing, viewing revision history, subscribing changes, to interacting with other contributors. In educational settings, wikis have been implemented for various tasks, including showcases, portfolios, group projects, and collaborative knowledge building. Research shows that students perceived wikis innovative and transformative because the process of collaboration and consensus building were supported via wikis in a timely, dynamic manner (Hemmi, Bayne, & Land, 2009; Rhoades, Friedel, & Morgan, 2009). With appropriate instructional scaffolding, wikis offer a potential to foster the collaborative, constructive, and customized learning environments to transform higher education and meet the challenges of the 21st century education (Lin, 2013). Thus, I will be discussing the ideas for integrating wikis to enhance such learning experiences with the CLIL approach in local classrooms:

How wikis may be used to enhance the CLIL approach and address challenges in local classrooms?

4.1 Invite *Students to Collaboratively Build* or *Customize Learning Materials* for CLIL on Wikis:

Although instructors' effort to re-create materials is desired for content-related learning, I propose that students should be actively involved in this process of customizing materials through collaboration on wikis.

- Instructors post weekly assigned readings to a class wiki, where all students have access to
- Students are invited to co-create the supplementary materials with their peers remotely prior to classes
- Examples of students' created supplementary materials may be, not limited to, content-obligatory vocabulary, content-compatible vocabulary, glossary, key ideas, relevant background knowledge, or discussion questions

The potential benefit of this approach is: by returning the learning responsibility to students, students can become aware of their individual needs and pursue their personal learning goals before attending classes. Individuals' needs and goals may involve several gaps to be identified and bridged in the progression of understanding, such as the gaps between what they are able to understand on their own without resources, with resources, and with peers and instructors' support in class. In brief, inviting students' active participation in customizing CLIL learning materials with their peers on wikis support students' learning in content, language, and meta-cognitive skills.

4.2 Recognize Students' Interests and Strengths from their Wiki Contributions and Integrate into Class Activities Accordingly when Appropriate to Develop Students' Confidence in Participation:

Because interaction is desired in CLIL classroom, helping students overcome the cultural barrier and gain confidence in class participation requires careful scaffolding.

- Students become familiar with content and language because they are expected to read and co-create supplementary materials on wikis prior to classes
- Instructors should spend some time browsing students' wiki contributions to get a sense of students' interests and strengths
- When possible, instructors may adjust class activities in a way that recognizes students' effort, values their input, and encourages individuals to share what they contributed on wikis in class
- Instructors provide a friendly environment, and many opportunities for students with all levels of language skills to interact with others to build positive experiences

Furthermore, to scaffold the culture change and promote active learning, instructors may help students link the importance of contributions on wikis to participation in class. For example, instructors can discuss with students how their knowledge building on wikis and brainstorming in class can help each other learn; or encourage reflecting on what they have learned from their peers and how they have contributed to their peers' learning.

4.3 Require Students to Document Evidences and Reflections on Wikis For Assessments

One possibility for instructors to conduct formative assessments in CLIL classrooms is to require students self-collect learning evidences, reflecting their own progression in language and content-related learning.

- Each student creates a personal wiki page on class wiki, and self-document online and off-line contributions (i.e., activity logs) on personal wiki pages
- Students update their wiki pages frequently and reflect on their own learning progress, if desired, at any time during the semester
- The personal wiki pages are available to instructors, peers, and the public
- Formative assessments: Instructors evaluate individuals' development in language and content competence at certain points of time based on the evidences presented, and provide feedback
- Peer feedback: Students are encouraged to browse others' personal pages and offer constructive feedback by using the discussion feature on wiki

In this way, students are given the opportunity to review their own learning progress over time, as well as to learn from observing peers' effort in learning. Instructors and peers may offer feedback in regard to students' personal development, quality of their contributions to the class, and strategies for language and content-related learning in a course. Therefore, on the one hand, individuals can frequently self-adjust or improve based on feedback during a semester. On the other hand, instructors may review individuals' learning evidences and customize activities to meet learning needs when needed.

5. CONCLUSION AND DISCUSSIONS

This paper presents a strategic plan of my own personal journey in adopting the CLIL approach: I briefly summarize my take-away from the CLIL workshop, explain the expected challenges when CLIL is implemented in local settings, and then to address the challenges, I propose wikis for increasing students' level of participation in a CLIL classroom (See Table 1).

Table 1. Goals, challenges, and wiki-enhanced participation strategies

CLIL Goals	Local challenges	Wiki-enhanced strategies	Examples
Content: Instructors evaluate, select, and recreate texts for learning to help understanding.	Due to students' diverse language skills, it may be inefficient and ineffective to have instructors recreate materials.	Have students collaboratively construct learning materials on wikis to support customized learning.	Students may co-construct list of glossary from readings, key ideas, or relevant background knowledge
Language: Active class participation is essential to develop receptive competence and productive competence.	Cultural barrier and inadequate language skills may hinder willingness to participate.	Recognize students' contributions on wiki, promote interest and confidence, and emphasize participation.	Quiet students may be encouraged to share their valuable contributions on wikis in class.
Formative assessments are desired. Peer assessment and self-assessment can also be helpful in CLIL.	Tracking individuals' progress over time may be challenging for instructors.	Require students document various evidences of learning on wiki, so formative, peer, and self-assessment can be conducted easily.	Individuals create a wiki page to document online and off-line contributions. Pages are available to instructors and peers, allowing assessment and feedback at different points of time.

I envision that learning in such a wiki-enhanced CLIL classroom, as proposed, requires students to transform their traditional (passive, isolated) learning approach to a collaborative, constructive, and self-directed one. I look forward to share the preliminary findings and personal reflection according to the initial implementation this semester at the conference presentation. Furthermore, as turning the CLIL theory into practice can be complex, it is still in an early adopting stage in Taiwan, further research discussion and implementation are desired. For example, future research on developing and refining the strategies is urgently needed, such as action research, case studies, and design-based research to collect empirical evidences in local contexts and to inform its theoretical basis. Other directions involving educational technologies, such as uses of mobile devices, to support personalized learning in CLIL contexts is also worth exploring as powerful tools to support students' learning in the 21st century.

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PRAGMATICS AND SEMIOTICS: MOVIES AS AESTHETIC AUDIO-VISUAL DEVICE EXPEDITE SECOND LANGUAGE ACQUISITION

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ABSTRACT

The author as teacher educator and her students as teacher candidates conceptualized pragmatics, semiotics and aesthetics into literacy education by inviting students of diversity to watch movies, talk about movies, write movies, and act movies. Pragmatics is the study of how language is used for communication in various social and cultural contexts, semiotics is the study of signs, and aesthetics is the artistic stance that learners take for response to literary works. The purposes of this study are multi-functional: to develop the multisensory acquisition of five literacy skills in thinking, listening, speaking, writing and reading in a pleasant and natural authentic discourse setting. Both students from diversity and mainstream cultures acquire natural language for social functions. Based on research, most students of diversity need two years to develop the social language, while they need five years to obtain the academic language. But this audio-visual approach in terms of movies expedites the second language acquisition for social function towards academic success.

KEYWORDS

Pragmatics; Semiotics; Aesthetics; Social Language; Second Language Acquisition.

1. INTRODUCTION

The author explored the second language acquisition process of students from diversity, whose first language was not English at the urban school district in Georgia, US, for two semesters when she supervised teacher candidates' practicum from Pre-K to 4th grade. The author and the teacher candidates employed "movies" in the after school program and found that movies expedited the ELLs (English language Learners) social language and benefited them for academic language too.

1.1 The Limits in the Classroom

Bardovi-Harlig (2011) assured that most ELLs have little opportunity to engage in the appropriate linguistic activity outside classroom, which results in a growing awareness that simply exposing ELLs to grammatically appropriate rules is inadequate. The author observed that most K-4 students from diversity rarely asked questions or answered questions, but kept smiling. Those students were very active when they played with their Spanish-speaking peers in the playground during recess or lunch time, while they had little interaction with their English-speaking peers. One new classroom teacher complained, "They have been in the U.S. for more than two years, but they did not pass CRCT's!" (The Criterion-Referenced Competency Test designed to measure students' performance in reading, English/language arts, mathematics, science and social studies in Georgia).

1.2 The Limits of Teachers Being Cultural Bound

The US Immigration Reform Bill (2013) proposed to issue the W-Visa for nonimmigrant labors to solve the problem of labor shortage in the U.S, and the new bill will issue up to 185,000 new working visas in the next four years. More people will immigrate into the U.S. bearing W-visas, and their children whose native language is not English will populate this country and legally enroll in the public schools. With the immigrant population grows, schools adapt to help kids learn English (Kozma, 2014). Since most school

teachers are cultural-bound (Cushner, McClelland, & Safford, 2012; Lu, 2014) and are not ready to work with the students from diversity.

1.3 Sociopragmatic Failure and Pragmalinguistic Failure

In using languages for effective communication, most learners have to figure out “when” it is appropriate to perform a particular language function and “how” to encode it. Thomas (1983) noticed that learners frequently experience difficulties with both: “sociopragmatic failure”, which occurs when learners produce socially inappropriate behavior, and “pragmalinguistic failure”, which occurs when learners do not express themselves in a linguistically appropriate manner. This is the reason that nonverbal communication skills (Cherry, 2014) obtained from watching movies were included in this pilot study, while there has been very little research on second language (L2) learning with movies (Gibson, 2014).

1.4 Objectives

The author was inspired by the *Movie Script* from Hoffner (2003) and Gormly’s research on movies that enhance language-learning program in 2013. She and the teacher candidates attempted to install movies in the After School Program daily by encouraging students to finish their daily assignments and to watch movies later. The movie activity engaged students and their parents from diversity, and developed the students’ functional literacy (Ariza, 2009; Dolly, 1998) for social interaction towards academic success.

2. PRAGMATIC, SEMIOTICS AND AESTHETICS

2.1 Pragmatics

To Grice (1989), pragmatics is a branch of linguistics that deals with norms of conversation. Generally pragmatics was defined as the study of how language is used in communication in various social and cultural contexts (Ariza, 2009; Ellis, 1995; Reutzel & Cooter, 2012). It covers a wide range of linguistic phenomena like deixis, conversational implicature and presupposition, illocutionary acts, conversational structures, and repair (Ellis, 1995). Pragmatics is particularly concerned with appropriateness, with regard to what is said in a particular context and how it is said.

2.2 Semiotics

Semiotics is the study of signs like languages, arts, music, dance, drama, films, cultures, etc. that humans created to mediate the world (Cunningham, 1992; Sebeok, 1978; Siegel, 2006). In this pilot study, the movie is the target sign, with its audio-visual artistic device to demonstrate various nonverbal communication signals (Cherry, 2014) such as kinesics, gestures, head movements, posture, eye contact, tone of voice, and facial expression that were infused in literacy education for appropriate and effective communication. For a good language art curriculum must be able to expand a learner’s potential for understanding and communicating through various signs, not only languages.

Movie is the all-inclusive artistic composition (Eisner, 2002; Goldberg, 2001; Uhrmacher, & Matthews, 2005) with language, arts, music, dance, drama, cultures, and nonverbal communication signals, etc. which attract learners’ attention more than the books, and motivate their interest in using multisensory literacy skills in thinking, listening, speaking, reading, and writing, as well as nonverbal signals for more appropriate communication to achieve personal goals.

A good movie, like literature, that bears the moral themes like the love of peace, justice, courage, honesty, kindness, righteousness, collaboration, and friendship. Since Disney movies compose these themes and are employed in this study. The students’ favorite movies are *Finding Nemo*, *Wizard of Oz*, *Little Mermaid*, *Lion King*, *Pocahontas*, etc. In this pilot study, only *The Little Mermaid* is discussed.

2.3 Aesthetics

Aesthetics is the artistic stance that learners take to the response to literary works (Cornett, 1999; Eisner, 2002; Goldberg, 2001). It is beyond the aim and scope of pragmatics.

3. METHOD

Teacher candidates, and students from PreK – 4th grades in the after school program in the inner city participated in this research by watching the movies released by Walt-Disney.

The teacher candidates briefly introduced the movie, and the key vocabulary words for enhancing the “comprehensive input” (Krashen 1982).

Students were grouped by five or six from diversity and mainstream cultures. The whole class watched the movie for 5 five minutes, and the 1st group went outside of the classroom talking about the movie, picking up roles, writing the movie script (playwright) based on his/her role, sharing the draft of the movie script in the small group. Teacher candidates and the group members reviewed and modified the movie script for group rehearsal. The other groups kept watching the movie. Five minutes later, the 2nd group went out to do the same activity until the last group completed the rehearsal. The whole class acted the movie.

Each group submitted the draft of the movie script to the teacher candidates who tutored the students in the After School Program. Teacher candidates collected the drafts of the movie script, edited the draft, typed it, and highlighted the movie script with different colors, i.e. red, blue, green, purple, and yellow for students to memorize the script for the week playing later on Friday.

4. FINDINGS

4.1 English Language Proficiency

Movie invited multisensory development through the stimuli of aesthetic audio-visual device for listening comprehension, speaking fluency, writing skill, reading comprehension, for example, every student, either from diversity or the mainstream cultures, was able to use at least two complete sentences to express what he/she watched of the movie for five minutes. Many students used invented spelling (Laminack, & Wood, 1996) to compose their sentences when they drafted their movie scripts. For the PreK to 1st graders, they preferred to dictate their sentences to the teacher candidates.

4.2 Pragmatic Competency: Teaching Natural Conversation

In addition to the instruction of essential linguistics (Freeman & Freeman, 2014) including reading strategies, ESL, spelling, phonics, and grammar, the teacher educator implemented activities for Pragmatics: Teaching natural conversation (Houck, & Tatsuki, 2011) in this course, so that teacher candidates will learn how to teach their students of diversity the following interactional activities in authentic language patterns like expressing gratitude (Bardovi-Harlig & Nickels, 2011), saying apologies (Lieske, 2011), paying compliments (Carduner, 2011), taking turns & talking naturally (Carroll, 2011), and performing pragmatic competency in telephone conversation (Wong, 2011). Through this kind of authentic discourse, the ELLs developed functional literacy (Dolly, 1998) for social interaction with their teachers and their English-speaking peers..

4.2.1 Communicative Competence

The ability to use language in a contextually appropriate fashion, and pragmatic competence is a fundamental aspect of a more general communicative competence including the effectiveness of communication for the purposes of confirming, commending, convincing, and persuading. To achieve the communicative competence, what the learners need is beyond the correct instruction of phonics (sound system), Syntax (grammar), and semantics (meaning). The students were observed to communicate with the various types of nonverbal communication: kinestics, gestures (emblems, illustrations), head movement, posture, eye contact, facial expression, and intonation in an appropriate manner during their rehearsal of the moving acting.

4.2.2 Sociolinguistic and Discourse Competence

Learners are knowledgeable of sociocultural rules of use. It is concerned with the learners' ability to handle settings, topics and communicative functions in different sociocultural contexts. In addition, it deals with the use of appropriate grammatical forms for different communicative functions in different sociolinguistic contexts, and social skills for collaboration through speaking, talking, discussion, negotiation for the building of leadership.

The discourse competence is related to the learners' mastery of understanding and producing texts in the modes of listening, speaking, reading and writing. It deals with cohesion and coherence in different types of texts.

5. DISCUSSION

Gibson (2014) declared that there has been very little research on second language learning with movies, and there does not appear to be any data on the amount of time that L2 learners watch movies. The pilot study in this research reveals that movies provide valuable resources in second language classrooms and fit Krashen's second language acquisition hypotheses (1982): acquisition rather than learning, natural approach, comprehensive input, free filter environment, self-monitor opportunity, and motivate interest in learning. The benefits of using movies in second language classroom are more valuable than the books, especially the audio-visual artistic effects, and the nonverbal communication signals to the second language learners for acquisition of language proficiency and social/cultural competency.

6. SIGNIFICANCE

The author plans to adopt the pragmatic formulas for oral/aural assessment (Bardovi-Harlig, 2011) and WIDA Consortium (2009) – The World-Class Instructional Design and Assessment Can DO Descriptors across the contents in the future when she uses the movies as supplementary materials in the literacy program.

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