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Supervision and Monitoring Guidelines for Instructional Outcome Based Teacher Development Project Using Content and Language Integrated Pedagogy via Electronic Communication System

Artnarong Mansuttirit¹, Jenjob Suksangprasit², Eknarin Bangathamai³

Abstract

This study was a participatory action research, which aimed to develop the supervision, monitoring, and evaluation guidelines for instructional outcome based teacher development project using content and language integrated pedagogy via electronic communication system and to examine the satisfaction levels of teachers and students participating in this project. The population and samples of this study were 35 administrators and teachers from 5 schools under Thailand’s Secondary Educational Service Area Office 1, in the second semester of academic year 2015. The information about instructional conditions and student learning outcome was collected by the interviews, class observations, and teaching supervisions using both face-to-face and electronic approaches. The researcher as well as participated schools, administrators, teachers, and central research team collaborated on opinion sharing and project implementing in order to develop and modify the effective supervision, monitoring, and evaluation guidelines.

The results suggested that the supervision, monitoring, and evaluation guidelines for instructional outcome based teacher development project using content and language integrated pedagogy via electronic communication system consisted of five steps, which were 1) coordinate with the schools and responsible administrators, 2) set a meeting to create better understanding and determine operational plan together, 3) provide a training for participated teachers, 4) make follow-up appointments and monitoring using both face-to-face and electronic system approaches, 5) implement instructional practice according to predetermined plan and evaluate the outcome. The findings showed that the teachers had high level of satisfaction toward the instructional practice of this project, with a mean score of 3.86 and a standard deviation of 0.89. The students were also found to

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have high level of satisfaction toward the teaching style, with a mean score of 3.97 and a standard deviation of 0.69.

Keywords: Supervision and Monitoring, Teacher Development, Electronic Communication System

1. Background
The 21st century global society is considered a society of progress, especially in terms of technology and economic competition. It is essential for Thailand to develop Thai youth into human resources with knowledge, ability, skills, proficiency, and readiness to drive and enhance the country’s development. Teachers and educational personnel are the most important factor propelling the educational reform and enabling the Office of the Basic Education Commission to achieve its policy objectives on educational quality enhancement and preparedness for the ASEAN community and global society, especially in terms of student quality development. Educational personnel in all relevant sectors are the key factor for the reform of education and learning system, good and sufficient learning resources, better student achievements, and higher educational rankings. The Office of the Basic Education Commission has carried out instructional management based on innovative learning approach for the schools with English for Integrated Studies (EIS) model. The learning innovation enables the teachers to develop better school curriculum, learning processes, instructional media, and achievement evaluation system. The innovative instructional approach focusing on learning behaviour according to EIS model is considered a learning innovation that applies the principle of self-reliance and results from innovative teacher training practices and development. Providing bilingual communication technique from short and easy English lessons and various teaching styles, developing student knowledge through teacher’s instructional processes, organizing group discussion and conversation activities in classroom through integrated basic course, linking classroom/school to international affairs, and building learning technology development network with international institutions based on student-centred concept, are learning processes associated with the basic knowledge, skills and attitudes of students that focus on students’ experiences. In content and language integrated classroom, a teacher will act as a content and language facilitator and teach English vocabulary together with other related content in order to practically achieve learning activities. When students experience language barriers, the teacher will respond to their language problems during actual learning activities. The teacher will take account of the students’ ability in terms of existing knowledge and English background. The teacher may need to repeat the message and spend a certain period of time in order to achieve effective learning outcome. Therefore, it is vital to initiate a development project for administrators and teachers in the fields of science, mathematics, and computer by using English for Integrated Studies (EIS) model and Content and Language Integrated Pedagogy via Electronic Communication System (e-CLIP) in network schools. [1]
Content and Language Integrated Pedagogy via Electronic Communication System (e-CLIP) refers to an innovative teacher development using lesson study method through information technology system. It focuses on content and foreign language integrated instruction based on the principles of good learning. This approach consisted of 5 main components, which are 1) understanding of course learning objective, 2) instructional strategy design, 3) English skills needed for specific content and classroom communication, 4) knowledge of the teaching content and understanding of expected learning outcome, 5) evaluation for further development. These are basic components reflecting teaching performance, which indicates quality of teacher and will contribute to the reform of learning (Montri Yaemkasikorn, 2015). [2]

The supervision, monitoring, and evaluation guidelines for instructional outcome based teacher development project using content and language integrated pedagogy via electronic communication system were developed to planning and implementing the supervision, monitoring, and evaluation processes. The instructional data was collected and synthesized in order to modify and improve an instructional outcome based teacher development project using content and language integrated pedagogy via electronic communication system.

2. Research Objectives
2.1 To develop the supervision, monitoring, and evaluation guidelines for instructional outcome based teacher development project using content and language integrated pedagogy via electronic communication system
2.2 To examine the satisfaction levels of teachers and students participating in this development project

3. Scope of the Study
Population and Samples
The population of this study was 700 administrators, teachers, and students from high schools under the supervision of the Secondary Educational Service Area Office 1, Bangkok, Thailand.
The samples were 35 administrators and teachers as well as students of 5 high schools under the supervision of Thailand’s Secondary Educational Service Area Office 1. A specific random sampling was employed to select the samples from participated high schools.
Data collection period was from August 2015 to May 2016.

4. Research Methodology
The methodology of this research can be divided into the following three main steps:
Step 1: Preparation
• Select the samples by surveying and studying background information of each school and its teachers thoroughly. Then draw the appropriate samples.
• Build a good relationship with the samples and obtain their acceptance. All teachers should be allowed to give comments, suggest problems, and share ideas.
Step 2: Operation
- Study the requirements by investigating problems, needs, as well as existing resources together with the samples. Provide knowledge and procedures.
- Identify the problems by studying basic information and determining priority of the problems, which requires joint discussion.
- Collaborate in designing the guidelines. Start by determining objectives, data collection, duration, responsible person, and operational practice.
- Set up a meeting to present the obtained information, confirm mutual understanding, verify the information, and share helpful suggestions and solutions.

Step 3: Development
- Establish the project by identifying goals, activities, operational procedures, and responsibilities.
- Implement the project according to predetermined plan. Leaders and coordinators are assigned and work together to comply with the goal and characteristics of activities.

5. Results of the Study
5.1 The supervision, monitoring, and evaluation guidelines for instructional outcome based teacher development project using content and language integrated pedagogy via electronic communication system consisted of the following five steps:
- Coordinate with the schools and responsible administrators.
- Set a meeting to create better understanding and determine operational plan together
- Provide a training for participated teachers.
- Make follow-up appointments and monitoring using both face-to-face and electronic system approaches (on Social Network with mobile and electronic devices).
- Implement instructional practice according to predetermined plan and evaluate the outcome.

5.2 The results showed that the teachers had high level of satisfaction toward the instructional practice of this project, with a mean score of 3.86 and a standard deviation of 0.89. The students were also found to have high level of satisfaction toward the teaching style, with a mean score of 3.97 and a standard deviation of 0.69.

Acknowledgements:
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Ministry of Education and Faculty of Education, Burapha University, Thailand
References


Enabling Synchronous Collaboration in Web Mobile Learning Applications

Ivica Boticki1, Nino Uzelac2 and Martina Holenko Dlab3

Abstract

This paper presents the Author system for designing and delivering interactive and multimedia-based learning lessons. The system is designed as a generic tool for building learning contents and as a multi-platform content delivery tool. Every web application is considered to be a widget that can be imported into the system and then made collaborative. By specifying collaboration attributes such widgets are empowered with synchronous collaborative support to be used in and out of the classroom, depending on the devices available to students and the teachers. The paper presents the system design, two collaborative widgets for synchronous math learning in pairs and triplets and the initial experiences in deploying and using the system in early primary school settings.

Keywords: mobile learning, web applications, collaborative learning, frameworks

1. Introduction

Creating applications for mobile learning nowadays comes with a variety of concerns and challenges such as sustainability, multi-platform deployment, usability. This puts additional burden on researchers and developers and potentially increases both the development and maintenance time and the price of the developed learning applications. This in turn potentially leads to the lack of creative and novel designs that could possibly push the boundaries in the field.

This paper presents a framework for mobile collaborative synchronous learning (Ivica Boticki, Wong, & Looi, 2013) that is based on novel and relatively mature technologies that could be applied to turn existing web mobile learning applications into synchronous collaborative mobile learning applications (Caballero et al., 2014; Chen & Chen, 2014; Sun, Looi, & Xie, 2014). As part of the SCOLLAm mobile learning project (Jagust, Mekterovic, & Boticki, 2015), the Author system was designed and equipped with such extensions, therefore allowing applications developers to utilize synchronous mobile learning designs (Boticki, Baksa, Seow, & Looi, 2015).

In addition to demonstrating the design underpinnings of the system and synchronous collaborative learning extensions, a case of using two such applications is given and demonstrated within early primary school learner context. Such an approach is designed to demonstrate that existing designs can be easily converted into synchronous mobile learning designs and used in mobilized classrooms.

2. The Author System

The Author system resides on the SCOLLAm architecture which is built to support development access to multiplatform web-based mobile learning applications and content.

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Designers can use the Author system to design and store web mobile learning lessons into the system database via the custom designed web services. Once the content is created it can be accessed both by the authors to be reviewed or reused and subsequently by the end consumers (students) to be used in educational scenarios (Figure 1).

![Figure 1. SCOLLAm architecture as the base for the Author system operation](image)

2.1. Designing Multimedia Learning Content

One of the Author system functions is to serve as a tool for designing and reproducing interactive lessons. Each lesson is a package that may contain multimedia elements such as text, image, shapes, widgets and others. There is also an option of defining interactive rules that trigger an action based on some interaction. Some examples of user-defined triggers can be object move, object touch, object drag and drop that can make some other object change position, style or size. Using these simple concepts, a variety of interactive lessons can be created which would allow for easier usability.

Layout of the Author system is depicted in Figure 2. The layout of the system graphical user interface is divided into three distinct parts: the left column part showing all the lesson visual subelements (also referred to as slides), the central part showing the currently edited visual element and the right column part showing the parameters of the element focused upon in the central area. The central part allows for the addition of multimedia visual elements via the top toolbar buttons.

A lesson defined in such a way can be played via the Author system by using the Play toolbar button. This means the lesson preview will start and that all multimedia and interactive elements will be shown to the end user. Similarly, such preview can be started from any web-enabled device outside of the Author system, which will be in detail presented further in the paper.
2.2. Widgets - Bundling Interactive Learning Content

Building multimedia lesson as presented in the previous paragraphs is a very straightforward way of building web and mobile learning applications, but does come with a limiting set of functions. Since users can only choose from a limited set of multimedia elements, there is no way to implement more interactive user experiences. This is not only a limitation as seen by the system power users, since nowadays even young learners expect more interactive and engaging elements for any application. The Author system opens up the possibility for delivering more interactive and engaging learning contents by introducing modular pluggable learning application support, known in the system as widgets. Widgets are taken as already created modules and inserted into digital lessons that are being designed via the Author system, as illustrated in Figure 1.

The Author system will accept as widget any already developed web-based content that conforms to the three design requirements:

- The application must be developed using any web-technology that can be used in today’s web browsers (such as Chrome, Internet Explorer etc.).
- The application must be described by a simple metadata file indicating its main properties.
- The application may communicate with the Author system to exchange some data (i.e. send usage log to the Author system, collect input parameters from the Author system or achieve group communication via Socket.IO etc.).

In order to better illustrate the use of widgets in the Author system, an example of a simple web application is presented in Figure 3. A simple standalone web application for adding two numbers is converted into a widget by simply adding widget metadata, which are shown to lesson designers as configurable parameters (marked with red in Figure 4).
Figure 3. A simple interactive web page that is to be converted into a widget

Figure 4. Anatomy of an Author compliant widget

Figure 5 illustrates in detail the anatomy of an Author compliant widget where the left hand side of the figure shows code used to realize the widget appearance and behaviour, the middle part of the picture widget metadata code used to parametrize the widget via the Author system, and the right hand side of the picture the interfaces used to communicate with the Author system and to achieve group communication.

It is to be noted that any web-based code or framework can be used to create a widget, and that widgets interfaces already exist and are ready to be used in programming by the widget creator.
Figure 5. Anatomy of an Author compliant widget

2.2. Synchronous Collaboration with Widgets
As a technological base for implementing synchronous communication in the SCOLLAm system, a Socket.IO was utilized. It allows for two way communication in real time and consist of a server and client components, which are both web-based. Socket.IO encapsulates and deals with numerous communication and coordination issues such as reliability, automatic reconnection via long-polling, detection of communication interruptions, various web browsers. It also allows for an easy setup of communication groups for sharing messages to one or more users on one or more devices.

Table 1. Synchronous communication methods in SCOLLAm to be used by widgets implementing collaborative learning scenarios

<table>
<thead>
<tr>
<th>Method name and parameters</th>
<th>Method description</th>
</tr>
</thead>
<tbody>
<tr>
<td>postGroupMessage(object message, object options)</td>
<td>Sending a message to all group members</td>
</tr>
<tr>
<td>postPersistentGroupMessage(object message)</td>
<td>Sending a message to all group members and saving the message on the server</td>
</tr>
<tr>
<td>onGroupMessage(function callback)</td>
<td>Listening for an incoming group message and reacting to her</td>
</tr>
<tr>
<td>updateStateOnBackend(object message)</td>
<td>Saving custom (any data) state on the server</td>
</tr>
<tr>
<td>requestState()</td>
<td>Requesting state from the server</td>
</tr>
<tr>
<td>requestMessages()</td>
<td>Requesting saved messages from server</td>
</tr>
<tr>
<td>onStateFromBackend (function callback, boolean executeOnlyOnce)</td>
<td>Listening to a state change from the server. The executeOnlyOnce flag will remove the listener if set to true</td>
</tr>
<tr>
<td>onMessagesFromBackend(function callback)</td>
<td>Listening to received saved messages from server</td>
</tr>
<tr>
<td>onUserInfo(function callback)</td>
<td>Equivalent for onStateFromBackend(callback, true) + requestState for easy state fetch from the server</td>
</tr>
<tr>
<td>getState(function callback)</td>
<td>Notifying the Author system that the widget registered all listeners and is ready for message receival</td>
</tr>
<tr>
<td>ready()</td>
<td></td>
</tr>
</tbody>
</table>

As depicted in Figure 5, widgets creators will use already prepared communication interfaces in their widget designs to in order to utilize the SCOLLAm synchronous infrastructure for collaborative learning scenarios. The list of available methods which comprise the group communication widget interface is listed in Table 1.

Figure 6 illustrates which messages get exchanged when the Author system initializes a widget. Widget issues three initial method calls where the third lets the Author system know the widget is ready to begin its operation. The Author system then utilizes the server-side Socket.IO component to request any state pending on the server. This communication is especially important if widget designers want to save data as the user switches between different applications on her device.
3. A Case Study: Learning Early Primary School Mathematics with Pairs and Triplets
Collaborative Learning Widgets

In order to utilize and to pilot the SCOLLAm project infrastructure and the Author system, two widgets for learning Math were created: one for learning early grade Mathematics in pairs and the other for learning in triplets. Since widgets differ significantly in problem presentation, the process students are to exhibit when participating in the learning activities with widgets and the roles students are assigned when participating in the learning activity.

**Table 2.** The process of solving a mathematical problem via the pairs synchronous collaboration widget

<table>
<thead>
<tr>
<th>Step</th>
<th>The Editor role</th>
<th>The Checker role</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Mathematics for 1st grade</td>
<td>Mathematics for 1st grade</td>
</tr>
<tr>
<td></td>
<td>Task 1 of 3: 10+ 2 =11</td>
<td>Task 1 of 3: 10+ 2 =11</td>
</tr>
<tr>
<td></td>
<td>7 8 9</td>
<td>1 2 3</td>
</tr>
<tr>
<td></td>
<td>4 5 6</td>
<td>1 2 3</td>
</tr>
<tr>
<td></td>
<td>Please wait for results.</td>
<td>Please wait for your group members.</td>
</tr>
<tr>
<td>2</td>
<td>Mathematics for 1st grade</td>
<td>Mathematics for 1st grade</td>
</tr>
<tr>
<td></td>
<td>Task 1 of 3: 10+ 2 =11</td>
<td>Task 1 of 3: 10+ 2 =11</td>
</tr>
<tr>
<td></td>
<td>Is the solution correct?</td>
<td>Is the solution correct?</td>
</tr>
<tr>
<td></td>
<td>Please wait for results.</td>
<td>Please wait for your group members.</td>
</tr>
<tr>
<td></td>
<td>Group members: 1 2 3 4</td>
<td>Group members: 1 2 3 4</td>
</tr>
</tbody>
</table>
* Steps 2 and 3 appear only in the case of wrong solution offered

**Table 3.** The process of solving mathematical problems via the triplets synchronous collaboration widget

<table>
<thead>
<tr>
<th>Step</th>
<th>The Author role</th>
<th>The Editor role</th>
<th>The Checker role</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td><img src="image1" alt="Mathematics for 1st grade" /></td>
<td><img src="image2" alt="Mathematics for 1st grade" /></td>
<td><img src="image3" alt="Mathematics for 1st grade" /></td>
</tr>
<tr>
<td>2</td>
<td><img src="image4" alt="Mathematics for 1st grade" /></td>
<td><img src="image5" alt="Mathematics for 1st grade" /></td>
<td><img src="image6" alt="Mathematics for 1st grade" /></td>
</tr>
</tbody>
</table>
Table 2 illustrates the process of solving a mathematical problem in different roles where two students get assigned the roles of Editors and Checkers and participate in problem-solving tasks. Similarly, Table 3 displays the triplets widget in which three students get assigned the roles of Author, Editor, and Checker to participate in a problem-solving task.

### 4. Discussion

The case study demonstrated two educational widgets for computer-supported collaborative learning used in early primary school mathematics education. The first widget implements working in pairs in two roles: editors and checkers, which means students participate in tasks assuming various roles. On the other hand, the second widget is for working in triplets where...
the process is more complicated since a new role (author) is introduced. Additionally, tasks for working in triples are more high level, where the author student role had to translate the textual assignment into a mathematical expression.

The two widgets differ in terms of graphical user interface and the implemented process, which is all done by the widget creator. When it comes to communication with the server side communication feature of the SCOLLAm system, the differences are minor since the widget creator is making a few interface calls more in order to support one role more.

The experience in using the widgets and the SCOLLAm system was gathered via a series of experiments taking place in years 2016 and 2017 in the 1st and 2nd grade in a primary school in Croatia. The widgets were co-designed with the primary school teachers and the task contents were provided by the teachers themselves so that they are aligned with the curriculum and the pace teachers take in delivering their lessons. Preliminary results show that the increased complexity of working in triplets on more difficult and abstract tasks affects the ways young learners use the system leading to more engaged and on task behaviour. This confirms that the special care should be paid to the alignment of the digital lesson tasks with the curriculum implementation flow.

Implementing synchronous collaborative learning solutions does come with a need of ensuring available stable connection throughout system usage and possible contingency when system operation becomes less stable. As part of the case studies, mobile 4G routers were used with 8 children sharing one mobile 4G router when participating in the activity. In most of the performed tasks this turned out to be sufficient, but on certain occasions, seemingly non-deterministically, this proved to be a challenge because mobile network signal dropped or the service level became unsatisfactory. This leads to two lessons learned: contingency in terms of additional non-connected mobile learning content needs to be provided to bridge the idle time of young learners and the learning systems need to be designed so they are able to continue operation from the exact point when the lesson was interrupted.

5. Conclusions
Synchronous collaborative mobile learning activities can be designed in a way they are added to current content via the central server infrastructure. By providing an interface consisting of two method calls, widgets for working in pairs and triplets were implemented and the following major experiences gathered: collaborative learning contents should be aligned with the curriculum, there should be contingency and recovery planned in the case of connection failures, and the complexity of different roles should be aligned to ensure adequate digital learning activity dynamics.

Acknowledgements:
This work has been fully supported by the Croatian Science Foundation under the project UIP-2013-11-7908. The authors would like to thank the staff of Primary School Trnjanska - Ivančica Tajšl Dragičević, Kristina Vlah, Luci Plenković Omerso, Jasna Haraminić, Petra Crnjević Trstenjak and Nada Šimić - for their enthusiastic partnership in the realization of the study presented in this paper.

References


Hand Carry Data Collecting Through Questionnaire and Quiz Alike Using Mini-computer Raspberry Pi

Fajar Purnama¹, Muhammad Bagus Andra², Hendarmawan³, Tsuyoshi Usagawa⁴, Masahiro Iida⁵

Abstract

Conventionally data collecting through surveys or quizzes are usually done by distributing hard paper based questionnaires or by directly asking people themselves. With the invention of the Internet, the base of these methods changes to online. For example, in a high developed information communication technology (ICT) University, the authorized personnels sends emails to students to complete an online questionnaire resided on a certain website. However, in most cases on developing countries such as the ones resided in South East Asia, the people are already familiar with computer devices such as gadgets, laptops, netbooks, etc, but they do not have a reliable Internet connection. Therefore this work proposes a method which utilizes this situation that can improve the convenience of survey process for both the surveyors and participants. Since most people have gadgets, our method involves in providing a portable hotspot device for them to connect and access our local survey questionnaire website. This is possible thanks to the invention of credit card size computer such as Raspberry Pi. Like any other computer it can be filled with an operating system (OS), installed with a hotspot module and a webserver which are enough to conduct surveys or quizzes alike through wireless local area network (WLAN) except that the size is hand carry which is easier to carry than laptop. In this work the method is realized and was put to few trials. This research is more of mobile on surveyors’ or teachers’ side than mobile learning on students’ side.

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Keywords: Convenience, Data Collecting, Hand Carry, Raspberry Pi, Portable, Mobile.

1. Introduction
There are many forms of data collecting, for example questionnaires which their results are used to create statistical analysis like finding the students’ and teachers’ perspective of e-learning like in some of our peers’ research Paturusi (2015) and Monmonthe (2016) where they are needed to determine the e-readiness in their respective researched Universities. In classrooms, quizzes are more used to access the knowledge of the students of which parts of the subject that were clearly understood and which parts were not. Quizzes also have other benefits like stimulating the learning process of the students which can guide them in learning the subject and help them in performing better in exams as discussed on McDaniel (2012) where they performed experiments on different type of quizzing such as repetitive quizzing with item identical to exams with only related to exams, and providing feedbacks after quizzes. Both questionnaires and quizzes serves a purpose for information gathering.

Unfortunately, these are not what wanted to be discuss here. What wanted to be discussed is the method or process of conducting the data collecting or survey. The methods of our peers were still quite conventional, by distributing paper questionnaires and recollecting them back, while the others uses online method that utilizes computer and Internet connection which is currently one of the easiest way. However in most developing countries such as in South East Asia, Internet connection is not well established The World Bank Group (2016), meaning that online survey is not the answer, like in Indonesia for example Kusumo (2012) which forces our peers to use the conventional method. However most people there are familiar and owns computer devices such as gadgets, androids, and iphones The World Bank Group (2016) and this research tries to utilize that situation which aims to be more convenient than the conventional method. Since computers are utilized the method will also have the advantage of online survey which is the convenience of having automated data collection Wright (2005).

This topic can be said more of mobile on the surveyors’ or teachers’ side than the typical mobile learning on the students’ side. The method proposed is to use a portable server where the users’ computer devices can connect to and perform the survey there. The data obtained will be stored on that miniserver and later be extracted by the surveyors with ease, also it is possible to program a preprocessing on that miniserver which can make things more easier.

This idea can easily be realized since the invention of a credit card size computer Raspberry Pi (there are other brands as well but for now this one is used). All that is needed is to program this Raspberry Pi by inserting an OS, installing a hotspot module where the users will connect through WLAN, and a local website for the survey materials itself. After this idea was realized, a small trial was conducted on few users. More importantly the advantages of this method was shown and discussed, on the other hand also the limitations of this method based on resource consumptions.
2. Related Work
There are other researches that had similar situation to this one where people have their own computer device but insufficient infrastructure in their respective places to connect to The Internet. Most of these researches shows making things portable as the answer. Here are some related works:

- The work of Royyana (2010) proposed to make an online quiz to be portable where the students can take home using their computer devices and attempts them offline, later on the online system will be synchronized once the students come across a reliable Internet connection.
- Kuziek (2016) proposed a method using Raspberry Pi to be able to conduct Electroencephalography (EEG) experiments outside the laboratory, since it is not easy to get the naturality of the occurrence when EEG experiments are conducted inside the lab.
- An interesting work by Wittenberg (2015) proposes a use of keys which is a flash drive that contains a computer environment to run specialized software need for Computer Science courses. Since not many students are versed in programming, setting up their own environments, etc, flash drives already pre-installed with an OS, and softwares were distributed to students where the students can boot on any computer machines.
- This one O'Connor (2011) is similar to this work where they use laptops for collecting data for home visitation program where normally they use paper based questionnaires and input them into the database later. Using a laptop saves from that trouble and other costly stuffs like printing papers. The result showed reduced cost in money and time. The difference between this work is that this work will use a smaller size computer and targeted for mass size survey.

3. Materials and Methods

3.1. Device
The device used is a hand carry or a minicomputer which functions as a portable server. Table 1 shows the modules needed to execute the method on the next section and Table 2 is the specification of the minicomputer. Nowadays the price of Raspberry Pi ranges from $30 - $50. If not already owned items to configure the Raspberry Pi the following items can be purchased; high definition multimedia interface (HDMI) compatible display starting from $20, keyboard beginning at $5, mouse as cheap as $1, and power bank from $10.

| Table 1. A list of modules necessary for the device. The items column is general while the materials column are like specific brands used that can perform the item’s function. |
| Items | Materials | Details |
| Computer: | Raspberry Pi 2 | The minicomputer. |
Operating System: Raspbian

Abbreviation for Raspberry Debian which is a Linux based OS for the Raspberry Pi itself.

Hotspot Module: Hostapd

This is an application to start the wireless interface to server as hotspot for users to connect.

DHCP Server: Udhcpd

Each connected devices needs to be assign an identity for the WLAN which is internet protocol (IP) address.

Webserver: Apache2

The questionnaire will be a web based where the connected users will use their browser to access it. This is used to host a local website.

Database Server: MySQL

Using a structured query language (SQL) to store the data input by the users.

Loading Page using DNS server: Dnsmasq and Iptables

Normally the users have to be told the address of the website of the questionnaire, but with this the browser will automatically redirect to it.

Survey Software: Limesurvey

A content management system (CMS) used for online surveys.

The materials that can be used are not limited to these ones for as long as it can perform the functions.

Table 2. Specification of the hand carry computer Raspberry Pi 2 Model B.

<table>
<thead>
<tr>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>A 900MHz quad-core ARM Cortex-A7 CPU</td>
</tr>
<tr>
<td>1 Giga Byte (GB) Random Access Memory (RAM)</td>
</tr>
<tr>
<td>4 Universal Serial Bus (USB) ports</td>
</tr>
<tr>
<td>40 General Purpose Input Output (GPIO) pins</td>
</tr>
<tr>
<td>Ethernet Port</td>
</tr>
<tr>
<td>Camera Serial Interface (CSI)</td>
</tr>
<tr>
<td>Display Serial Interface (DSI)</td>
</tr>
<tr>
<td>Micro Serial Digital (SD) card slot</td>
</tr>
<tr>
<td>Video Core IV 3D graphics cire</td>
</tr>
<tr>
<td>Size of 85.60 mm × 56.5 mm (3.370 in × 2.224 in), not including protruding connectors</td>
</tr>
<tr>
<td>Weight of 45g</td>
</tr>
</tbody>
</table>
3.2. Method

This work is designed to give convenience and mobility to the surveyors and teachers alike to do their desired task which for now limited to only getting responses from others, for examples conducting quizzes to assess the students’ knowledge, and surveying the crowds to know their perspective. With the situation of limited Internet connection, the modern online survey is unusable, but with many ownership of computer devices, an easier way than the conventional paper based questionnaire becomes available. That method is the use of hand carry computer which functions as a portable server to gather data inputed from other users’ or participants computer device which can be connected and functions as a client illustrated on Figure 1. When conducting surveys, it is no longer needed to handover paper questionnaires, but only ask the people to connect to the device and answer the questions from their gadgets. It can be applied by surveyors to gather data on institutions, teachers who are giving quizzes to their students, surveyors who gather data from home to homes, or even by random persons on crowds in the public whether for commercial or personal use. Unlike the paper based, processing can be task on the device which eliminates the needs to manually inputing and process the survey data afterwards which also means results can be obtained instantly and accumulatively.

As described in the previous sub section, the hand carry device used is a Raspberry Pi. Raspbian OS is then flashed into this computer which is a Linux based OS. Required modules can be downloaded and installed from The Internet which the Raspberry Pi can connect from the wired or wireless interface. The first modules needed are means to connect users to this Raspberry Pi through wireless connection which will use the one based on IEEE 802.11. They are Hostapd to run the wireless interface as a hotspot and Udhcpd to give IP address to the clients attempting to connect. The second modules needed are means to host the questionnaires, quizzes, or alike which is web based on this work. Apache2 as the web server to show the electronic questionnaire and MySQL as the database server to store the inputed data from clients. In this work, CMS Limesurvey is used to manage the local questionnaires, a sample screenshot is available on Figure 2. The third modules is not essential but eases the clients on the attempting process which are DNS server Dnsmasq to resolve all domain name to the local survey website and Iptables to redirect if the server is connected to The Internet, simply they function as a landing page in order to automatically direct clients to the questionnaire’s location when they open their browsers. If not, we have to tell them beforehand and let them find the location manually. With all of this done the Raspberry Pi will function as a hand carry server.
Figure 1. Illustration of using hand carry computer device to gather information from other users inputed from their own computer device.

Figure 2. Screenshot of attempting a survey using this method where it can be seen the client connects through a hotspot and received an IP address 172.16.0.2 and the survey link resides on 172.16.0.1/limesurvey. This was attempted on a laptop but it is not much different on mobile.

3.3. Simulation
Small simulations or trials were carried where there was 1 surveyor and he surveyed 30 people simultaneously. The surveyor is one of our lab members name Elphas Lisalitsa, and it is also fortunate that he never heard of Raspberry Pi when we approached him, which is good that the feedback of using this method can be more objective. It is conditioned that the surveyor knew how to do this method including using Limesurvey CMS. Before conducting
the trial the surveyors are trained to do this method which fortunately only took one time that only last few minutes, since it’s quite unfair that the surveyor is versed in computer literacy, meaning that he is already skilled in creating questionnaire using document editor softwares and printing them. As he is already versed in using Microsoft Word, Libreoffice Writer, and similar softwares it is fair that he should also be versed in using our method. Imagine if a person does not know how to use Libreoffice Writer, he/she will take a long time to make this questionnaire, which is the same story of not knowing to do this method.

The first experiment was the conventional one where they use paper based which the process includes writing 29 item questionnaires, printing them out, handing them to the participants, collecting them back, finally inputing them on the database. The second experiment is using our method which the process includes writing 29 item web based questionnaires, starting the device, asking the participants to connect and answer the questions. Due to some current limitations, field survey cannot be conducted but simulation with 29 virtual users provided and 1 real user attempted the survey on the Raspberry Pi. The same can be said for paper based where only distributing and collecting the papers are simulated with only single participants answering the questions. In the end the surveyor will be asked to compare the convenience of both methods. The questionnaire items were based on a survey of MOOC readiness survey in high schools and a national University in Mongolia containing 18 five point likert scale questions, 5 yes or no questions, 4 multiple choice questions, and 2 fill in question, also 633 words with 3628 characters. The survey was lead by our peer Otgontsetseg Sukhbaatar.

For further simulation, stress testing was conducted to see if it could handle up to one hundred users. Unfortunately as stated before that the authors did not have a real testing ground, instead a simulation is carried using Funkload a web stress testing application (Delbosc, 2017) from another powerful computer to simulate a hundred virtual users at the same time accessing and conducting the survey. The application was able to record the activities on the browser starting from accessing the survey, answering questions, then viewing current results, and later to be replayed in benchmarking mode to include more virtual users. CPU and memory usage, and power delivery were also measured, but more importantly the response time.

4. Results

4.1. Data Collection Process
Figure 3. Time consumption of survey process from preparation, responding, to post survey. For paper based method the preparation consists of question typing and question printing, responding consists of question distribution, question answering, and response collection, and Post Survey consists of response insertion. For hand carry server method the preparation consists of question typing with web delays, responding consists of server connection, question answering with web delay, and the advantage of this method is no need for post survey which the response already automatically inserted.

Figure 4. Time consumption captured during creating survey, and attempting survey on Raspberry Pi. Idle time can represent the time taken for typing, choosing, etc (manual labor), while others are web delay such as time to load a page and time to submit forms.

Figure 3 shows the time consumption of both method showing little difference on preliminary and during data collection process. During the preliminary data collection process, the conventional method starts of by opening Libreoffice Writer, then writing 29 questions which took 33 minutes. Next printing the questionnaires of 3 pages for 30 people using OKI C332 fast printing machine which took as quickest of a second per page and everything took roughly 1 minute and 30 seconds assuming that it had the capabilities of automatic stamping. Using old printers may take much longer. Also the more the paper the heavier the weight, while Raspberry Pi only weights 45g. Making questionnaires on Raspberry Pi solely depends on what application was used, on this case is using Limesurvey LMS. The time consumptions can be divided into two which are typing the questions and delays from the web system with detailed data showed on Figure 4. Using developer tools available on all browsers the process of questionnaire creation can be
monitored in detail. It can be summarize that delays from the web like loading and scripting took a minute and 28 seconds while typing the questions itself took 34 minutes and 27 seconds. For paper based the issue is the needs to produce hard copy which contributes time needed for printing, while for this method depends on the hardware and software capabilities of the server and/or client if chosen to work remotely. With greater capabilities it can lessen the web delays such as loading page, and vice versa that more lags will occur with lower capabilities.

For data collection process, it is the manual labor that is needed to be worried for paper based method which are distributing questionnaires and collecting them back while for Raspberry Pi based is dependent on its computer capabilities where the more the user, the more its performance degrades, more details are discussed on next subsection, also the capabilities of the client’s computer device influences. For paper based, distributing questionnaire took a minute 15 seconds and collecting them back took a minute 10 seconds. For this method the time to connect is a minute and 2 seconds and the web delay is 11 seconds tested for one user with 29 virtual users logged in (this result is highly related to Figure 6). As for answering the questions itself there is little difference where for paper based took 2 minutes and 54 seconds while for this method took 2 minutes and 59 seconds.

Finally the post data collecting process is where the advantage of this work’s method was shown. An extra process will have to be taken if using the conventional method which is inputting the data to the database. On Figure 3 is assuming the fastest semi-automatic way using machines which are a scanner to scan the answers and optical character reader (OCR) to read the answers to be automatically put into the database like on English tests or national

Figure 5. Data in form of bar graph and pie chart was shown the instance the hand carry server received the responses. Only 6/29 item result shown here since it is too much to show all.
examination tests which took 7 minutes and 30 seconds for 90 pages of responses (3 pages multiplied by 30 people), with our scanner Epson ES-H300 was able to handle 5 seconds per page. Thought most surveyor does not have this technology and manually types them one by one which can take a lot more time, also usually two people are assigned doing the exact same thing for which in the end their answers to be cross checked with each other to mitigate human errors. Note that this have not include generating graph like analysis.

Even so the hand carry server method surpasses those methods (whether manual or using machines like scanner) that can input and generate analysis with graphs the instance the participants answers the questionnaire. This made clicker possible to be implemented which is like polls on television shows. The page on Figure 5 showing the statistic have to be refreshed manually everyday to show latest results but this depends on the services provided by the LMS, though a bit implementation of asynchronous JavaScript and XML (AJAX) or the newest method JavaScript Object Notation (JSON) can make it more real time where the page updates automatically. In short this process can be a heavy burden for the surveyor if using paper based while using this method there is no need to go through this process which can save quite a lot of labor energy and time. In the end, the total time consumption on Figure 3 is shorter because for this method because it does not need to go through post data collecting process.

4.2. Device’s Performance Measurement

As said on the previous section the authors currently unable to conduct larger field testing, therefore a simulation was done instead using Funkload to simulate up to a hundred virtual users conducting this survey. From Nah (2007) a tolerable waiting time for information retrieval is approximately 2 seconds, and from Baily (2001) around 5 seconds is still ok, and 10 seconds is the maximum. For this work 10 seconds response time was taken as the maximum limit.

Figure 6 showed the response time when 1 up to 100 virtual users attempted the survey. This can be said the worst case scenario since the users access the survey at the exact same time meaning all questions multiplied by up to 100 was loaded and all answers multiplied by up to 100 was submitted instantaneously. It is called worst case scenario since loading and submission at the same time almost never happen, in real scenario is a random probability which the load is always lighter. Because of this the data obtained was quite unexpected showing that it was too much to handle 100 virtual users simultaneously loading and submitting 30 questions (extra fake question to round the number) and answers as described of the questionnaire on the previous section. Therefore more experiments results with fewer questionnaire items were added which are 5, 10, and 20 items.

For the real case of 30 items, if guaranteed below 10 seconds response time is seek then 10 users at a time is the maximum, if average of 10 seconds is still okay then it can handle up to 30 users (matches quite well with Figure 4). If longer time is alright then it can take up to 85 users before failure occurs and finally the service broke after 90 virtual users where restart of web and database server was required. Though fewer questionnaire items allows faster
response time. For items of 20, 10, and 5 the maximum of 10 seconds occurred respectively at 15, 25, and 30 virtual users, while average of 10 seconds occurred at 45, 70, and 100 virtual users. Why does the number of items relates to response time? Because the user will have to load the items on the web browser when attempting the survey. To be more specific, the user requests and the web server transmits, and the more the items, the more transmission took place. Also after the attempt the users will have to send its response where the more the items the more the responses that must be sent. Again Figure 6 showed the worst case where all users requests all the items and returns all its responses at the same where this case is almost unreal. Therefore more user capacity might actually be available, but referring to the data as the limit may proof reliable judgment. In short it is guaranteed.

To get the CPU and memory usage an application called Vmstat is used and ran every seconds printing the current CPU and memory usage. The method of calculation was how much of CPU and memory was free differentiate from the total CPU and memory available. Figure 7 showed the measurement that during survey creation the CPU usage was below 40% and memory usage was below 500 MB. It is expected less resource is used since only one user is creating the survey. However during survey attempt the CPU usage was mostly above 80% and memory usage was mostly above 600 MB, which is because 30 users are attempting at the same time with questionnaire of 30 items. The explanation is almost the same as response time that more computer resource is needed to allow more user attempts and more questionnaire items.

The energy consumption is measured based on how much was consumed on the power bank. The powerbank has a specification of 20000 milliampere hour (mAh). After going through all the process on Figure 3 the percentage showing on the powerbank’s monitor drops from 100%-97% meaning only using 3% and the calculation is on Equation 1 showing 0.6Ah in 39 minutes. In an hour it should use 0.92Ah which the result is quite matching to the experiment done on “Raspberry Pi FAQs” (2016). The voltage was 5 volts (V) which the current delivery will be 0.92Ah multiplied by 5V and will be 4.6 watt hour (wh). In the end power delivery is not a big deal.
Figure 6. Response time of simulated survey process from participants side ranging up to a hundred virtual users, (a) left is accessing survey page and right is viewing results, (b)
number of question for left image is 5 and right image is 10 (c) number of question for left image is 20 and right image is 30.

(b) Figure 7. CPU and memory usage of (a) survey creation (b) survey attempt with additional 29 virtual users.

Figure 7. CPU and memory usage of (a) survey creation (b) survey attempt with additional 29 virtual users.

5. Conclusion and Future Work

This work shows that the hand carry server method was more convenient than the paper based method. For the time consumptions comparing the two methods, this work’s method’s showed faster result since less manual labor are done. The advantage of this work’s method is visible in post data collecting process which can provide automatic insertion of responses to the database and instantly display them in statistics in real time. Although that it provides great convenience there are limitation due to the resource available on the hand carry server. With 5, 10, 20, and 30 number of questions on the survey, it can be guaranteed that the response time will not exceed 10 seconds if users does not exceed respectively 35, 25, 15, and 10. If beyond that is still tolerable, then the simulation showed that the average response time of 10 seconds occurred at number of virtual users of 100, 70, 45, and 30 when there are 5, 10, 20, and 30 items in the questionnaire. It’s the same for CPU and memory usage that it was mostly consumed when number users is above 30 with each loading 30 items of questionnaire. If it is just a class with average number people the device can handle it.

This work showed only some applicative which introduces the idea and yet to be implemented. There are room for improvements on its data structure, and performance. Another issue which is yet to be discussed is the privacy and reliability, for example its
susceptibility to data loss and failures. Additionally synchronization may also be discussed starting from the hand carry device to the main server, then between hand carry devices if more than one is used for a survey, like how to combine the data together. In the future will also try using other more popular hand carry devices such as mobile phone whether it is possible for it to function as a portable server such as the one on this work and compare those ones with this work.

Acknowledgements:

Part of this work was supported by JSPS KAKENHI Grant-in-Aid for Scientific Research 25280124 and 15H02795. The authors would like to thank Elphas Lisalitsa for willing to be a subject for the trial as a surveyor, which he was burdened with doing two kind of surveys that were paper based method and hand carry based method, starting from creating the questions, collecting the data, and inputing the data. The authors would also like to thank Otgontsetseg Sukhbaatar for providing us her questionnaire items and informing us about her survey experience using paper based in some high schools in Mongolia.

References


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Design of Mobile Learning Feedback Analysis System for Flipped Classroom

Hung-Hsu Tsai¹, Jie-Yan Peng², You-Ming Yong³, Pao-Ta Yu⁴

Abstract

The paper presents a Mobile Learning Feedback Analysis System, which is called MOLFAS hereafter. It can be utilized to support learning activity of flipped classroom, a kind of classroom learning (c-Learning). First, students can use mobile devices to watch multimedia teaching units over Internet outside classroom. They then send feedbacks on studying multimedia teaching units to the MOLFAS through mobile devices. A characteristic of the MOLFAS is to integrate two kinds of operations to view teaching units and to upload feedbacks in the same window (screen). Because the design is based on the spatial principle of multimedia learning, it can collect more accurate feedbacks from learners and then get more reasonable analysis results of feedbacks. The MOLFAS is cross-platform for many kinds of mobile devices, which is another characteristic of the MOLFAS. Before class, teacher can exploit the MOLFAS to analyse the responses students offer. The analysis results can help teacher to decide whether the instruction models such as learning activities or key contents explanations have to be changed in classroom according to the analysis results of learners’ responses.

Keywords: mobile learning, classroom learning, flipped classroom, multimedia learning, feedback analysis, spatial principle, cross-platform design

1. Introduction

Nowadays, using mobile devices is ubiquitous and changing human life. Most people employ mobile devices in dealing with their own businesses. Especially, the development of mobile learning (m-Learning) on education is emerging and becomes a popular research. The main advantage of using m-Learning is to create learning opportunity in anywhere and on anytime. This kind of learning is significantly different from traditional learning (Ozdamli & Cavus, 2011). Moreover, in recent years, flipped classroom (FC), a new learning model, has been
diversely spread to promote the traditional classroom learning (c-Learning). FC is a new instruction model that make learning be learner-oriented. Learners study teaching units out of class (not class time), which can be readily obtained from learning management platform over Internet. These teaching units are generally constructed by multimedia materials (Yilmaz, 2017). An important thing for FC is to have more time in classroom and then to increase interactive learning activities due to without teaching or reducing teaching time. Therefore, it is critical how to apply m-Learning in FC to construct a novel learning model. Currently, although many m-Learning systems support watching multimedia materials, but most of them do not provide user-friendly feedback interface for users. Furthermore, they also ignore to offer teachers the function to get statistics of feedbacks on watching multimedia materials by means of mobile devices. Here Table 1 presents a comparison among learning systems in terms of several functions. The e3Campus is a learning management platform used in National Formosa University in Taiwan.

**Table 1.** A comparison among learning systems with displaying video in terms of several functions.

<table>
<thead>
<tr>
<th>functions</th>
<th>e3Campus</th>
<th>Youtub e</th>
<th>Adobe Connect</th>
</tr>
</thead>
<tbody>
<tr>
<td>Recording video</td>
<td>x</td>
<td>x</td>
<td>v</td>
</tr>
<tr>
<td>Watching video embedded in the same window</td>
<td>x</td>
<td>v</td>
<td>v</td>
</tr>
<tr>
<td>Mobile learning</td>
<td>v</td>
<td>v</td>
<td>v</td>
</tr>
<tr>
<td>Watching video and answering feedbacks in the same window</td>
<td>x</td>
<td>v</td>
<td>x</td>
</tr>
<tr>
<td>Easily query analysis results of feedbacks</td>
<td>x</td>
<td>x</td>
<td>x</td>
</tr>
</tbody>
</table>

Consequently, the paper presents the MOLFAS which offers a user-friendly feedback interface for users by merging these two operating interfaces, displaying multimedia materials and sending users’ feedbacks to cloud server, into the same window. This design concept is based on the spatial contiguity principle in multimedia learning (Mayer, 2002). That is, a window includes the region that learners operate to watch teaching units and other corresponding regions that learners send feedbacks. This way makes learners rather hold the information represented by watching teaching units in their working memory while performing the operations to send feedbacks. If they don’t, their referential links between watching teaching units and answering feedbacks will decrease, thereby degrading students’ cognition (Lai, et. al, 2011). This leads to collect bias feedbacks. Additionally, the MOLFAS provides analysis results (statistics) of feedbacks on watching multimedia materials by mobile devices. Accordingly, when performing FC in a classroom, the analysis results can help teacher to decide whether the instruction models, learning activities or key contents explanations have to be changed in the classroom before class. Namely, before class, teachers can obtain the analysis results of responses on watching teaching materials outside classroom. This results can help teacher to determine their teaching plans in class if necessary.
In Section 2, some related literatures are reviewed. In Section 3, the MOLFAS is briefly described. In Section 4, an instructional design using the MOLFAS is proposed for flipped classroom and some discussions are given. Finally, conclusions are drawn in Section 5.

2. Literature Review

2.1. Mobile Learning
In recent years, many articles proposed the promise results of applying m-Learning in higher education. With more innovative mobile technology, m-Learning has become more popular and various for education. Due to the highly mobile feature of m-Learning, it is able to access numerous data over network for reading or studying. There is a challenge problem how to collect useful data by mobile devices while learning and then to discover relationships or correlations among those data. (Fulantelli et al., 2015). M-Learning is a learning model. Learners acquire diverse learning materials through mobile devices over network. In this kind of learning model, learners feel free and more flexible than tradition learning. Moreover, m-Learning can help learners to improve their learning performance. There are five basic components of an m-Learning model, which consists of Learner, Teacher, Environment, Content and Assessment. Main features of m-Learning include ubiquitous/spontaneous, portable size of mobile devices, blended, private, interactive, collaborative and instant information (Ozdamli & Cavus, 2011).

2.2. Flipped Classroom
FC is a popular learning model with a learner-oriented fashion in recent years. Learners are asked to study teaching materials out of class (not class time). For instance, learners watch multimedia teaching materials outside class, and then during class time learners have more time in discussing their opinions or more interactive activities. The way makes learners more active and interactive with teachers or others learners. In FC, during class time, teacher plays a role as a support to help students in learning when students have needs. Performing FC can change the traditional learning that teachers only teach their knowledge just using a single way (Yilmaz, 2017). Due to learning out of class, learners can feel free to adjust their learning time or learning way for teaching units that are assigned by teachers. Because multimedia learning units can be watched repeatedly once learners still cannot understand multimedia learning units, learners have more chances to understand teaching units. Traditional learning has a problem that learners cannot quickly resolve their questions due to having time pressure. Additionally, for FC, in class teachers have more time to observe learner’s learning performance by getting learners’ feedbacks appropriately (Kim et al., 2014).

3. The MOLFAS Descriptions
3.1 System Architecture

Figure 1. The system architecture of the MOLFAS.

Figure 1 shows the system architecture of the MOLFAS. It provides cross-platform services by mobile devices and personal computers. First, the MOLFAS offers administrator to perform course, class, user, and authentication managements. Teacher can employ the MOLFAS to manage/maintain teaching materials with multimedia format, to query analysis results of students’ feedbacks on teaching materials, and to manage/maintain announcements for classes. Students can exploit the MOLFAS to watch teaching materials and then to send their feedbacks on teaching materials students watch. Meanwhile, the MOLFAS offer students who can post their comments or questions on the discussion board.

3.2 Functions of the MOLFAS

In the MOLFAS, system functions can be divided into four groups, Cloud Server, Administrator, Teacher, and Student. They are briefly stated in the following, respectively.

(i) **Cloud Server**

- Keep feedbacks: Cloud server stores feedbacks given by students who watch teaching materials.
- Analyze feedbacks: Cloud server offers analysis functions to compute the results of feedbacks.
- Users’ authentication portfolio: Cloud server keeps users’ authentication portfolio as using the MOLFAS.

(ii) **Administrator**

- Class management: Administrator can maintain class information.
- Course management: Administrator can maintain course information.
• User/role management: Administrator can maintain user information including user creation, deletion and update. Also, each user is assigned to a role in the system.
• Authentication management: Administrator can maintain authentication information to make sure to prohibit illegal users entering the system.
• Questionnaire for feedbacks: Administrator can maintain questions of a questionnaire for getting students’ feedbacks on watching teaching materials.

(iii) Teacher
• Teaching material management: Teacher can edit teaching materials for one of courses.
• Query analysis results of feedbacks: Teacher can query analysis results of feedbacks.
• Announcement management: Teacher can edit announcements which can be read once entering the system.

(iv) Student
• Watch teaching materials: Students can employ mobile devices or personal computers (web interface) to watch teaching materials. One of advantages of the MOLFAS is to offer a window including watching teaching materials and operating sending feedbacks to Cloud Sever. In contrast, several existing systems offer a window to display teaching materials for watching and the other separated window to operate the function of sending feedbacks to Cloud Sever. The later needs to often switch these two windows when sending feedbacks to Cloud Sever. This design may result in collecting bias feedbacks due to often switching windows.
• Send feedbacks to Cloud Server: Students can employ mobile devices or personal computers (web interface) to view teaching materials. Meanwhile, they can deliver feedbacks to server via sending feedbacks in the same window in which teaching materials also are displayed.
• Post students’ comments on discussion board: Another kind of feedbacks is to collect students’ comments on discussion board. Students can give their comments or discussions on the discussion board.

4. An Instruction Design

4.1 An Instruction Procedure Using Functions of the MOLFAS

Figure 2 displays an instruction procedure when applying the MOLFAS in learning. First, Administrator creates classes, courses each class has, and teachers who teach their courses for Steps 1-2. Figure 3(a) and (b) exhibit show course creation and teacher with a new account creation, respectively. Next, for Step 3, Teacher maintains the courses Teacher teaches, and imports or maintains teaching materials (teaching units with multimedia format) for each course. Figure 4 illustrates a situation that Teacher can import teaching units of a course in
Cloud Server. Subsequently, for Step 4, Students can watch or study teaching units with multimedia format by mobile devices with web APPs or personal computers with web interface. Meanwhile, learners can send their feedbacks on the units to Cloud Server or post their comments (or discussions) on discussion board whose position followed by the displaying-unit region. Figure 5(a) shows a case while students use their mobile devices to learn teaching units with video format. Figure 5(b) and (c) display the mobile device’s screen of Students who can post their comments or discussion on the discussion board and choose the answers for questions of the questionnaire, respectively. The MOLFAS offers cross-platform services. Figure 6 (a) and (b) show students can watch video and answer questions of the questionnaire by web interface for personal computer and pad, respectively.

Figure 2. An instruction procedure supported by the MOLFAS.

Figure 3. (a) and (b) show course creation and teacher with a new account creation, respectively.
Figure 4. (a) and (b) display importing students and teaching units of a course into Cloud Server, respectively.

Figure 5. (a) Students watch a unit with video format; (b) Students post their comments or discussion on the discussion board; (c) Students choose the answers for questions of the questionnaire.
Figure 6. (a) and (b) exhibit students watch video and answer questions of the questionnaire by web interface for personal computer and pad, respectively.
Figure 7. A query result for the analysis results of learners’ feedbacks.

Finally, for Steps 5-6, Teacher can obtain analysis results of feedbacks by sending a query of getting the results of feedbacks for each course. Once Teachers have the analysis results of feedbacks before class, they may consider to adjust the instruction plan or teaching activity in class for teaching units according to analysis results. Figure 7 presents an example for the analysis results of learners’ feedbacks.

Figure 8. The diagram of an instructional design for learning based on flipped classroom supported by the MOLFAS.
4.2 Discussion on the Analysis Results of Feedbacks

Observing Figures 2 and 7, the MOLFAS can support an instruction procedure stated in Subsection 4.1. The procedure can be applied in learning for flipped classroom. That is, the paper develops an instructional design based on flipped classroom via utilizing the MOLFAS. More specifically, Following Step 3 in Figure 2, Teacher can devise a teaching plan of arranging students’ assignments for each class. For example, the assignments are to watch multimedia teaching units outside classroom. Subsequently, in Step 4, students study assignments, viewing multimedia teaching units by mobile devices or personal computers outside classroom. Once students have finished to study assignments, they are encouraged to send their feedbacks to Cloud Sever. The feedbacks probably contain students’ comments, discussions, and answers on questions of a questionnaire. The operations, to send feedbacks and to view teaching units, are designed in the same window here. The analysis results of feedbacks can be obtained in Step 5. Finally, the results are outputted in Step 6.

Therefore, the paper proposes an instructional design for learning based on flipped classroom supported by the MOLFAS. A diagram of this instructional design is illustrated in Figure 8. The learning procedure for the instructional design can be briefly described as follows.

Step 1: Teachers notify students’ assignments which will become teaching contents used in next class time.
Step 2: Students get the notification and then watch or study the assignments outside classroom.
Step 3: Students deliver their feedbacks to cloud server once they have finished to watch or study the assignments outside classroom.
Step 4: Teacher queries the results of feedbacks before class.
Step 5: The analysis function is enable to analyse the feedbacks, and corresponding results are stored in cloud server.
Step 6: Teacher gets the analysis results of feedbacks before class. At that time, Teacher may consider to adjust teaching plans or activities in class according to the analysis results.
Step 7: Teacher starts instruction in classroom.
Step 8: Teacher selects teaching units for next class and repeats the teaching process for FC.

Before class, teachers can get analysis results of feedbacks for this class. This results can help teachers to decide whether they adjust their teaching plan in class or not. The following states three cases for the help, which make teachers have preparations or responses for the analysis results in class.

• Feedbacks are more negative for some teaching units: Teachers may give more clear explanations for these teaching units students watch outside classroom.
• Feedbacks are almost neutral for some teaching units: Teachers may hold a quiz.
• Feedbacks are more positive for some teaching units: Teachers may give more supplements related the teaching units for study.
5. Conclusion
The paper has proposed the MOLFAS, the mobile learning feedback analysis system. It can offer cross-platform services to support learning activities for FC via mobile learning. First, students can use mobile devices to watch multimedia teaching units over Internet outside classroom. Meanwhile, they send their feedbacks on multimedia teaching units to the cloud server of the MOLFAS via mobile devices. A characteristic of the MOLFAS is to integrate two kinds of operations to view teaching units and to upload feedbacks in the same window (screen). The way can collect more accurate feedbacks and then get more reasonable analysis results of feedbacks according to the spatial principle of multimedia learning. Before class, teacher can query the cloud sever of the MOLFAS to analyse feedbacks students offer. The analysis results of feedbacks can help teacher to decide whether the instructional designs such as learning activities, holding an examination, or key contents explanations will be changed in class. Table 2 presents a comparison for the MOLFAS and existing learning systems displaying video in terms of several functions. Observing Table 2, the MOLFAS can provide several appropriate functions to support the learning for FC with mobile learning. In future study of the paper will conduct experiments via questionnaires to predict and investigate the performance of the MOLFAS on learning effectiveness according to students’ acceptance for the ease of use and usefulness.

Table 2. A comparison for the MOLFAS and existing learning systems with displaying video in terms of several functions.

<table>
<thead>
<tr>
<th>functions</th>
<th>e3Campus</th>
<th>Youtub e</th>
<th>Adobe Connect</th>
<th>MOLFAS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Recording video</td>
<td>x</td>
<td>x</td>
<td>v</td>
<td>x</td>
</tr>
<tr>
<td>Watching video embedded in the same window</td>
<td>x</td>
<td>v</td>
<td>v</td>
<td>v</td>
</tr>
<tr>
<td>Mobile learning</td>
<td>v</td>
<td>v</td>
<td>v</td>
<td>v</td>
</tr>
<tr>
<td>Watching video and offering comments in the same window</td>
<td>x</td>
<td>v</td>
<td>x</td>
<td>v</td>
</tr>
<tr>
<td>Watching video and answering feedbacks for a questionnaire in the same window</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>v</td>
</tr>
<tr>
<td>Easily query analysis results of feedbacks</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>v</td>
</tr>
</tbody>
</table>

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Authors would like to thank the Ministry of Science and Technology of Taiwan, for financially supporting this research under Contract no. MOST 105-2511-S-150-003-MY2, 105-2511-S-194-002-MY3, and 105-2511-S-194-001.
References


Supporting Collaborative Interaction among Learners with InCircle

Noriko Uosaki\(^1\), Takahiro Yonekawa\(^2\) and Chengjiu Yin\(^3\)

Abstract

This paper describes the development and evaluation of a chat system called InCircle. It is widely recognized there has been a paradigm shift in education. One of the trends is the shift from teacher-centered to student-centered learning. IT technology has facilitated its shifting. With the spreads of educational application of SNS (social network services), it has enabled us to share information and knowledge in real time. InCircle was introduced in a language and culture class at university in Japan in order to facilitate interaction among students and to enhance learning opportunities. The number of the students’ posting dramatically increased after it was introduced compared with the blog comment function. The result of the questionnaire endorsed its usability and effectiveness as a communication tool.

Keywords: Collaborative learning; InCircle; International students; International exchange subject; Student-centered learning

1. Introduction

Student-centered collaborative learning has been drawn attention not only from the researchers but also practitioners. It is reported that student-centred and small-scale course programmes resulted in more academic success than lecture-based course programme (Severiens et al. 2015). According to Oxford (1997), collaborative learning has a “social constructivist” philosophical base, which views learning as construction of knowledge within a social context and which therefore encourages acculturation of individuals into a learning community. It is also reported that a student-centred collaborative learning is one of the most effective ways of learning in language class (Chen 2003). In fact, most studies investigating the link between the extent to which course programmes are student-centred on the one hand and promote academic success on the other hand, find positive relationships between the two (Severiens et al. 2015). Recent prevalence of high-performance mobile devices has enhanced the potential of students’ active interaction via mobile-based communication tools. We have seen a good deal of researches on communications applications such as educational application of SNS (social network service) (Muoz & Towner 2009, Hung & Yuen

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2010, Kim & Kim 2013, Kwak et al. 2014). Our communications application project, InCircle system, is among them. In this study InCircle was introduced for the purpose of facilitating interaction among students and enhancing learning opportunities.

2. InCircle

InCircle System is a client-server application. The server side runs on Linux OS and Windows Server. The client side is working on iOS, Android, and PC web browser. Chat messages are transmitted and received through the network (Figure 1).

The system allows users to create groups. Group members are able to send and receive messages and multimedia files in their chat room with an easy operation. Chat messages are synchronized in real-time to realize smooth communication. Figure 2 shows its log in interface (left) and chat room interface when it was first introduced in class (right).
Figure 2. InCircle log-in interface (left) and chat room interface (right)

In our system, we have mainly four major advantages:

• Teachers can be administrators of the system. Teachers can be administrators of the system so that they can watch the users/their students’ behaviours. Therefore they can avoid their students’ malicious behaviours via InCicle. Even if some case happens such as a harassment case, teachers can abort the student’s accounts.

• User accounts are pre-registered. Unlike other SNS or chat tools such as Facebook and LINE, user accounts are pre-registered. Teachers create accounts for their students and make a group for the class in advance. There are always some students who do not want to use the existing SNS systems. In fact in one of the authors’ class that some students rejected to create a Facebook account and some students did not want to use LINE. Unless all the students agree to use it, it is next to impossible to use it as a communication tool in class. Besides, the existing SNS users usually post their private information on their profiles. In fact the system encourages them to fill out their profile pages. However some students may not wish to share private information with some of their classmates. In our system, on the contrary, there is no page in the first place to fill in their private information such as school career, birth place/date.

• Ensured security Every effort was made in order to ensure the security, such as encryption of the cache data in the client terminal, channel coding, encryption of database, the use of different cryptography keys for each company or school in the server side. Therefore it is highly protected against divulging of information or account hacking.

• To be able to delete the sent messages. In our system, we can delete messages after it is sent not only on the sender’s side but on the recipient’s side. It is likely to happen that we send messages by mistake. Out system can handle such human errors.

Our research questions are:
(i) Can InCircle contribute to the enhancement of interaction among the students?
(ii) As a result, can InCircle contribute to the effective student-centered learning?
(iii) As a result, can InCircle contribute to the enhancement of their learning opportunities?

3. The target class
The class was one of “international exchange subjects” which was targeted mainly for international exchange students. Japanese students who are interested in class held in English can also join it. The target class was held 14 times once a week in a CALL (computer assisted language learning) room during the fall semester, 2016. The class language was mainly in English. The objectives of the target class were (1) to enhance cross-cultural understanding and (2) to improve the skills of their target languages, which were Japanese or English.
4. Evaluation

4.1. Procedures

An evaluation was conducted in one of the authors’ class at university in the western part of Japan. It consisted of 17 students (4 Japanese, 3 Germans, 2 Chinese, 2 Indonesians, 2 Taiwanese, 1 American, 1 Egyptian, 1 Hong Konger, 1 Vietnamese). All the participants were owners of mobile phones.

In order to examine the effectiveness of InCircle system, the comparison was made between InCircle and blogger’s comment function. A class blog and a mailing list (ML) were created by the teacher as communication tools because not all the students had facebook accounts, nor LINE accounts, nor Twitter accounts. Google Blogger service was used for creating the class blog. It was used throughout the semester from October 4, 2016 to January 24, 2017. She posted contents which were useful for classroom learning. As for the mailing list, even though the teacher instructed the students to use ML as a communication tool among classmates, it turned out that it did not play any role as a communication tool. Therefore the mailing list was used only by the teacher when she needed to share necessary information with the students.

InCircle was introduced in the latter half of the semester and was used from November 29, 2016 to January 24, 2017. Therefore during the period, both Blogger and InCircle were used as communication tools. The teacher posted theme topics on both sites, where interrogative sentences were often posted so that the students felt it easy to post comments and interact each other on the both media (eg. “Is your language stress-timed or syllable timed?”, “Is kindergarten compulsory education in your country?”, “Do you have priority seat in your country?”, “How do you celebrate new year holidays in your country?”). The students were instructed to post comments on both media. They were informed that their posting would reflect their grades.

4.2. The Results

Table 1 shows the comparison of the numbers of posts between the blog comment columns and InCircle talk room. Even though the length of the trial use of InCircle was short (November 29, 2016 – January 24, 2017 for InCircle and October 4, 2016 – January 24, 2017 for Blogger) and the number of the theme topics were small (17 for InCircle and 76 for Blogger), the total number of posts was 146, which overwhelmed the number of blogger comment posts, 16.

<table>
<thead>
<tr>
<th></th>
<th>InCircle</th>
<th>Blogger</th>
</tr>
</thead>
</table>
The number of talks (InCircle) | 17  
---|---
The number of blog pages (Blogger) | 76  
| The number of posts | The number of comments |
Teacher | 48  | 4  |
Students | 86  | 12  |
TA\* | 12  | 8  |
| 146  | 16  |

\*TA: teaching assistant

Figure 3 shows interaction among the students when they were asked how you celebrate new year holidays in your country. Figure 4 shows comments from the students when they were asked how you usually make yourself or your room warm. As the number of the post shows, the students were more active in posting messages in InCircle. As for Blogger comment function, its users cannot post multimedia files. Besides, in order to post a comment, they need to log in Google account. Otherwise, the system requests them to prove that they are not robots. Apparently InCircle’s easy operation facilitated interaction among classmates.

![InCircle post](image1)

**Figure 3. InCircle posts**

![Blogger comments](image2)

**Figure 4. Blogger comments**

At the end of the phase, they were asked to answer the five-point-scale-questionnaire as shown in Table 2. Q1 and Q3 were created based on the technology acceptance model proposed by Davis (1989). Q2 was created to examine the fun factor of our system. Q4 and
Q5 were created to examine its usefulness of the class learning. Q6 and Q7 were created for examining the user acceptance of its interface and the whole system.

Table 2. The results of the 5-point-scale questionnaire

<table>
<thead>
<tr>
<th>Questions</th>
<th>Mean</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Q.1 Was it easy for you to use InCircle?</td>
<td>4.8</td>
<td>0.39</td>
</tr>
<tr>
<td>Q.2 Was it fun for you to use the system?</td>
<td>4.5</td>
<td>0.66</td>
</tr>
<tr>
<td>Q.3 Was it helpful as a means of communication with your classmates and teacher?</td>
<td>4.5</td>
<td>0.78</td>
</tr>
<tr>
<td>Q.4 Was it helpful for your classroom learning?</td>
<td>4.3</td>
<td>1.21</td>
</tr>
<tr>
<td>Q.5 Was it helpful for your target language learning?</td>
<td>3.4</td>
<td>1.30</td>
</tr>
<tr>
<td>Q.6 Please rate its interface</td>
<td>4.1</td>
<td>0.51</td>
</tr>
<tr>
<td>Q.7 Please rate the whole system.</td>
<td>4.0</td>
<td>0.60</td>
</tr>
</tbody>
</table>

The highest score, 4.8 was given when they were asked the usability of the system (Q.1). As some students felt it was like other existing apps (Table 2 Comments #1, and 4), most students had already used other similar apps, which lead to the high score of the usability of InCircle. The lowest score, 3.4 was given when they were asked if it was helpful for their target language learning (Q.5). Since the class was held in English, communication language in InCircle was mostly English. Therefore it was helpful for English language learners, but it was not so helpful for Japanese language learners as a language learning tool. In fact, 15 out of 17 students’ target language was Japanese. In order to contribute to the improvement of their Japanese language skills, it is necessary to consider how to use this tool more effectively for Japanese language learning, which will be included in one of our future works.

Table 3. The students’ impression of InCircle

| #1 | it is just a messenger and i do not feel the difference between incircle and other messenger apps such as google hangouts, or line. |
| #2 | It was an interesting way of communication with teachers and peers |
| #3 | Fun way to communicate |
| #4 | its like whatsapp |
| #5 | use it in class to share with others |
| #6 | Feel interested in chatting with friends |
| #7 | It was easy to use and good for classroom discussion use. |

4.3. Discussions

Our research questions were, as mentioned, (i) Can InCircle contributed to the enhancement of interaction among the students? (ii) As a result, can InCircle contribute to the effective
student-centered learning? (iii) As a result, can InCircle contribute to the enhancement of their learning opportunities? As for (i), our system contributed to enhancement of interaction among the students with the following reasons: 1) The students’ posting via InCircle outnumbered Blogger comments. 2) As the students #2, #5, and #7 in Table 3 pointed out, knowledge can be shared via our system instantly so that they were able to interact each other in a very effective way. In traditional class, most possible way to share knowledge with other classmates was to present them one by one in turns, which takes time, thus ineffective. Besides, in pair work or group work, which are regarded as typical collaborative learning methods, it is difficult to share knowledge with other pairs or groups.

As for (ii) and (iii), if the (i) is accomplished, it leads to the accomplishment of (ii) and (iii).

In traditional teacher-centered lecture style class, the students are not able to gain knowledge from other students. However by using InCircle, they could gain knowledge through interaction with other students. For instance, they could learn job hunting systems in other countries through InCircle communication. These are among what the teacher cannot provide. Thus we believe that it can be safely be said that InCircle contributed to the effective student-centered learning and to the enhancement of their learning opportunities. As mentioned earlier, other SNS tools such as facebook, LINE, twitter have a weakness as a communication tool in class. Therefore InCircle could be a powerful communication tool to run effective student-centered collaborative learning class.

It was further investigated if our system contributed to the accomplishment of the course objectives, which were (1) to enhance cross-cultural understanding and (2) to improve the skills of their target languages, which were Japanese or English. As for the course objective (1), InCircle facilitated the enhancement of the cross-cultural understanding as explained when we dealt with our research question (i). They could gain knowledge and enhance cross-cultural understanding through InCircle communication. Besides, the fact that the average point of Q.4 (Was it helpful for your classroom learning?) was as high as 4.3 endorsed it. As for the course objective (2), since the lowest score, 3.4 was given to Q.5 (Was it helpful for your target language learning?), at this point it can hardly be said that our system facilitated their target language learning. It will be considered in our future work.

As for the last question (not required) in the questionnaire: “Is there any functions that you feel great if InCircle could provide?” Student #1 suggested “easier login access”. In our system, we can maintain the login state for 30 days. Therefore frequent users like users who use every week in class can keep the login state so that they do not need to text their ID and password when they log in. The login state for 30 days was set for the security reason. To enhance both security and convenience is a trade-off situation. In order to enhance convenience without losing high security, a new function, passcode input at regular intervals, has been under development. This function is expected to facilitate its users’ login procedure.

5. Conclusion and Future Works
In this study, we describe enhancing communication among students using InCircle. When InCircle was introduced in the mid-semester, the number of the students’ posting
dramatically increased. The high points of the questionnaire results showed that the participants were satisfied with its usability, its fun factor, its interface and the whole system. Our hypotheses (research questions (i), (ii), and (iii)) were proved to be correct. However it was found out that our system was not supportive for their target language learning. Since it is one of the two objectives of the target class, it is needed to consider how to introduce InCircle from the pedagogical viewpoint in order to support their language learning. It is among our future works to find out some solutions to improve the skills of their target languages via InCircle.

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References


Promoting independence: Multimedia-based mobile learning for children with autism

Iffat Jabeen¹, Timothy Yuen², Lee Mason³

Abstract

This paper presents a study that examined the effectiveness of multimedia-based mobile learning for promoting self-directed learning by children with autism. The multimedia-based instruction involved learning of functional sight vocabulary words. Participants of the study included three children with autism. A single subject research design with four phases was utilized. Results of the study were varied; however, findings were positive for most participants and inform how we can effectively design mobile learning environments to facilitate self-directed learning in children with autism.

Keywords: Multimedia, mobile learning, autism, functional vocabulary

1. Introduction

In the US, it is estimated that one in 68 children has been diagnosed with autism spectrum disorders (Centers for Disease Control and Prevention, 2014). Autism is a neurodevelopmental disability that profoundly affects a child's communications, social skills, and language development. Other traits associated with autism include self-stimulation, repetitive movements or stereotypical activities, a defiance to change, and an obsession for routines (American Psychiatric Association, 2013). With communication, social, and language skills being an important aspect of daily life, this disorder negatively impacts a child's ability to be self-reliant, and instead, they become dependent on adult and peer guidance (Goodson, Sigafos, O’Reilly, Cannella, & Lancioni, 2007; Hall, 2009). Further, autism significantly affects a child's academic performance (Individuals with Disabilities Education Act, 2004). Classroom instruction requires a prerequisite level of communication that students with autism may not develop without intensive intervention (Mason, Davis, and Andrews, 2015) such as asking questions and working with peers. In particular, deficits in communication skills and language development can influence literacy development, or lack thereof, in children with autism (Kluth & Chandler-Olcott, 2008). Though important as functional living skills, literacy—the ability to read and write—is also a prerequisite for

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developing more advanced academics. Teaching of functional literacy begins with functional sight word vocabulary, which focuses on words that children encounter in their environment daily. This critical functional academic skill for children with autism not only facilitates independence, it also enhances reading skills. Teachers are constantly exploring techniques to teach children with autism functional vocabulary. This study explored the use of multimedia-based instruction delivered through mobile technologies to teach functional sight word vocabulary. The reason behind this focus is the need to reduce dependence on others and encourage self-reliance and independence for children with autism so that they can successfully integrate in the environment around them. The need for self-reliance stems from the increasing prevalence of autism that requires continuing exploration of effective teaching strategies for children with autism that promote independence while learning academic skills. A self-directed learning approach will teach children with autism to become more self-reliant and initiate interactions with others. Self-directed learning also minimizes the dependence on adults and their typically developing peers to enhance functional independence. This paper presents a study regarding how mobile technologies can facilitate self-directed learning of academic skills in children with autism.

1.1 Autism Spectrum Disorders and Mobile Technologies
Using mobile devices to deliver educational interventions for children with disabilities also has the benefit of avoiding stigma from typically developing peers due to the ubiquitous nature of mobile devices in everyday life, especially amongst children (Rodriguez et al., 2014; Lenhart, 2015). Teachers have noted that mobile device usage has resulted in prolonged engagement with academic tasks in students with developmental disabilities, which lead to improved student achievement (Cummings, Strnadova, & Singh, 2014; Rodriguez et al., 2014). Thus, there are many advantages in using mobile technologies to support students with autism in learning academic skills and makes it a feasible platform for teaching self-directed learning. Since children with autism are naturally drawn to technologies and multimedia-based instruction that motivate learning (Bosseler & Massaro, 2003; Corbett & Abdullah, 2005; Ganz, Earles-Vollrath, & Cook, 2011; Maione & Merinda, 2006; Massaro & Bosseler, 2006), it would make sense that technology-based solutions would assist in teaching a self-directed approach. Specifically, mobile devices can deliver such media-rich educational resources that children with autism are drawn to while also being portable. Using a handheld mobile device can deliver a more personalized learning experience as it is closer to one's personal space and is designed to go anywhere the user takes it. Touch-screens affords more interaction (Magder, 2011; Crichton & Kinash, 2013) with these multimodal resources. The intuitive and user-friendly nature of touch-screens and the portability of mobile devices are valuable for any learner, but are also very beneficial for those with disabilities because they promote engagement, access, communication, and independence (Rodriguez, Strnadova, & Cumming, 2014; Shah, 2011; Steinweg, Williams, & Stapleton, 2010).
1.2 Need for Mobile Learning for Children with Autism

Even though there is an influx of multimedia education applications for students with autism, especially applications that help these students identify feelings or facial expressions, it is not yet evident whether they are successful in promoting independent self-directed learning. There is negligible research regarding instruction for students with disabilities promoting the use of a self-directed learning approach for self-management skills, let alone focusing on academic skills (Argan, Cavin, Wehmeyer, & Palmer, 2006; Mechling, 2007). As a relevant and current platform, it becomes important to investigate how mobile learning that support multimedia-based instruction can promote self-directed learning of academic skills in children with autism.

As children with autism may refrain from interaction with others (American Psychiatric Association, 2013), self-directed learning approach seems like a viable option for providing instruction. Moreover, as the field of technology advances frequently, there is a need to explore the potential of emerging technologies that are at children’s disposal in classrooms as well as at homes for promoting self-directed learning. Particularly, the purpose of this paper is to identify and discuss the aspects of effective multimedia-based mobile learning environments for children with autism to facilitate self-directed learning.

2. Designing Mobile Learning Environments for Students with Autism

Designing effective mobile learning environments to help students with autism to become more self-directed in learning functional sight words requires a theoretical understanding of self-directed learning, mobile learning, and multimedia learning. This section presents a review of literature on these concepts as related to children with autism.

2.1 Self-directed Learning Approach

Self-directed learning occurs when the learner is responsible for managing his or her own learning process by integrating self-management and self-monitoring (Argan, 1997; Bolhuis, 1996; Garrison, 1997; Wehmeyer et al., 2000). Professionals in the field of education believe that adult-directed learning may pave the way for independent learning for children with disabilities (Weinhert & Helmke, 1995; Stright & Supplee, 2002). Adult-directed learning occurs both at home and at school. At home, parents or caregivers are the first adults who guide young children to learn various skills, explicitly or implicitly; once the child starts going to school learning becomes more teacher-directed.

Several researchers have shown how self-directed learning in students with autism have led to better academic achievement (Hume, Palvnick, & Odom, 2012; Cihak, Wright, & Ayers, 2010; Argan, Cavin, & Palmer, 2006). Self-determination is a significant factor in the education of children with disabilities (Wehmeyer, Cavin, & Hughes, 2000; Halloran, 1993). The idea is that by developing self-determination, students with disabilities are empowered to make own choices, facilitate their own learning, and become independent and autonomous.
individuals. Self-instruction and self-management are both critical skills involved in self-directed learning approach that are also key players in a person’s independence.

2.2 Mobile Learning and Self-directed Learning
As discussed earlier, mobile technologies can be used to facilitate self-directed learning based on portability and personalization as well as the interactive multimedia-based instruction it can deliver. The approach of self-direction learning involves self-management which requires prompting/cueing or guidance through pictures or audio (Harchik, Sherman, & Sheldon, 1992 as cited by Mechling, 2007). These cues eliminate dependency of the learner on others by removing the need for waiting for instructions by another person (Riffel et al., 2005 as cited by Mechling, 2007). Additionally, task performance fluency and learning as well as maintaining skills are increased with the use of this cueing system. An interesting notion that arises here is that since pictures and audio are essential components elements of a multimedia program; therefore, the task of providing self-directed learning opportunities to children with disabilities can be accomplished by incorporating multimedia technology for instruction. By doing so, children will be guided through the audio and visual cues without continuous adult supervision or prompting. The audio and visual cues decrease children’s reliance on the adults while increasing their level of independent learning (Riffel et al., 2005). This integration of multimedia into learning will specifically benefit learners with autism since they are naturally drawn to multimedia technology, as discussed earlier. This aspect of multimedia learning is further discussed later in subsequent sections of this paper. Existing literature on self-directed learning that supports the use of technology involves instruction of life skills or task completion skills for students with disabilities (Davies, Stock & Wehmeyer, 2002; Lancioni et al., 2000). However, there is limited research on using the self-directed learning approach incorporating multimedia technology for teaching academic skills to students with autism.

2.3. Mobile Learning for Children with Autism
Few researchers have focused specifically on the use of computer-based instruction for children with autism. However, research has shown how computer-based instruction can lead to higher achievement in reading for children with autism. Lee and Vail (2005) developed and evaluated a multimedia computer program embedded with CTD procedure to teach sight word recognition to elementary school students with developmental disabilities. Their research showed an increase in target word recognition during the intervention as compared to baseline for all students, although the progress varied from student to student. However, the authors also noted that software should still have been modified for each student based on their individual needs to be more effective. Coleman-Martin et al. (2005) also compared computer-based instruction with teacher-assisted learning although they added another component, that is, of teacher-assisted instruction in conjunction with computer-based instruction. The researchers examined the effectiveness of the use of
technology for word identification using the reading strategy Nonverbal Reading Approach (NRA) (Heller, Fredrick, & Diggs, 1999) for students with speech impairments accompanied by physical or developmental disabilities. Their results showed that all participants could reach criterion using the NRA during each of the three conditions; however, the computer-based instruction alone was found to be more efficient than the other two conditions. Further, Hetzroni and Shalem (2005) conducted a study to investigate the effectiveness of using technology to teach children with autism to identify words from commercially available logos using a gradual fading procedure. Results of this study showed a steady increase in learning the target words by all participants within five to ten intervention sessions (mean=97.8%, range=87%-100%) with the use of technology based instruction. Follow-up data results showed that all students were also able to maintain the learned target words over time (mean =83.8%, range 79%-96%). The results show that the intervention worked as intended but most students were not able to transfer learned words accurately to other material. Effectiveness of yet another computer-based sight word reading intervention (CBSWRI) for teaching Dolch words (Dolch, 1948), which are frequently used sight words, to a student with autism was investigated by Yaw et al. (2011). Results of their study showed an increase in words read correctly by the student during intervention as compared to the baseline. In the final assessment, the student read 25 out of 30 words correctly. The researchers have noted that the student’s performance during maintenance phase was slightly higher than during intervention showing the effectiveness of the computer-based instruction. Computer-based instruction has been shown by the research to improve student achievement in reading. Evident from research findings discussed, most children with autism are primarily visual learners who are drawn to computers and tend to sustain engagement and focus on academic tasks when using mobile devices, which lead to improved learning outcomes (Cummings, Strnadova, & Singh, 2014; Rodriguez, Strnadova, & Cumming, 2014). The affordances of mobile devices also promote independence and self-directed learning since these devices are less cumbersome than a desktop computer or laptop allowing learners to have a more interactive and personal experience. These characteristics of mobile learning lead to a more learner-centered approach for teaching academic skills.

2.4 Mobile Learning and Multimedia Learning

Learner-centered approaches to instruction emphasizes the need for students to be autonomous and proactive in their learning. Learning could be made relevant to the children because they are more engaged in authentic and equitable learning regardless of their deficits. Active learning is crucial to these approaches as they have the tools that allow them to be engaged and challenged and undertake activities that allow them to move forward. The research presented here is also informed by the Cognitive Theory of Multimedia Learning (CTML) that draws on constructivism (Mayer, 1998). This theory postulates that instruction should be designed according to how people learn. Moreover, people are inclined to learn better when words are combined with images and animation rather than from words.
alone. This theory is based on three key aspects: (a) there are distinct auditory and visual channels that are used for processing information; (b) channel capacity is insufficient; and (c) that learning is a dynamic process that comprises of sorting, selecting, organizing, and integrating information (Mayer 2001). The presentation mode of instruction in the current study included textual, visual, and auditory information; thus, compensating for the inadequacy of a single channel. Children were actively engaged in knowledge building since “multimedia learning is a sense-making activity which allows the learner to build a coherent mental representation of the presented material” (Mayer, 2001, p. 17). For children with autism, effective multimedia design can focus their attention towards the important aspects of learning, which in turn provides engaging support and scaffolding they need toward self-directed learning.

Existing research support that multisensory (or multimedia) mechanisms such as pictures, sounds, movement and interactions are more effective than static text (Phillips & Feng, 2012). The use of technology provides an easy setting for integrating all these elements into a single activity. Furthermore, instructional material created with computers can be tailored to suit each learner’s sight word list, are reusable, and more durable than traditional flashcards.

2.4.1. Universal Design for Learning Framework
Interactive and multi-modal resources give more potential for supporting the Universal Design for Learning (UDL) framework, which addresses the needs of students with disabilities (O’Connell, Freed, & Rothberg, 2010). Since the CTML suggests that learning is facilitated when multiples modes of representations are utilized (Mayer & Moreno, 2002); this can be looked as an opportunity for utilizing the UDL. As defined by the Higher Education Opportunity Act of 2008, UDL is a scientifically proven framework for guiding educational practice that decreases barriers to learning by providing variable means for presenting information, for children to respond, and participate in learning (National Center on Universal Design for Learning, 2010).

UDL stemmed out of the field of architecture (Meyer & Rose, 2000) to provide equal access to buildings to all people, with and without disabilities, paving the way for the requirement by the Individuals with Disabilities Education Act (IDEA, 2004) to provide equal access to education to all children. Educators may ask, where does computer-based instruction fit into the UDL? The answer is that most technologies are flexible and customizable to allow for the implementation of UDL framework (CAST, 2014). Technology may be incorporated to apply the three main principles of UDL into instruction: (a) providing various means of representation of instruction, (b) allowing children to express ideas and knowledge through multiple means, and (c) engaging children through multiple means.

Consequently, accessibility to the general education curriculum and classrooms for children with disabilities can be achieved through the employment of the UDL in schools. According to Jiménez, Graf, and Rose (2007) the UDL approach in the classroom diminishes the need for teachers to constantly modify and adapt instruction for individual children with special
needs; instead, they can plan instruction to meet the needs of a diverse group of learners. Presently, CTML was applied to literacy instruction for students with autism using multimedia mobile technology.

3. Methods
The study explored effective interventions for teaching functional sight word vocabulary to children with autism. The researcher investigated self-directed learning in combination with a multimedia-based instruction delivered using a mobile device. The research question of this study is: How do mobile technologies using multimedia-based instruction facilitate learning of functional sight words in children with autism?

3.1 Research Design
This study was conducted using a single subject experimental design, specifically, a multiple baseline. Use of single subject research design is an established norm in the field of special education. The advantage of using this design is that it does not require a large sample size since it uses within and between subject comparisons and each participant is his/her own control group (i.e., performance prior to intervention (baseline) is compared to performance during and/or after intervention and so forth) (Horner et al., 2005). The multiple baseline across participants allowed for confirmation of a functional relationship between behavior (i.e., learning of sight words) and the intervention (i.e., multimedia-based instruction on an iPad®) through the duplication of its effects across participants (O’Neill et al., 2011). Intervention is offered in a staggered style to additional participants in a multiple baseline design. It means that when the criterion is attained for the first participant and the data are stable, the intervention is introduced to the second participant. In other words, the multiple baseline design allowed for evaluating the effects of the interventions across multiple participants while each participant served as the baseline for the next participant (Barlow, Nock, & Hersen, 2009).

There were four phases in this study: (i) baseline: the condition where the intervention is not utilized; (ii) intervention phase: the condition where the multimedia-based instruction was utilized; (iii) maintenance phase: to gauge whether participants retained the learned skills over a period of time; and (iv) generalization phase: to gauge whether participants were able to recognize learned words presented differently. These four phases are fundamental components of a single subject experimental design.

3.2 Participants and Setting
The participants for this study were three male children who were diagnosed with high-functioning autism. Pseudonyms of Adam, Ian, and Rick were used for the children. The participants displayed suitable verbal skills, meaning they were able to use verbal language in order to participate in this study. There were no restrictions as to the gender, race, or
socioeconomic status of the participants. Specific details about the participants are presented in Table 1.

**Table 1. Information about Participants**

<table>
<thead>
<tr>
<th>Participant</th>
<th>Age</th>
<th>Instructional Environment</th>
<th>Classification of Autism and Verbal Behavior</th>
</tr>
</thead>
</table>
| Adam        | 4 years | • Preschool Program for Children with Disabilities (PPCD) | • Moderate: Verbally fluent (ADOS-2; Lord, Rutter, Dilavore, & Risi, 2012)  
|             |       | • Applied Behavior Analysis (ABA therapy) | • Verbal behavior overall score = 69.7% (VB-MAPP, Sundberg, 2008) |
| Rick        | 7 years | • First grade, General education (co-teaching) | • Moderate: Verbally fluent (ADOS-2; Lord, Rutter, Dilavore, & Risi, 2012)  
|             |       | • ABA therapy | • Verbal behavior overall score = 97% (VB-MAPP, Sundberg, 2008) |
| Ian         | 6 years | • Kindergarten | • Moderate: Verbally fluent (ADOS-2; Lord, Rutter, Dilavore, & Risi, 2012)  
|             |       | • ABA therapy | • Verbal behavior overall score = 72% (VB-MAPP, Sundberg, 2008) |

All the sessions of this study for Adam and Ian took place at a university’s autism clinic’s main therapy room and play therapy rooms. Since Rick was not attending therapy at the university’s autism clinic for the three sessions, they were conducted at his home.

**3.3 Intervention: Multimedia-based Functional Sight Word Instruction**

For this study, the experimenter used a commercially available application for the iPad® that allowed for the creation of customized multimedia-based vocabulary lessons. Individual lessons were created for each participant based on his unique sight word list identified during a pretest. Each lesson included text, narration, and image of the target words. The design of the materials and instructions were aligned to the tenets of self-directed learning, mobile learning, and multimedia learning. Directions and verbal feedback were recorded by the experimenter into the application. Prior to the commencement of the first session, each participant was trained on how to use the instruction. All participants were already familiar with the operation of an iPad®.
The instruction worked as follows: (a) the child began by tapping the screen and a word was displayed as text along with its narration and an image; (b) the child was expected to say the word along with the narration; (c) the child then swiped the screen to move to the next screen that displayed only the text of the word. The child was expected to say the word by himself/herself; and (d) the child moved to the next word and repeated the steps till all 10 words were covered. To document each learner’s interactions with the intervention, the experimenter collected observational data during each session.

3.4. Implementation Procedures
To select suitable target words for each child, pretest was conducted and participants were randomly assigned to the baseline phase of 1, 2, and 3 (Jensen, 1994). Digital flashcards for 50 different sight words were created for each child using Microsoft PowerPoint™. Each word was presented in text form only using a laptop during pretest. After the pretest, two lists generated: one for words correctly identified by the child and one for incorrect ones. The words that the child could not identify were presented once again to confirm selection of appropriate target sight words.

The ten words that were identified for each child by the experimenter during pretest were presented to each child during the baseline phase. The child was shown the text of each word on a laptop using Microsoft PowerPoint™ presentation with one word per slide. Verbal prompting was used by the experimenter to cue the child to read the word. No other prompts were given. The next word was presented if no response was provided within 4 s. This process continued until all target words were presented.

After the baseline phase, the intervention phase was executed for four to six weeks. Probes were administered by the experimenter after the first week of intervention using the same procedure as the baseline. Each session was also audio recorded for verification purposes. Maintenance and generalization probes were administered one week after the end of the intervention phase. Procedure for maintenance probes remained identical to the intervention probe sessions. During the generalization phase, each child was presented with the words that he had mastered during intervention phase. The words were presented within short sentences based on individual reading abilities to measure whether the child could identify the previously learned words now presented in a different manner.
4. Results
Instruction was provided for an average of three sessions to each child before the first intervention probe was administered. Results of the probes are presented graphically in Figures 1 and 2.

4.1 Adam
Adam did not show progress from baseline \( (n = 0) \) to self-directed condition for any of his thirteen sessions \( (n = 0) \). Findings during the maintenance phase showed similar patterns for Adam as his baseline; he was not able to retain the two vocabulary words that he had acquired during the adult-directed condition.
4.2 Rick

After the first week of instruction, Rick’s data showed an increasing trend when compared to his baseline ($n = 0$). His score for correctly identified functional sight vocabulary words for the self-directed condition ranged from 6-9 ($M = 7.2$). Rick was able to maintain and generalize all nine words (100%) that he had acquired during the intervention sessions.

Figure 2. Multiple baseline of participants’ probe data during the four phases of the study
4.3 Ian
When compared with baseline ($n = 0$), Ian’s data also showed an increased trend during intervention. His scores ranged from 3-10 words ($M = 8$). Ian achieved 100% accuracy ($n = 10$) target words that he had mastered during the intervention phase for maintenance and generalization.

5. Discussion
Probe data were analyzed visually to interpret the findings of this study. The three fundamental items in a visual analysis include the level, trend, and variability of data patterns. Level gives an average of the data within a condition and is typically calculated as the mean or median and permits for a comparison of patterns between phases. Trend is construed as the “best-fit” straight line that can be situated over the data within a phase. The degree to which individual data points deviate from the overall trend is referred to as the variability.

5.1. Analysis
An analysis of the graphed data in relation to the level, trend, and variability is presented in Figure 2.

5.1.1. Adam
There was no change in the level of data among the four phases since Adam was not able to learn any of the target words during intervention; therefore, a flat trend line indicated a lack of variability of data. It can be deduced from this visual analysis that self-directed learning was not effective for Adam since it did not result in changes in his performance of the correctly identifying functional sight word vocabulary.

5.1.2. Rick
Since Rick did not identify any of the words correctly during baseline, the data path was stable. Significant variation in the level of data was apparent from baseline to intervention which shows progress ($M = 7.2$; range 6-9). The trend line was ascendant for Rick and the spread of data points displayed little variability. Additionally, the changes that occurred during the intervention phase were replicated in the maintenance and generalization phases. These results demonstrate that self-directed learning was effective for Rick.

5.1.3. Ian
Separation of data paths was evident throughout the intervention phase. There was a strong change in level from baseline where Ian did not identify any of the target words to intervention ($M = 6.6$; range = 4-10). An upward trend along with low variability were apparent in the data for the intervention phase. Data of maintenance and generalization phases replicated the same pattern where Ian correctly identified all target words.

Keeping the above analysis of findings in mind, it can be construed that, as indicated in previous research findings and this research, learner self-directed learning may be significant for some children with autism (Argan, 1997; Wehmeyer, 2000). Nevertheless, in order for
self-directed learning to be successful, some factors such as self-regulation of behavior and self-management strategies are important (Argan, 1997; Wehmeyer, 2000). For this reason, an examination of the possible factors that may have impacted the learning of each child in this study was conducted that provides an understanding about the learning process of each child.

5.2. Possible Influential Factors

After an analysis of the probe data in combination with observation data, the experimenter was able to pinpoint certain factors that may have influenced each child’s learning. These influencing factors included learner’s age, reading proficiency, level of attentiveness, and the multimedia-based mobile intervention itself.

5.2.1. Learner’s Age

Adam, Ian, and Rick were four, six, and seven years old respectively. The youngest child, Adam, was the one who did not make any advancement in learning the functional sight vocabulary as compared to the two older children. The self-directed learning approach was not beneficial for Adam inferring that, based on his developmental age, he needed more structure and adult supervision to be successful. These results show that the older children, ages six and seven, benefitted more from the intervention in this study. However, there is a need to replicate this study with children with autism who are in upper elementary grades for these findings to be conclusive.

5.2.2. Learner’s Reading Proficiency

As discussed earlier, based on their assessment results, the three children were reading at some level. Nevertheless, an analysis of Adam’s results shows that he not ready for learning new vocabulary words. Rick and Ian, conversely, were reading the new words easily. It was interesting to note that Rick and Ian utilized different approaches for identifying new words correctly during probe sessions. When Rick would come across an unfamiliar word, he read it out but would say “[the word] is not a word”. Ian spelled out each word that he could not identify and then ask, “What does this spell?” or “What is this word”? Adam on the other hand, did not utilize any of these strategies and would say “No” when asked to read the target words during probe sessions.

5.2.3. Learner’s Level of Attentiveness

Adam was distracted easily and would lose focus that is a required for learning. He frequently left his seat to switch lights off or on or go to the door and try to open it. He also liked to move chairs around. The experimenter noted that Adam seemed to have the need to move around, which significantly hampered his instruction sessions. In comparison, neither Rick nor Ian lacked concentration during instruction time. This may have been another factor that allowed both of them to make significant progress in learning their functional sight words.

5.2.4. Multimedia-based Mobile Learning
All three participants displayed excitement while using the iPad® and the multimedia component of the instruction. The engagement level for Rick and Ian was very high during instruction. Even Adam, who was easily distracted enjoyed using the iPad® and going through the pictures and narrations, although his focus was more on watching the pictures than on reading the text or repeating the words. These findings corroborate with existing research (Cummings, Strnadova, & Singh, 2014; Phillips & Feng, 2012; Rodriguez, Strnadova, & Cumming, 2014) that indicate that multimedia and mobile devices promote learner engagement. Further analysis show that self-direction developed and enhanced for Rick and Ian because they did not rely on adult guidance to use the mobile device or the multimedia instruction.

6. Conclusion
This study is significant as its results add to current research on self-directed learning and the use of mobile technology for teaching functional reading to children with autism. Additionally, an interdisciplinary perspective to research is presented through this study. As evident in this research, integration of technology in special education can support and facilitate self-directed learning for children with disabilities who may otherwise face barriers to learning. Challenges in the ability to engage and sustain attention, motivation, and completion of assigned tasks may be diminished for children with disabilities through incorporation of mobile learning and multimedia technology into instruction. This research shows that technology is a viable solution that can be utilized by educators to help children with disabilities become independent and successful, and children with autism may be empowered into becoming independent learners when engaging and appropriate supports are provided.

References


Performing Active Learning through Project Based Learning in Electrical and Computer Engineering Curriculum

Linawati¹, I Made Supartha Utama², NMAD Wirastuti³

Abstract

Most of the subjects in higher education can be categorised as theoretical subjects. Generally, most students can pass with good marks in these fields. Conversely, they face difficulties to apply and integrate all of those knowledge to answer many problems in the society. Hence a new subject has been added in electrical and computer engineering department. Therefore the paper will analyse the implementation of the subject with active learning method through project based learning. The results have shown that most students actively participated in all learning activities. None of students failed to the subject. This learning method has been successfully implemented in small class, on the other hand it will be a challenge to apply in big size of class.

Keywords: Active Learning, Project based Learning, Engineering

1. Introduction

Generally speaking, curriculum for bachelor degree in the university has been set for three years up to four years study period. The same as in Electrical and Computer Engineering Department in Udayana University. Its curriculum has been set for four years study period with subjects can be classified as compulsory subjects and elective subjects. Most of the subjects are theoretical fields. Commonly, most students achieve good marks in the theoretical fields. However, they face difficulties to apply and integrate all those theories to solve many problems in the society. Therefore since year 2014, the Department has revised and updated its curriculum. A new subject has been added, namely ‘Applied Information Communication Technology’. The subject is to assist the students to be innovative and creative as problem solvers for their society. Therefore in this paper will discuss the implementation of the subject which will focus on “how to perform active learning through project based learning in the subject?” Hence the paper proposed active learning accomplishments on the subject implementation.

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2. Active Learning and Project based Learning
When MOOC’s tries to achieve its popularity in this modern era, there is a research found that face-to-face classroom cannot be thrashed by MOOC’s as long as active learning approached is not accommodated well [Ubell, 2017]. Since active learning classes are proven to reduce number of undergraduate students of science, math, and engineering to fail the subjects, when compared to traditional lecture classes [Freemana, 2014], [Bhatia, 2014]. Many examples have been explained in [Bhatia, 2014], such as learn how to ride a bike, that active learning approach was more successful for students in mastering subjects, as the students engaged enthusiastically through series of accomplishment. They explains that STEM fields are still favourite choice for students in US. However more than half of them then shifted their major either to a non-STEM field or drop out of college. On the other hand in [Husamah, 2015] states that blended project based learning likely effectively to produce a professional biology teacher with future vision. The learning activity must meet learning characteristics which is part of active learning strategy, such as effective learning, thinking skills learning, and learning strategies.

Other paper states that students should be provided professional education for their future career [Srinath, 2014]. For that purpose, active learning has been picked as a mainframe tool for providing managerial and team skills to meet the Industrial and companies requirements, especially for Science, Technology, Engineering and Management (STEM) education. The active learning can be applied through practical examples in the classroom. Then according to [Songkram, 2017] that both creativity and innovative skills are very important in the 21st century. Both skills have to be output or outcome of learning process. An integration of modern teaching management with learning principles, such as using modern technology, is utilized to promote creativity and innovative skills. The integration is to create changes, at the same time as the current education emphasizes on creating changes. They proposed open learning that involves students, instructors, foreign students, foreign friends, and local and international experts who did information exchange at any time and any place. Seven steps of learning process were utilised, i.e. Preparation, Identifying a topic or issue to be studied, Brainstorm, Creating innovation, Testing, Evaluation, and Presentation. Moreover the major characteristics of active learning approaches is explained by [Bonwell, 2017]. The characteristics involves of active listening of the students; reading, discussing, writing activities; more developing on student skills; increase of student motivation; more exploration of attitudes and values; quick feedback from their instructor; and encouragement of higher order thinking (analysis, synthesis, evaluation). As long as the students have some challenges in the class by giving them some questions or problems, giving them time to respond, and encouraging them to share their responses / idea / solutions, either they work individually or in a group, this activity can be classified as an active learning process too [Felder, 2009]. Furthermore Authors [Bell, 2006] define that active learning objective is to build understanding of facts, ideas, and skills through the completion of lecturers or instructor directed tasks and activities. The discussion about applying new technologies of virtual learning environment for the project based learning on socio-health subjects is described in
[Márquez, 2014]. They used process and final steps of learning as assessment points with rubric, logs, and peer evaluation matrices as instruments.

In addition limited opportunity in higher education to practice how to innovate is discussed in [Gerber, 2012]. Therefore extracurricular design-based learning model is proposed to practice creating innovating solutions to authentic, pro-social, and local challenges in an extracurricular setting. They found that students build innovation self-efficacy through successful task completion, social persuasion, and vicarious learning in communities of practice with clients, peers, industry professionals, and faculty. The comparisons of project based learning with problem based learning implementation on Medicine and Engineering curriculum are found in [Bédard, 2012]. The students’ engagement and persistence were analysed. Results presented a variation in nine variables predicting engagement and persistence, with the most significant predictor being stress related. Finally in [Guven, 2014] investigates an impact of project based learning method which was supported by prediction-observation- explanation method on attitude and behaviour towards environmental problems. The investigation used explanatory mixed method, such as Attitude Scale towards Environmental Problems, Behaviour Scale towards Environmental Problems and a semi-structured interview question for data collection tools.

3. Electrical and Computer Engineering Curriculum Revision

Electrical and Computer engineering department of Udayana University has updated its curriculum regularly based competency to prepare the students with skills of creativity and innovation. The curriculum revision is based on the Ministry of National Education of Republic of Indonesia guideline [DGHE, 2008], as seen in figure 1. The guideline also refers to the UNESCO’s 4 pillars, i.e. (i) learning to know, (ii) learning to do, (iii) learning to live together, and (iv) learning to be and learning throughout life.

The project based learning method which is doing and developing projects systematically and presents the output in a forum or in a class, is recommended in the guideline. Starting with identification of graduate profiles, the curriculum of the department has been revised in year 2014. The profiles remain the same with previous curriculum [Linawati, 2013], i.e. to be a professional engineer, an academician such as teacher or researcher, an entrepreneur, a consultant, and a professional manager. However some new subjects are added in this curriculum. One of the new subjects is called ‘Applied Information Communication Technology’. The subject is classified as one of compulsory subjects in the 7th semester or last year of study period. The subject syllabus is shown in table 1.
Figure 1. Curriculum Development Guideline [DGHE, 2008]

Table 1. Syllabus of Applied Information Communication Technology

<table>
<thead>
<tr>
<th>Week</th>
<th>Core Topic</th>
<th>Assignment</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Introduction of the subject</td>
<td>-</td>
</tr>
<tr>
<td>2</td>
<td>What are project, ICT project, and applied technology?</td>
<td>-</td>
</tr>
<tr>
<td>3</td>
<td>Identification of humanity, social problems, and environmental problems</td>
<td>Explanation of mini project assignment</td>
</tr>
<tr>
<td></td>
<td>in the society</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>How to develop idea or solution for the problems?</td>
<td>Part 1 of the assignment: Discussion of students’ short report of the public problems</td>
</tr>
<tr>
<td>5</td>
<td>Writing log activity of the project and discussion on innovative solutions</td>
<td>Part 2 of the assignment: Discussion of students’ short report of their proposed solutions to the problems. Starting to write log activity as an attachment of the report.</td>
</tr>
<tr>
<td></td>
<td>using ICT</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>Discussion on some case studies that proposed ICT solutions for humanity,</td>
<td>Part 3 of the assignment: Discussion of students’ short report of prototype scheme</td>
</tr>
<tr>
<td></td>
<td>social, and environmental problems</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>Discussion on how innovative the</td>
<td>Discuss and share part 1 to part 3 of</td>
</tr>
</tbody>
</table>
4. Active Learning Strategy and Project based Learning Implementation

An art and discipline can create innovation [Miller, 2007]. Thus skill to build innovation is also implemented for this subject. The skill is practiced by engaging the students to build simple prototype in one integrated mini project assignment. They actively identify the problems in the society and then propose simple solutions with high good impact to the society. Simple means that the project is realistic and practical to build as a student project and low cost budget. High good impact means that the project brings effective solutions. Table 1 shows that active learning is applied in this subject by encouraging student to develop prototype as one solution to society problems such as health problem, environmental problem, safety problem, etc. The prototype is an individual project. The objectives why the project is individual project, are, 1) to train and practice the student as a professional person to be a solution maker, and 2) to build students’ understanding on knowledge to integrate all relevant subjects of the previous semester. One student has to do totally one mini project as one assignment. Two evaluations were designed. The first one was weekly evaluation through discussion of their progress. The second one was final evaluation by assessing their prototype and supporting documents (report, poster, and video).
5. Results and Discussions
The subject has been implemented for two years, starting from year 2015. Totally 65 students enrolled the class. Overall the students have shown their interest and excitement in this learning method. Most of their comments were positive. Below are some interesting projects of the students.

- Wireless hand band for kid’s safety.
- Smart helm for motor bike rider.
- Smart assets monitoring and protection for museum.
- Parking Slot Finder System based on Web Application
- Adaptive traffic light for emergency services.
- Wireless detector for gas leakage.
- Smart pollution monitoring.
- Voice detection for parking system.

One of the project, i.e. ‘Parking Slot Finder System based on Web Application’ was a winner in national IEEE IOT Competition in year 2015. The prototype objective is to save fuel consumption for cars when they are finding park in a big city. Figure 2 presents the project of parking slot finder. The project is categorised as an innovative solution for transportation system in a big city and a low cost project as it costs only USD 153. Figure 3 displays the project poster.

![Figure 2. Prototype of the project of parking slot finder](image-url)
At the end of the course, most students obtained the highest score. More 80% of students got ‘A’ mark, the rest got ‘B’. The explanation why students got ‘B’ mark is that their prototype did not worked properly. Although they demonstrated good design, suitable simulation, report, poster, and presentation. These results have evidenced that the course has provided the students with skills of innovation and creativity at the initial phase.

Finally, all students in the department must fill a questionnaire. The same type of questionnaire is for all subjects which has been standardised by the department to evaluate learning process of all subjects. The questionnaire has 17 questions or statements that are categorised into 4 groups. Nine questions are categorised as class implementation assessment, three questions as for appropriateness of learning contents assessment, two questions as for
quality of learning content assessment, and three questions as for learning output assessment. The students then can choose strongly disagree, or disagree, or agree, or strongly agree to the statement. The filled questionnaires then are statistically analysed. Table 2 shows the results.

Table 2. Evaluation Result of Learning Process

<table>
<thead>
<tr>
<th>Group</th>
<th>Categorization</th>
<th>Results (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Strongly</td>
</tr>
<tr>
<td>1</td>
<td>Assessment of class implementation</td>
<td>0</td>
</tr>
<tr>
<td>2</td>
<td>Assessment of appropriateness of learning contents</td>
<td>0</td>
</tr>
<tr>
<td>3</td>
<td>Assessment of quality of learning content</td>
<td>0</td>
</tr>
<tr>
<td>4</td>
<td>Assessment of learning output</td>
<td>0</td>
</tr>
</tbody>
</table>

In general, table 2 demonstrates that more than 60% of students strongly agree that they experienced beneficial learning process of the subject. The highest percentage of 84% is for the quality learning content. This indicates that the contents are very useful, very interesting, and innovative. The lowest percentage of 68% is for the class implementation assessment. This indicates that very few students still faced difficulties to obtain good references of the subject and they needed more assistance in learning process. Therefore the lecture should pay more attention on managing the class especially for ‘learning delivery in the class for easy and better understanding by the students’, ‘increase tutorial for students who dealing with difficulties’, and ‘give more links and access to the references’. In summary, all evaluation results have shown that the learning process has successfully motivated all the students to be active learners.

6. Conclusion
Active learning through project-based learning method for subject of applied technology to engineering students have shown the students ability in creativity, innovation, discussion skill, promoting idea, and developing the idea. The method was successfully implemented in small class and it will be challenging to implement in big size of class.

References
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Student engagement through commonly used instructional techniques and mobile & technology-enhanced learning approaches

Mark Stout¹, Kumaran Rajaram²

Abstract

The paper aims to perform a review on themes namely, student engagement and commonly used instructional techniques. Also, with the addition of technology-enhanced learning approaches found on mobile devices. In the first section of the paper, we present a working framework for the term engagement in the educational domain. After that, we examine on how these methods could be effectively adapted for higher levels of student engagement. The section on the relationship between instructional techniques, mobile & technology-enhanced learning approaches and student engagement shows the intertwined aspects between these elements holistically. Finally, the discussion section outlines the gaps in the current literature and derives important research questions to be investigated.

Keywords: Student Engagement, Instructional Techniques, Technology Enhanced Learning, Mobile Learning

1. Introduction

Engagement could be defined along Kuh’s (2001) line actions people take to further their learning. Student engagement can be an enigma, as many of those who have taught face-to-face courses will be the first to concede. In some cases, the realization of an engaged class has not occurred until after the class has passed, as the instructor reflects on the event or retells the situation to a peer. It may be difficult to verbalize to another person, but a class feels livelier, more active, the students appear to be more engaged with the lesson. The paradox continues, as instructors are not always sure what they did to get the students engaged, but they do opine that engaged students learn more and have a deeper understanding of the course materials. These instinctual feelings are justified, as (Finn & Zimmer, 2012) outlined that engaged students do, in

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fact, have a better understanding of the covered course materials. Furthermore, by having a productive classroom experience, the benefits to students engaged in a course extend beyond the walls of a classroom. Students also have better attendance (Clay & Breslow, 2006), and engaged students’ motivations transition from extrinsic to intrinsic (Vansteenkiste, Simons, Lens, Sheldon, & Deci, 2004). To further outline the benefits, student engagement is correlated with participation in public service, self-reported learning gains, increased student achievement (Carini, Kuh & Klein, 2006) and job engagement (Busteed & Seymour, 2015).

Engaged students not only makes it easier for the instructor to manage the class but more importantly, their behavioral aspects encourage instructors to put forth more efforts in their course of instruction (Skinner & Belmont, 1993).

While the above statements outline the premise that by engaging students, the learning outcomes will improve, unfortunately, it is not as simple as it appears to be. Even the term engagement has several constructs, such as behavioral, emotional, and cognitive. Furthermore, to make the simple more complex, having the ability to quantify these constructs and have them correlated where we could comprehend the connections or the intertwined aspects embedded in these elements holistically. This paper will make an effort to provide a working framework of the term ‘engagement’ in the educational domain.

However, the real thrust of this work is to analyze commonly used instructional techniques and their ability to engage students. We know that for effective learning and optimal knowledge transfer to happen, the first aspect that needs to be addressed is having students engaged. Rajaram & Collins (2013) advocates that effective learning and optimal knowledge acquisition cannot be guaranteed by any fixed type of instructional strategy. Instructors should have a thorough comprehension of students’ learning attitudes, behavioral aspects, and students’ profile to adopt a
well-blended mixture of instructional techniques to achieve optimal learning effectiveness (Rajaram, 2013). In today’s context, we have to acknowledge that the commonly used instructional techniques comprise both the “non-technological” methods, which tend to be more traditional as well as “technology-enabled” methods. As for the last five centuries, one of the most highly adopted instructional technique has primarily been the lecture approach, especially at the post-secondary level. In the last forty or fifty years, technologically based tools are becoming embedded into curriculums, and instructors are implementing new and improvised instructional techniques into their courses due to these technologies. These new or improvised instructional techniques are gathering terms such as active techniques, as compared to the more traditional passive techniques. It should be noted, that these methods are receiving investigative study in parameters such as content retention, efficiency, and so forth. The focus that we are presenting here is how well the commonly used instructional techniques engage students. By examining active or passive methods and evaluating if, technological embedded instruction is affecting student engagement.

2. Instructional techniques

There are hundreds if not thousands of defined instructional techniques utilized in the higher education context. Rajaram (2013), Johnson (1991) and Warner (1991) advocate that the effectiveness of the instructional techniques for students from one culture differ from that of another culture. For the sake of brevity, we have clustered the instructional techniques into three domains, that of teacher-centered, student-centered, and collaborative. Oncu (2007) provides a framework where eight commonly used instructional techniques fall under these three domains. An outline of the instructional techniques are below:
Teacher-Centered Techniques (*passive*)

1) Demonstrations
2) Lecture

Student-Centered Techniques (*active*)

1) Hands-on Activities
2) Individual Student Work
3) Online Work or Simulation/Games

Collaborative Work (*active*)

1. Small Group Work
2. Student Presentations
3. Whole Class Discussions

Rajaram (2013) advocates that some of these instructional techniques require less student interaction, whereas other methods require more participation and exchange of perspectives between the instructor and students or among students themselves. Instructional techniques, which are clustered under active, are instructional techniques that facilitate more participation via a two-way communication between the instructor and students or among students themselves (Rajaram, 2013). In contrast, Rajaram (2013) reports that techniques that necessitate more of one way delivery by the instructors or acquiring information without much contribution and sharing from students are categorized as *passive*. Whether an instructional technique is teacher-centered or student-centered is not a binary function. Garrett (2008) proposes that these different techniques lie on a spectrum of an instructional continuum, as seen in Figure 1.
Lecture     Demonstration     Discussions     Group Work     Simulations

Teacher-Centered     Student-Centered

Figure 1. Instructional Continuum

Instructors usually script lectures and demonstrations before class, and they are unidirectional, as the instructor provides the content to the students. The implementation of the lecture is usually the same, regardless if the class is ten or a hundred students. Using these constructs, we classify these two techniques of instruction as teacher-centered. Teacher-centered techniques are not new; as it stands today, it is still the most prevalent instructional technique utilized in higher education. Justifications for its use are several-fold. Firstly, it is the technique that faculty is most familiar with because it was the method of instruction that they encountered the most when they were in school. Secondly, the technique allows for an easy and effective management of the students, and lastly, it is efficient means to disseminate information to a large class (Butler, 1992). The second domain, student-centered techniques differentiate themselves from teacher-centered because the students are in control of gathering and processing the information as prescribed by the instructor. Some of the caveats to these techniques is that it necessitates a paradigm shift in the instructional technique for the instructor, which is a challenge in itself (Lee & Hannafin, 2016). Moreover, if the instructor allows for too much reliance on the student to take ownership of their learning, with little or no guidance, the learning outcomes are quite small or even negative as compared to passive techniques (Kirschner, Sweller, & Clark, 2006). The third domain in the list is online...
work and simulations. These are included in the domain because it has similar characteristics to the first two techniques, hands-on activities, and individual work but also has a technological process embedded. While technological embedded student-centered learning is becoming more popular in the present times, it does require even more planning and effort due to the additional time and effort usually involved with embedding a technological in the instruction. Faculty need to have a reasonable amount of competence using the technology associated with their instruction. Plus, have the ability to take advantage of the technology to further benefit students to be an effective process (Harris & Hofer, 2011). The last domain, collaborative work is similar to a student-centered domain, as students are in control of their learning, but what makes this domain different is that students work with others students for a common goal and provide a peer-to-peer support mechanism.

3. Mobile and Technology Enhanced Learning approaches

Instructors can implement mobile technologies with a variety of interventions. As structured by Kirkwood & Price (2014) these interventions perform one of the three functions in regards to non-tech instructional methods.

1) Replicating existing instructional methods
2) Supplementing existing instructional methods
3) Transforming the instructional method, but also the possible inclusion of the learning process and outcomes

In case one, replacing an existing instructional method with technology, may be as simple as a set of flash cards that many students use to develop a foreign language vocabulary and they use a mobile application that simulates the experience of flash cards. Supplementation is taking pre-
existing course material, but making the material available accessible by student’s mobile device to use when and where they would like. A popular use of this supplementation is the use of podcasts. Newer versions of podcasting software allow students to embed notes, and the abilities to revise the content for their personal goals. The last intervention of transformation necessitates the instructor to modify the contents and instructional practice to work synergistically with the technology. Perhaps an instructor that teaches freshmen biology wants to offer a lesson about virus replication in the human body. The implementation of an interactive game such as Virulent would allow students to interact with virtual viruses, cells, and the immune system to gain an understanding of the virus replication process (Gaming Learning Society Studios, 2014).

4. Student Engagement

There has been an abundance of research investigating the relationship between instructional techniques and student achievement (Cohen, 1981; Schroeder, Scott, Tolson, Huang, & Lee, 2007; Tobias, 1982). Greater focus and emphasis on student engagement has come about more recently, and justifiably so, as evidence is showing positive correlations between instructional techniques and student achievement (Farkes, 2003). However, a more granular examination of the correlation between instructional technique and student achievement, frequently leads to the student engagement factor, as student engagement is a critical factor in instructional techniques and student achievement (Shernoff, Csikszentmihalyi, Schneider, & Shernoff, 2003). For the sake of clarity, we offer a definition by Trowler (2010) on student engagement:

“Student engagement is concerned with the interaction between the time, effort and other relevant resources invested by both students and their institutions intended to optimise the
student experience and enhance the learning outcomes and development of students and the performance, and reputation of the institution” (p. 3)

This definition allows for quantifiable constructs, which aids in the creation of an instrument for evaluation purposes. Secondly, this shows that the function of engagement is not solely a student endeavor, but a symbiotic relationship between the student and the instructor. Often student engagement is thought of a singular construct, but in fact, it is multifaceted. Fredricks, Blumenfeld, & Paris (2004) outline three types of engagement, which constitutes of behavior, emotional, and cognitive engagement. These three types of engagement are not distinct or independent systems, but overlapping components of the whole concept of student engagement. In relationship to a classroom setting, behavioral engagement entails adhering to classroom norms and performing tasks that have positive academic connotations, such as asking relevant questions or making a concerted effort to understand the material (Fredricks, Blumenfeld, & Paris, 2004). Emotional engagement falls more along the lines of happiness, curiosity, and enthusiasm for the topic at hand (Skinner & Belmont, 1993), and cognitive engagement demonstrates characteristics of intrinsic motivation. Intrinsically motivated students are internally driven to find a solution or a better solution and will invest more cognitive resources than the non-engaged student. Engagement could be visualized as the preliminary stage before the process of learning occurs. An engaged student will be motivated to listen and willing to learn because of the pull factor which has been duly created. This pull factor is where the student actively extracts relevant information from external resources, rather than having the instructor push the information on the student. Providing opportunities for students to move from extrinsic to intrinsic motivation by showing a sincere interest in their learning process which will ultimately facilitate effective learning outcomes and deliverables.
5. Relationship between Instructional Techniques, Mobile & Technology Enhanced Learning Approaches and Students’ Engagement

Technological tools are often demonstrating improved learning outcomes. While it is sometimes questionable, is the technology the variable that improved the learning or the modified instructional method to accommodate the technology. However, Mayer (2003) did demonstrate that a multimedia interventions offered improved learning outcomes, as compared to traditional instructional methods. Again, this study focused on learning outcomes and not engagement. We opine that technology has progressed so much and so quickly that the technological implementation requires a specific instructional method, or as one could say the method is not backward compatible. For example, an instructional method that is effective with student response system is not backward compatible. A faculty member poses a question and having the class as whole respond anonymously, with the faculty member modifying the content or the delivery, based on the response. It is still, in essence, a lecture, but the method has changed. This change in method improves outcomes but requires more research on the engagement issue.

6. Discussion – Possible “gaps” and direction ahead, formulating possible research questions – hypothesis

It is the author’s opinion that there is a dearth of research discussing instructional methods and student engagement, particularly at the post-secondary level. The advantages of studying at a post-secondary level would offer the largest return on investment, as instructors often have academic freedom to pursuit alternative instructional methods to improve student engagement. There is currently a plethora of studies involving student outcomes, such as performance on normed tests. Even a meta-analysis of mobile learning performed by Wu et al. (2012) indicated
that most of the studies are concerned with effectiveness, with the instructional design a close second. While we do contend that engagement is a precursor to effectiveness, however, the ability to quantify engagement is a bigger challenge than effectiveness, which could be a possible condition for the lack of research in the area of instructional methods and engagement. Lastly, the relationship between instructional methods and student engagement have cultural influences on the outcome or effectiveness of the method. As an open class discussion on minimum wage may produce a dynamic scenario, with a majority of students actively engaged with other students and moderated by the instructor in a Euro-centric university. Using the same method at University with a Sino-centric philosophy, may not produce as a productive outcome. Instructional methods need to be curve fitted to the cultural context, as well. With the above considerations in mind, we wish to investigate three hypotheses.

H1: Different instructional techniques (with or without technology-enhanced) have a varying level of effect on student’s engagement in a face-to-face course.

H2: Active instructional techniques offer superior student engagement compared to passive instructional techniques in a face-to-face course.

H3: Instructional techniques’ effectiveness on engagement has a cultural context.

We have also furnished a table Appendix 1 to put together a concrete framework to aid in the comprehension of correlating relationships of the student-centered and instructor-centered scale against the tech versus non-tech instructional techniques.

7. Conclusion

As many studies have revealed, instructional methods and learning outcomes do correlate. However, it is time for a more granular examination of why this occurs. We suggest that student
engagement is a key factor in this relationship. Do the improvements in learning outcome show an equal amount of improvement in student engagement? Does adding a technological layer improve student engagement? Do some instructional methods engage students more effectively across cultural boundaries, such as Euro-centric, Sino-Centric, Asia-Centric, and even a class that has a mix? It is these questions that we ask ourselves, and believe in the need for future research.
References


http://dx.doi.org/10.1108/03090599110137615


## Appendix 1 – Instructional/Technology Table

<table>
<thead>
<tr>
<th>Teacher Centered</th>
<th>Instructional Continuum</th>
<th>Student Centered</th>
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</thead>
<tbody>
<tr>
<td>Lecture</td>
<td>Peer Learning</td>
<td>Flash cards</td>
</tr>
<tr>
<td>Lecture with Video</td>
<td>Podcasts</td>
<td>Pre-Class Online Learning</td>
</tr>
<tr>
<td>Lecture with Video</td>
<td>Interactive Lecture with Blended Learning Approaches</td>
<td>Pods of student Working on construction Like Marshmallow Challenge</td>
</tr>
<tr>
<td>No Tech</td>
<td>Interactive Whiteboards</td>
<td>N/A</td>
</tr>
<tr>
<td>Technology</td>
<td>Lecture Capture Panopto</td>
<td>Lecture with Clickers</td>
</tr>
<tr>
<td>Technology</td>
<td>Interactive Learning Games</td>
<td>Flipped classroom embedded with Technology Enhanced Learning Interventions</td>
</tr>
<tr>
<td>Technology</td>
<td>Peer Review via Technology Interventions</td>
<td>Real-time online interactive and collaborative Activities-Based Learning approaches</td>
</tr>
<tr>
<td>Technology</td>
<td>VR</td>
<td>Like a military grade Flight simulator</td>
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Using Mobile and Emerging Learning Technologies in Regular Classrooms

Mingming Diao¹, John G Hedberg²

Abstract

Several learning technologies have been explored in higher education around the world. Learning has become more mobile, massive, open, flexible, blended, informal, audio-visual based, highly collaborative, and activity driven. While the traditional classroom still exists, it is being challenged. Increasingly checking emails in front of a PC or making phone calls are being replaced by students using their mobile phones to post on blogs, conduct Facebook chats, manage Instagram photos, submit assignments and directly access to learning resources. Teachers require more advanced skills or competencies to use mobile and digital forms of representation in order to make the content and activity more engaging, accessible, convenient, and customised. Teachers need skills in developing technological and pedagogical content knowledge and activities.

This paper explores how mobile and emerging learning technologies have been used in the face-to-face classroom through examining the three distinct ‘mega-trends’, namely, engaged learning, convenient learning, and customised and personalised learning. It addresses the different trends in well equipped classrooms in a private tertiary college. The specific examples and cases were drawn from a ‘Representational Fluency’ specifically designed to make conceptual connections between representations and how learners change their communication behaviour via using various mobile apps and emerging tools. It specifically explores the questions:

• How do students concepts of their discipline change by using new mobile learning technologies?
• How have students changed their communication behaviour by using new mobile learning technologies?
• What mobile and emerging learning technology and activities have engaged students in a regular classroom and use the mobile apps effectively in their study?

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Keywords: mobile learning, engaged learning tools, engaged learning, convenient learning, customised and personalised learning, face-to-face classroom, conceptual connections

1. Introduction

1.1. Background
Since late 1990s, a number of learning technologies have been explored in higher education with the rapid development of the Internet, digital techniques, Wi-Fi, smart phone and mobile networks. Learning has become more mobile, massive, open, flexible, blended, informal, audio-visual based, highly collaborative, and activity driven (Bonk, 2016). While the traditional face-to-face classroom still exists, it is being challenged. Increasingly checking emails in front of a PC or making phone calls are being replaced by students using their mobile phones to post on blogs, conduct Facebook chats, manage Instagram photos, submit assignments and directly access to learning resources (Lin, Sajjapanroj and Bonk, 2011). Teachers require more advanced skills or competencies to use mobile and digital forms of representation in order to make the content and activity more engaging, accessible, convenient, and customised (Nichols, Stevenson, Hedberg & Gillies, 2016). As Mishra and Koehler (2006) suggested, teachers need skills in developing technological and pedagogical content knowledge and activities. Thus teachers need to “effectively choose and use content-appropriate and multiple visual canonical representations … to promote students’ interpretation, understanding, explanation of, and even creation of representations” (Nichols et al, 2016, p.509).

This paper explores how mobile and emerging learning technologies have been used in the face-to-face classroom through examining the three distinct ‘mega-trends’ identified by Bonk, (2016), namely, engaged learning, convenient learning, customised and personalised learning. It addresses the different trends in well equipped classrooms in a private tertiary college. The specific examples and cases were drawn from a ‘Representational Fluency’ specifically designed to make conceptual connections between representations and how learners change their communication behaviour using various mobile apps and emerging tools.

1.2. Research methods
The study adopted both quantitative and qualitative methods, including online surveys, in-depth interviews and secondary data analysis. Table 1 provides an overview of the research methods, participants, types of data and timeline.
Table 1. Description of research methods, participants, types of data and timeline

<table>
<thead>
<tr>
<th>Research method</th>
<th>Participant</th>
<th>Timeline</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Online survey</strong></td>
<td>116 Undergraduates</td>
<td>July 2015 – March 2017</td>
</tr>
<tr>
<td><strong>Online survey</strong>*</td>
<td>476 Tertiary college teachers</td>
<td>2016</td>
</tr>
<tr>
<td><strong>In-depth interview</strong></td>
<td>8 Tertiary college teachers</td>
<td>March 2017</td>
</tr>
<tr>
<td><strong>Secondary data analysis</strong></td>
<td>18 Teachers from eight Australian schools</td>
<td>2014</td>
</tr>
</tbody>
</table>

*Note: The online survey was conducted by Navitas’ Learning and Teaching Initiative team in 2016.

**Note: The secondary data sourced from the paper ‘Primary teachers’ representational practices: from competency to fluency’ (Nichols et al, 2016).

**1.2.1. Online survey (students)**

To discover students’ experience on mobile and emerging technologies in a regular classroom, in the online survey, 116 undergraduate students in majors of Arts, Social Science, Humanities or Media and Communication were asked four areas relating to:

- Students’ favourite mobile devices and technologies
- The aims of using mobile and emerging technologies in regular classrooms
- The technical difficulties that students have experienced
- Students’ overall satisfaction with using mobile and emerging technologies in regular classrooms

**1.2.2. In-depth interview**

Eight tertiary college teachers (3 males and 5 females) participated in an in-depth interview. Three of them are ongoing staff and five are sessional/fix term. Half of the interviewees had more than 10 years of teaching experience and only one teachers’ teaching experience was less than 5 years. In the interviews, they were asked thirteen main questions and several follow-up questions to explore teacher’s experience and perspectives on mobile and emerging learning technologies, which relate to:

- Do you own a mobile device with the ability to add applications and use those applications in the face-to-face classroom?
- Could you tell me about an instance when you used mobile and emerging learning technologies to teach in the face-to-face classroom?
- How do you feel about using your mobile and emerging learning technologies for to support your teaching course related content?
• What device features would be important to your deciding to use your cell phone or mobile device for teaching?
• Could you please tell me about an instant when you used mobile and emerging learning technologies to enhance students’ engagement?
• Do you think mobile and emerging learning technologies can make your teaching and students’ learning more convenient? Why?
• Do you or your students have used a customised and personalised mobile app in the face-to-face classroom? If yes, what it is?
• Do you and your students use multi screens in the face-to-face classroom? If yes, how to you feel about multi-screen learning and teaching?
• Could you tell me about an instant when you used mobile and emerging learning technologies to enhance students’ collaboration?
• In general, do you think students’ communication behaviour has been changed by using new mobile learning technologies? Why?
• How easy or difficult would you find your students learning to use a mobile device for learning in the face-to-face classroom?
• Do you feel you are able to manage your time effectively and easily to complete teaching in the face-to-face classroom on time?
• Is there anything else you would like to share with me about your experience on using mobile and emerging learning technologies to teach in the face-to-face classroom?

1.2.3. Secondary data analysis
The secondary data consists of two sources. One was ‘University Program Preliminary Results of Teacher Technology Survey’ reported by Navitas’ Learning and Teaching Initiative team in December 2016 (Blakemore and Whittington, 2016). Although this was a preliminary report, it revealed tertiary college teachers’ attitude, skills, behaviours, experience and trends of using mobile and emerging learning technologies. Some of these results have confirmed the viewpoints and insights from qualitative discussions (i.e. in-depth interviews). In the survey, 476 teaching staff across 16 Navitas University Program colleges were asked a range of areas relating to:
• The devices that Navitas teaching staff use for teaching or preparation work
• Navitas teachers’ approach to students using their own devices in class
• The resources and materials that Navitas teachers use for teaching – paper-based or online/digital
• How Navitas teaching staff use technology for their teaching activities
• The communication between teachers and students, and among teaching staff at Navitas
• Navitas teachers’ attitude to new technologies
• The status of using multimedia (e.g. visual, audio and video) in teaching at Navitas
• How Navitas teaching staff talk about technology and share ideas
• The encouragement to try a new technology-related idea in teaching at Navitas
The barriers to using technology in teaching at Navitas
How Navitas teaching staff seek technology assistance
Navitas teaching staff’s preferred ways to learn new technology
The general feedback about using new technology in teaching at Navitas
The course teaching mode at Navitas
Navitas teachers’ teaching status, hours and years of experience

The other secondary data source was from the paper ‘Primary teachers’ representational practices: from competency to fluency’ written by Nichols, Stevenson, Hedberg and Gillies in 2016. The specific examples and cases were drawn from a ‘Representational Fluency’ specifically designed to make conceptual connections between representations and how learners change their communication behaviour via using various mobile apps and emerging tools. Two tables regarding to (1) Structure of Observed Learning Outcomes (SOLO) and levels of conceptual understanding around representations, and (2) the levels of use technologies and associated teacher practice were analysed and adopted to evaluate how representations can be facilitated by mobile and emerging technologies in regular classrooms.

1.3. Research concerns
Based upon the above research approaches, this paper explores the following questions:
• How do students concepts of their discipline change by using new mobile learning technologies?
• How have students changed their communication behaviour by using new mobile learning technologies?
• What mobile and emerging learning technology and activities have engaged students in a regular classroom and use the mobile apps effectively in their study?

2. Mobile learning in the age of Education 3.0

Mobile learning environments are not just a simple copy of the regular face-to-face classroom by using emerging mobile technologies. Bonk (2016) suggested learning facilitators need to make significant changes or adaptations to the web-based courses and/or mobile learning activities. Education 3.0, defined by Keats and Schmidt (2007), is

“characterized by rich, cross-institutional, cross-cultural educational opportunities within which the learners themselves play a key role as creators of knowledge artifacts that are shared, and where social networking and social benefits outside the immediate scope of activity play a strong role” (p.2).

In the age of Education 3.0, the roles of teaching staff more like being a facilitator to make learning playful, engaged and creative. Teaching staff attempt to “foster learner
autonomy and self-directed learning pursuits by guiding and mentoring their learners” (p.2). “Learners are demanding greater opportunities for play, purpose, passion and freedom to learn when, where, and how they prefer” (Duckworth, 2016 and Wagner, 2012, cited in Bonk 2016, p. 8). Bonk (2016) suggested 30 learning and technology-related changes reflect three distinct ‘mega-trends’: Engaged learning, convenient learning and customised or personalised learning. Engaged learning is the key concern for all educators today, which focuses on “fostering greater learner involvement and concerted effort in the learning process” (p.8). Convenient learning refers to both the ease, ability and availability of accessing to learning resources and activities anyway and anytime, and building pervasive blended learning environments. To satisfy learners and meet their demand, customised or personalised learning is described with “ideas about how to blend our learning pursuits as well as ideas about self-directed learning” (p.13).

2.1. Engaged learning
A wide range of technologies and online activities have been designed and applied in e-Learning environments. However, in regular classrooms, enhancing learners’ engagement is considered both a challenge and a new opportunity across the entire educational sector today (Bonk, 2016). Since we cannot really change the face-to-face model, physically, or on the surface, it looks like, the teachers and students are the two major components in a classroom. A traditional image or conception of face-to-face teaching style will be embedded into all classroom activities. However, new technologies, in particular mobile learning technologies can to a great extent enhance learners’ engagement. Although many scholars argue that we lose our social relationships as we have increasingly help on mobile devices, they do “let us extend the place, pace, and inherent space of learning” (Bonk, 2016, p.8).

Bonk, Medury and Reynolds (1994) suggest, online collaboration and team work has emerged since early 1990s along with the popularisation of the Internet and learning technologies. A number of collaborative tools allow learners to share their learning process, exchange ideas and knowledge and assemble feedback, with both local colleagues and the team members around the world. “As learning recourses and forms of delivering content continue to expand in virtual spaces, instructors and institutional designers are increasingly embracing blended forms of learning” (Bonk, 2016, p.13). Today, a combination of face-to-face and technology supported online experiences in unique ways has taken advantages of “enhanced [learning] resources as well as expert availability and accessibility to guide one through them” (p.13). As a result, collaboration tools and mobile apps such as Socrative, Kahoot, Padlet, ECHO360 Active Learning Platform (ALP), Google Slides and H5P have facilitated blended learning and mobile learning both online and in a classroom.

In recent times learning processes include social media to support the conversation of learning. Social media has emerged to provide communications in a variety of languages and using a variety of scripts, examples such as Facebook, Instagram, WeChat (emerged in
China), LINE (emerged in Japan) and Kakao Talk (emerged in Korea). The Russian psychologist Lev Vygotsky (1978, 1986) always insists that learning is initially a communication process and a kind of interaction in a society. From this perspective, making learning more social with embedded social interactives into a learning process can enhance students’ engagement. Furthermore, making digital media products is no longer the domain of professionals. Anyone with a camera or a smart phone can easily produce a video and share it with others. As Bonk (2016) suggests, learning today has become more digital, resource-rich and hands-on. Therefore, mobile learning technologies such as Splice, Quik and Pic Collage actively engage learners and support artefacts in digital form.

2.2. Convenient learning
The notion of convenient learning ensures students access resources and activities multiple times and ways. Convenient learning whether online or face-to-face, has become more open, free, synchronous, informal, global, and audio-visual (Shea, 2015; Carson, 2009; Allen and Seaman, 2014; Bonk, Lee, Kou, Xu and Sheu, 2015; Bonk, 2016). According to Bonk, Lee, Kou, Xu and Sheu (2015), students find more pleasure when they can search for and uncover the needed information on their own, from open, free and global resources such as the World Wide Web. These resources are no longer limited to formal text, in fact, a large component can be informal and audio-visual based, such as: YouTube videos, TED talks and MOOCs. Convenient learning can also appear in real time (synchronously) via web/video conferencing systems such as Adobe Connect, Blackboard Collaborate and Zoom. Today, web/video conferencing tools no longer rely on a PC or laptop with a cable connection. Along with the maturity of Wi-Fi and 4G/5G technologies, a smart phone or tablet can easily facilitate such mobile learning process. “As a result of the tremendous growth of fully online and blended learning [mixture of online and face-to-face classes] as well as informal and mobile learning, opportunities for humans to learn have entered every aspect of society” (Bonk, 2016, p.12).

2.3. Customised and personalised learning
Nowadays, learning is more student-centred other than teacher centred. Teachers are more considered the facilitators of customised and personalised learning. In a regular face-to-face classroom, students may design their own study plan by using a mob app (e.g. Study Cal and Evernote) and/or a mobile game (e.g. Airline Manager and Bridge Constructor). More studies are focusing on the provision of rich resources, learner freedom, choice, fun and personally driven goals in an e-learning environment, but there is need for greater research on how to achieve such customised and personalised learning with mobile apps in a regular classroom. The fusion of interactive classroom and mob apps have underpinned the customisation and personalisation of learning. Learners increasingly want to use customised and personalised apps to support their study and fill in the gaps between traditional learning resources and the demands of learning in the new age. Blended learning forms, another aspect of customised and personalised learning, and has been increasingly embraced by educational designers. Customised and personalised learning
requires a combination of face-to-face and online experiences “in unique ways to take advantages of enhanced learning resources as well as expert availability and accessibility to guide one through them” (Bonk, 2016, p.13). Today, almost all higher education institutions in the world are relying on certain types of blended learning experience to “enhance, extend, and perhaps even transform their classes” (p.13). Blended learning has been demonstrated as often the best option by a number of famous universities (Means, Toyama, Murphy, Bakia & Jones, 2010).

2.4. Representational competencies and practices
Teaching and learning in many disciplines such as media, communication and science require some competency in illustrating and interacting with various representations (Nichols, Stevenson, Hedberg, & Gillies, 2016). This competency, also known as ‘representational fluency’, consists of the skills and abilities of reading, interpreting (or translating meaning) and engaging meaning across different representations (Delice & Kertil, 2013; Nichols et al, 2016). In general, these representations can be facilitated by mobile and emerging technologies in a face-to-face classroom. As the choice of image can change meanings or create different concepts, it is critical to improve teachers’ technical and pedagogical capacities in using multiple representations, “as without it students may develop misconceptions and shallow knowledge” (p. 510). As Nichols, Hanan & Ranasinghe (2013) have suggested, it will be much easier for students to experience significant learning gains if teachers can make explicit conceptual connections between multiple representations.

Representational practice (or approach) requires “skills to understand the affordances of multiple representations” (Nichols et al, 2016, p.511). Therefore, to increase teachers’ awareness of their representational practices, it is needed to provide them an opportunity to “think critically about the concept of different modes of representation and how they fit in terms of purpose, tools, recourses and audience” (p.512). Nichols et al, (2016) explored the relationship between the levels of use and uptake of representational practices with the conceptual understanding of and ability to make conceptual connections between multiple representations. In terms of the Structure of Observed Learning Outcomes (SOLO) taxonomy (Biggs & Collis 1982, cited in cited in Nichols et al, 2016), “levels of complexity in an individual’s conceptual understanding of a subject, through five levels, and it is claimed to be applicable to any subject area” (pp.515-516). Table 2 below describes these levels of conceptual understandings as they relate to representations. The higher level of SOLO, more connections within the given subject area and even beyond it are made. In other words, individuals are able to “relate and extend conceptual ideas across representations within the topic of the unit and beyond to other topics” (p.516).
Table 2. SOLO levels of conceptual understanding around representations

<table>
<thead>
<tr>
<th>SOLO level</th>
<th>Associated conceptual understanding</th>
</tr>
</thead>
<tbody>
<tr>
<td>Level 1 Pre-structural</td>
<td>Individuals are simply acquiring bits of unconnected information, which have no organisation and make no sense. These individuals are able to draw ideas and information from separate representations but are unable to make any conceptual connections between any two representations</td>
</tr>
<tr>
<td>Level 2 Unistructural</td>
<td>Simple and obvious connections are made, but their significance is not grasped. Individuals at this level can make simple connections between representations that relate more to structure rather than conceptual ideas</td>
</tr>
<tr>
<td>Level 3 Multistructural</td>
<td>A number of connections may be made, but the meta-connections between them are missing, as is their significance for the whole study object. This individual is able to make structural and conceptual connections between two representations but not beyond that across multiple representations</td>
</tr>
<tr>
<td>Level 4 Relational</td>
<td>The individual is now able to appreciate the significance of the parts in relation to the whole. An individual at this level is able to relate the ideas across multiple representations within the topic but not extend them across subject domains</td>
</tr>
<tr>
<td>Level 5 Extended Abstract</td>
<td>The individual makes connections not only within the given subject area, but also beyond it, and is able to generalise and transfer the principles and ideas underlying the specific instance. This individual can relate and extend conceptual ideas across representations within the topic of the unit and beyond to other topics they are teaching</td>
</tr>
</tbody>
</table>

Source: Adapted from Biggs and Collis (1982, cited in Nichols et al, 2016, p.516)

In line with ‘levels of use and associated teacher practice’ suggested by Nichols et al (2016), teachers are yet to actually make use of the innovation if they are at levels 0 to 2 (see Table 3). Alone with the increase of the levels of use technologies, teachers tend to spend more efforts in using new classroom strategies, techniques and materials, improve learning outcomes, make changes of representations to benefit students, share positive experience with colleagues, and seek more effective alternatives to the established use of the innovation (2016). These principles actually match with the ‘University Program Preliminary Results of Teacher Technology Survey’ reported by Blakemore & Whittington (2016)
Table 3. Levels of use and associated teacher practice

<table>
<thead>
<tr>
<th>Level of use</th>
<th>Associated practice</th>
</tr>
</thead>
<tbody>
<tr>
<td>Level 0 Non-use</td>
<td>A teacher takes no action in relation to the programme or practice</td>
</tr>
<tr>
<td>Level 1 Orientation</td>
<td>A teacher seeks information about the programme or practice</td>
</tr>
<tr>
<td>Level 2 Preparation</td>
<td>A teacher decides to adopt the new practice and prepares to implement it</td>
</tr>
<tr>
<td>Level 3 Mechanical</td>
<td>In early attempts to use new classroom strategies, techniques and materials, teachers often feel inadequate and awkward. Teachers at this level may speak of problems with using the representations – have used them, but have not really addressed the issues</td>
</tr>
<tr>
<td>Level 4 Routine</td>
<td>Teachers move to improving learning outcomes rather than to reducing classroom management concerns. Teachers here will note that their students were more engaged when using the representations, that the representations helped students to better understand or visualise the concepts/ideas in the unit. They talk of students using representations independently and supplementing, facilitating, scaffolding learning from them</td>
</tr>
<tr>
<td>Level 5 Refinement</td>
<td>Teachers assess the impact of their efforts and make changes to increase that impact. Teachers use supplemental representations to expand the benefits for their students. They do not only use what was given to them on the professional development days</td>
</tr>
<tr>
<td>Level 6 Integration</td>
<td>In using the innovation teachers actively coordinate their efforts with those of their colleagues. Teachers at this level share information with other teachers regarding their effective retrieval and use of the representations. Teachers not only share ideas around the representations but also find additional representations and share with their colleagues</td>
</tr>
<tr>
<td>Level 7 Renewal</td>
<td>Teachers seek more effective alternatives to the established use of the innovation. Here teachers seem quite comfortable with using the representations given to them, believe in the benefits to their students, choose and utilise additional representations that they may have shared with colleagues and perhaps even speak of other representations they might use next time they do the unit. Teachers here are clear that multiple and different representations support learning, and building learning activities around representations makes learning ideas more accessible</td>
</tr>
</tbody>
</table>

Source: Adapted from Nichols et al (2016, p.518)

3. Results and analysis

3.1. How mobile and emerging learning technologies have been used for teaching in regular classrooms?

In the colleges that participated in this study, 94% of units were delivered in the regular face-to-face classroom on campus while 13% of units adopted blended delivery mode and 3% were delivered online. All teaching staff were encouraged to use their mobile devices including smartphone, tablet and laptop in teaching. At some colleges, teachers have been supplied a free iPad. According to Blakemore & Whittington (2016), as shown in Table 4 (n=476), although 94% and 61% teachers used their smartphone and tablet to access to teaching materials, only 36% used smartphone and 27% used tablet in teaching. By contrast, more teaching staff used laptop in teaching.
Table 4. Teaching staff’s use of personal devices

<table>
<thead>
<tr>
<th>Personal devices: access and use in teaching</th>
<th>Smartphone</th>
<th>Laptop</th>
<th>Tablet</th>
<th>Desktop computer</th>
<th>Smartwatch</th>
<th>I do not use personal devices for teaching work</th>
</tr>
</thead>
<tbody>
<tr>
<td>Personal access</td>
<td>94%</td>
<td>85%</td>
<td>61%</td>
<td>51%</td>
<td>4%</td>
<td>0%</td>
</tr>
<tr>
<td>Use in teaching</td>
<td>36%</td>
<td>68%</td>
<td>27%</td>
<td>57%</td>
<td>0%</td>
<td>0%</td>
</tr>
</tbody>
</table>

Source: Blakemore and Whittington (2016)

Comparing teaching staff, more students tend to use their smartphone or tablet other than a laptop or desktop in learning. According to the online survey (n=116), 58% students chosen smartphones and tablets, while 42% students used desktops or laptops for learning in the face-to-face classroom (see Table 4.5).

Table 5. Students’ use of personal devices

<table>
<thead>
<tr>
<th>Personal devices</th>
<th>DESKTOP</th>
<th>LAPTOP</th>
<th>Windows 8</th>
<th>32%</th>
<th>Mac</th>
<th>SMARTPHONES</th>
<th>7%</th>
<th>Android</th>
<th>18%</th>
<th>iPhone</th>
<th>TABLETS</th>
<th>30%</th>
<th>iPad</th>
<th>0%</th>
<th>Android</th>
</tr>
</thead>
<tbody>
<tr>
<td>43%</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>25%</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>30%</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

All interviewees (i.e. the 8 tertiary college teachers) have used emerging learning technologies in creating course content, presentation materials, lesson panning and seeking resources, as well as using mobile devices and apps to engage students, and to conduct collaborative group activities in a regular classroom. One interviewee said new learning technologies helped her to demonstrate examples in the classroom while for another interviewee, ‘Newsela’ assisted her in selecting news and giving news to different levels of students. These findings are repeated in the Blakemore and Whittington (2016) study (see Table 6 below).
Table 6. Navitas’ teachers’ use of technology and teaching activities

![Table 6: Technology and teaching activities](image)

Source: Blakemore and Whittington (2016)

To facilitate the above activities, a wide range of mobile and emerging technologies have been selected by Navitas teaching staff and categorised into the following fifteen main types (see Table 7).

Table 7. The main types of mobile and emerging technologies used by Navitas teachers

<table>
<thead>
<tr>
<th>Types of mobile and emerging technologies</th>
<th>Tools or apps</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Mainstream LMS</strong></td>
<td>Moodle and Blackboard</td>
</tr>
<tr>
<td><strong>Q &amp; A (online quiz)</strong></td>
<td>Socrative and Kahoot!</td>
</tr>
<tr>
<td><strong>Interactive teaching and learning</strong></td>
<td>Echo 360 ALP, Explain Everything and H5P</td>
</tr>
<tr>
<td><strong>Video conferencing</strong></td>
<td>ZOOM and Blackboard Collaborate</td>
</tr>
<tr>
<td><strong>Mind mapping</strong></td>
<td>DSRP and iMindMap</td>
</tr>
<tr>
<td><strong>Virtual reality (VR)</strong></td>
<td>Aurasma</td>
</tr>
<tr>
<td><strong>Collaborative learning</strong></td>
<td>Padlet, Pinterest and Seesaw</td>
</tr>
<tr>
<td><strong>Video production</strong></td>
<td>iMovie, Quik and Splice</td>
</tr>
<tr>
<td><strong>Quick response (QR)</strong></td>
<td>QR scanner</td>
</tr>
<tr>
<td><strong>Academic literacy</strong></td>
<td>RefME, Mendeley and WritingNav</td>
</tr>
<tr>
<td><strong>Presentation and writing</strong></td>
<td>Prezi, Google Slides, Pecha Kucha and Google Doc</td>
</tr>
<tr>
<td><strong>Assessment and marking</strong></td>
<td>Turnitin and Grademark</td>
</tr>
<tr>
<td><strong>Study planning and support</strong></td>
<td>Study Cal and Evernote</td>
</tr>
</tbody>
</table>
Although the teachers have been very keen to use various technologies in regular classrooms, more than half of technologies have been attempted only once. As one interviewee stated, “I always try new apps. Maybe 50% of the apps were only used once because they didn’t really work. I have to frequently search new apps and ask my colleagues are there any new apps”. This also was reflected in Blackmore and Whittington (2016) results (see Table 8).

Table 8. Encouragement to try a new technology-related idea

<table>
<thead>
<tr>
<th>Encouragement to try a new technology-related idea</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Recommendation from a teaching colleague</td>
<td>71%</td>
</tr>
<tr>
<td>Seeing an example of it in my teaching context</td>
<td>60%</td>
</tr>
<tr>
<td>Attending a PD session about it</td>
<td>67%</td>
</tr>
<tr>
<td>Reading/hearing an expert talk about it</td>
<td>48%</td>
</tr>
<tr>
<td>Using it in a non-teaching context first</td>
<td>36%</td>
</tr>
<tr>
<td>Reading academic research about it</td>
<td>20%</td>
</tr>
<tr>
<td>Students asking about it</td>
<td>20%</td>
</tr>
<tr>
<td>I only try new technology if it’s mandatory for my course</td>
<td>5%</td>
</tr>
</tbody>
</table>

Source: Blakemore and Whittington (2016)

Nonetheless all the eight interviewees agreed, a good teaching tool or mobile app that can be adopted in regular classrooms must meet the four criteria: (1) Compatible or suit all mobile devices, (2) easy to use, (3) relevant to teaching content and activities, and (4) supported by current technological infrastructure. Furthermore, Table 9 suggests students’ overall satisfaction with using new mobile and emerging learning technologies, which to some extent matches the above four criteria agreed by teachers. In other words, both teachers and students have similar standards of using new tools and apps.
Table 9. Students’ overall satisfaction with using new mobile and emerging learning technologies

![Image of satisfaction chart]

3.2. How to engage students by using mobile and emerging learning technologies in regular classrooms?

“Using mobile and emerging learning technologies in teaching already engages students”, claimed one interviewee. Irrespective of using new tools or apps for creating content or facilitating activities, one interviewee suggested “students feel more engaged than ever because they believe study has become to part of their life rather than ‘add-on’ work”. For example, in one class, students didn’t have to orally share group discussion results but used Padlet to share the discussion outcome. “Students can post their discussion result as a group and everyone can see it, which was quite engaging”.

Other teachers used Prezi, Echo 360 ALP and H5P to prepare for a flipped classroom delivery mode. These two tools allowed teachers to integrate lecture notes, video recordings, images, online audio-visual sources (e.g. YouTube) and online activities (e.g. quiz) together and provide them to students prior to a regular classroom. In this way, students can gain first exposure to new material outside of class, while in-class time is devoted to more engaging and interactive exercises, projects or discussions. Four teachers selected Socrative and Kahoot! to check students’ understanding of course content and track their learning process. One considered students not passive but active learners. In his words, “I always encourage students to share their own screens via Explain Everything with the whole class, which enabled all students to be engaged and interactive”. According to students’ feedback in the survey, 82% students think learning pursuits are no longer boring and 78% believe learning more entertaining. As one student commented, “we have been given more ‘hands-on’ work other than just listening’.

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3.3. Do mobile and emerging learning technologies make teaching and learning more convenient?

Most teaching staff thought emerging learning technologies have made teaching and learning more convenient. One commented, “I can easily share a news to all students in class other than have them printed out and circulate, particularly for off-campus or remote students”. Another said, “when students do not understand some concepts, they can easily flip back, because all pages have been recorded by Explain Everything”. The Blakemore and Whittington (2016) report indicates a similar outcome in Table 10 below.

Table 10. Teaching benefits of using technology

<table>
<thead>
<tr>
<th>Teaching benefits</th>
<th>Agree</th>
<th>Neutral</th>
<th>Disagree</th>
</tr>
</thead>
<tbody>
<tr>
<td>It enables me to access a wide range of additional content</td>
<td>94%</td>
<td>6%</td>
<td>1%</td>
</tr>
<tr>
<td>It allows me to create more variety in my lessons</td>
<td>90%</td>
<td>9%</td>
<td>1%</td>
</tr>
<tr>
<td>It encourages me to keep searching for effective ways to teach</td>
<td>81%</td>
<td>17%</td>
<td>2%</td>
</tr>
<tr>
<td>It helps develop my own skills set</td>
<td>60%</td>
<td>21%</td>
<td>3%</td>
</tr>
<tr>
<td>It helps with student engagement</td>
<td>76%</td>
<td>19%</td>
<td>5%</td>
</tr>
<tr>
<td>It helps me to be better organised</td>
<td>86%</td>
<td>12%</td>
<td>2%</td>
</tr>
<tr>
<td>It helps me to share ideas with other teachers</td>
<td>70%</td>
<td>25%</td>
<td>5%</td>
</tr>
<tr>
<td>It makes it easier to adapt to different student needs</td>
<td>84%</td>
<td>29%</td>
<td>7%</td>
</tr>
<tr>
<td>It helps to build my confidence</td>
<td>45%</td>
<td>45%</td>
<td>11%</td>
</tr>
</tbody>
</table>

Source: Blakemore and Whittington (2016)

Despite this, two teachers expressed different viewpoints. One claimed that technologies can make teaching and learning easier and convenient but require good preparation. The other suggested the new tools and apps were convenient for teaching but not convenient for learning some times. For example, students sometime use their mobile devices to do the things that are irrelevant to the class.

3.4. Do our students collaborate more by using mobile and emerging learning technologies?

Several different new technologies and mobile apps were suggested by the eight teachers to enhance collaboration in regular classrooms. Students have used Padlet and Pinterest to collaboratively work on their group assignment. Meanwhile, they also used Google Slides and Google to share ideas. Another teacher suggested Pecha Kucha to students for group presentation. Pecha Kucha is a simple, informal and snappy style of presentation where 20 images are shown for 20 seconds per image, with the speaker talking along with them as they automatically advance. Another has used H5P in her media and communication class for more than one year. H5P empowers everyone to create, share and reuse interactive content. Apart from working collaboratively among students, the new technologies also enable collaboration between teachers and students. One stated, “when I introduce H5P to my
students, this is a kind of engagement; but when students share their using experiences and tell me the best way to use, this is a kind of collaborative work”.

Multiple screen teaching and learning is yet another approach to enhance collaboration although some teachers believe this may distract students from the class. Suggested by Interviewees C, D and E, maximum 4 screens have been used by a student in their class: Laptop for typing and searching online sources, iPad (for interactive apps, mobile phone for communication and smart board for sharing.

3.5. What kind of customised and personalised mobile and emerging learning technologies may support teaching and learning in regular classrooms?

In light with customised and personalised learning concept, teachers are undertaking a facilitator role in regular classrooms to provide students a blended learning environment, in which students are the centre and controlling over their own learning pursuits. According to Blakemore and Whittington (2016), blended teaching and learning materials have been widely used by Navitas teaching staff in their classroom (see Table 11).

Table 11. Resources and materials used in teaching

![Resources / materials used](image)

Source: Blakemore and Whittington (2016)

However, finding good quality multimedia sources and suggesting to students appropriate learning technologies have been found challenging by most educators. As shown in Table 12, only 24% teachers didn’t think using multimedia was challenging while 49% teachers thought it was hard to find good quality media and 40% believed creating their own media was difficult.
In spite of this, many teachers have found their solutions to support customised and personalised learning through using mobile and emerging learning technologies. One used ‘Slack’ to communicate with students, monitor their learning pursuits, share media resources and offer students personal advice. Another teacher adopted ‘Evernote’ and ‘Study Cal’ in her class to help students with their personal study plan. According to the online survey, many students expressed that they have been seeking their own learning sources (e.g. TED Talks videos), mobile apps (e.g. Splice and Quik) and games (e.g. Airline Manager, Bridge Construction and Nintendo Switch games). Students commented that the online free videos have “provided additional sources for their study”. The mobile apps and games made their learning “more fun and engaging”. They felt “more entertained, connected with their peers, confident to be able to present themselves and their work”. This demonstrates that students are increasingly controlling their own study pursuits in a blended learning environment.

3.6. Do students concepts of their discipline change by using new mobile learning technologies?
Teachers require more advanced skills or competencies to use mobile and digital forms of representation to help students with conceptualising disciplinary knowledge (Nichols et al, 2016). Thus, if teachers effectively choose and use content-appropriate and multivisual representations, it will be much easier for students to experience significant learning gains. The Blakemore and Whittington (2016) report also showed teachers value using multivisual representation (see Table 13).
Table 13. Multimedia: perceived by teachers

<table>
<thead>
<tr>
<th>Multimedia: perceived value by teachers (average)</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image" alt="Graph showing multimedia perceived value by teachers" /></td>
</tr>
</tbody>
</table>

Source: Blakemore and Whittington (2016)

Interviewees gave an explanation why many teachers thought multi forms of representation may change students’ conceptualisation.

“new mobile and emerging technologies make our students more independent. They seek help online and look for different sources to help them understanding content other than asking teachers directly. However, some students only see mobile devices as entertainment or social connections rather than learning and support. We need to change this situation. Students need to see their leaning devices as both social/entertainment and learning. This is something we need to teach them more, e.g. use mobile devices to support learning”.

Other interviewees believed that students tend to use new technologies to get instant answers other than conceptualise the knowledge thorough a designed learning process. Nonetheless, another two interviewees claimed that some new technologies and tools still guide students to conceptualise course content through group collaborative work, other than work out by themselves. Students indeed enjoyed this approach. One teacher pointed out that more visual materials and interactivities have changed students’ way of conceptualising content from reading a paper to playing an app or game.

**3.7. Have students changed their communication behaviour by using new mobile learning technologies?**

Communication behaviour can be influenced by culture, personality and previous experience. In terms of the online survey, 83% students agree that their way of communication with teachers and other students have changed to certain extent since mobile devices and apps have been introduced into regular classrooms. Most teachers also realised such changes. A teacher claimed, “students now communicate with us much less than before. In the past, I can see their facial expression and know if they understand or not, but now new technologies have to a great extent reduced eye contact”. Students today rely on the technologies and instant quizzes, other than direct communication and nonverbal communication with teachers.
4. Discussion and recommendation

4.1. Attitudes to mobile and emerging technologies
Blakemore and Whittington (2016) have shown that most teachers are positively disposed to using technology as part of their teaching. Rethinking the development of technologies in the past two decades, many different equipment (e.g. PC, camera, fax machine and scanner) have been merged into the one device. Thus the current devices can be used for many functions and in some ways simplify the learning and teaching tasks.

Table 14. Positivity about teaching with technology

| Source: Blakemore and Whittington (2016) |

4.2. Prepare well for the class but be ready for a potential challenges
Most teachers had same teaching experience – with insufficient time some planned teaching activities could not be completed. This happened for several different reasons including unexpected technological issues, teachers’ and/or students’ unfamiliarity of new technologies, the time spent on managing class, overloaded teaching content and extension of in-class activities (e.g. Q&A and discussion). Teaching staff required preparation prior to a class and being ready for a potential problem. In line with this paper’s concern, the Blakemore and Whittington (2016) report revealed the barriers that may stop teachers from using technology more effectively in teaching (see Table 15).
Table 15. Barriers to using technology in teaching

<table>
<thead>
<tr>
<th>Barriers to using technology in teaching</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nothing stops me</td>
<td>38%</td>
</tr>
<tr>
<td>I don’t know how to use it well enough</td>
<td>27%</td>
</tr>
<tr>
<td>I don’t have access to the right facilities</td>
<td>20%</td>
</tr>
<tr>
<td>No internet/slow internet</td>
<td>22%</td>
</tr>
<tr>
<td>I don’t have time</td>
<td>21%</td>
</tr>
<tr>
<td>I worry things will go wrong</td>
<td>17%</td>
</tr>
<tr>
<td>I don’t need to use it</td>
<td>0%</td>
</tr>
</tbody>
</table>

Source: Blakemore and Whittington (2016)

As shown in Table 15, despite the 36% ‘pioneers’ who thought nothing can stop them, more than a quarter teachers considered they did not know how to use technology enough or did not have access to the right facilities. Under these circumstances, some suggestions have been given to teachers including offering a training session (face-to-face or online), providing user guides, sharing ideas with other users and involving in a pilot project. Tables 16 and 17 below indicate teachers’ preferred way to learn new technologies and their need from a training session.

Table 16. Preferred way to learn new technologies

<table>
<thead>
<tr>
<th>Preferred ways to learn</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Face to face PD sessions</td>
<td>67%</td>
</tr>
<tr>
<td>Practice things myself</td>
<td>56%</td>
</tr>
<tr>
<td>Idea-sharing with teaching colleagues</td>
<td>54%</td>
</tr>
<tr>
<td>Online PD sessions</td>
<td>37%</td>
</tr>
<tr>
<td>Explore and find information</td>
<td>32%</td>
</tr>
<tr>
<td>Online teaching communities</td>
<td>20%</td>
</tr>
<tr>
<td>Doing research or pilot projects</td>
<td>18%</td>
</tr>
<tr>
<td>Formal qualifications</td>
<td>12%</td>
</tr>
</tbody>
</table>

Source: Blakemore and Whittington (2016)
Table 17. The focus of professional development

![PD focus chart]

While teachers are improving their own technological skills, they suggested providing students clear instruction on using these technologies to prevent any learning delays. Teachers also need to understand it may take time for students to become familiar with new things. However, in most cases, this is manageable, though many think this is not automatically easy.

4.3. Has Wi-Fi killed teaching?
It is no doubt Wi-Fi, one of the greatest inventions, has helped educators to achieve technology-enhanced teaching and learning. Some activities cannot be conducted at all in the classroom without Wi-Fi. Not all educators appreciate this invention and some of them even think teaching has been killed by Wi-Fi. Table 18 shows teachers’ attitudes about the Bring Your Own Device (BYOD) policy.

Table 18. Teachers’ BYOD attitudes

![BYOD attitudes chart]

Although most teachers require or encourage students to use their own devices, a quarter of the teachers do not have preference and 10% even discourage or don’t allow BYOD in a
regular classroom. The in-depth interviews and students’ online survey explained why some teachers dislike BYOD. Teachers considered Wi-Fi has made managing class more difficult. At most times, they did not know if students were using their mobile devices for study or for something else. Sometimes they wished the Wi-Fi could be blocked to make sure students were really involved in the learning task. Despite this, most teachers and students believed Wi-Fi’s strengths are much more than its weakness. There was a lesson in 2016 when Wi-Fi was not working one day, and over 80% class activities could not be completed. As suggested by one interviewee, “if we can’t stop students using mobile devices and multiple screens in the classroom, we need to provide them clear instructions on how to use these new technologies to support their learning”.

5. Conclusion

It is obvious that “learning is now in a state of significant flux” (Bonk, 2016, p. 15). During the flux, we have entered the age of Education 3.0, in which teachers are most likely expected to be at an expert level of facilitating a regular class in mobile learning environments. Under such circumstance, students concepts of their discipline have been changed by using new mobile technologies. Many teachers agree that the difficulty of answering ‘has new technologies changed students’ communication behaviour or has their communication behaviour promoted the development of new technologies is equivalent to answering the questions ‘chicken and egg which comes first’. Students communication behaviours have been changed in their daily life due to the development of social media and the application of new technologies. Such changes actually have led the change of teaching technologies and classroom settings in order to meet students’ expectations. Younger students are considered typical digital natives. They tend to use more tools and devices to communicate with each other and this has brought into their learning pursuits. So, can we say new technologies changed their communication behaviour or they changed the technologies that used in the classroom? In fact, new technologies have changed a lot of classroom settings and how teachers facilitate their classes, but not really changed students’ way of communication and learning. Because we have changed the learning technologies, which has impacted on students’ expectation from their teachers and their learning experience in a regular classroom. As Bonk (2016) suggested, “it is time for instructors to give voice to their learners and to grant them multiple opportunities and pathways to learn” (p.15). Learning and teaching in the remaining of rest of 21st century will be full of exciting ways to engaged learning, convenient learning, and customised and personalised learning.
Acknowledgements

I would like to express my special thanks of gratitude to Western Sydney University – Sydney City Campus Academic Director Felicity Orme as well as Campus Principal Heather Tinsley who provided the opportunity to do this study on ‘Using Mobile and Emerging Learning Technologies in Regular Classroom’. Secondly I would also like to thank Lucy Blakemore and Yindta Whittington who shared their survey results with us. The study could not be completed without those important data. Last but not least I would like to thank Professor John G Hedberg who gave me many valuable suggestions and helped me a lot in finalising this study within the limited time frame.

References


Education Strategies Via Mobile Learning to Enhance Volunteer Spirit for Undergraduate Students

Pakwipar Phosri

Abstract

The purposes of this study were to analyze problems and role of mobile learning to enhance volunteer spirit and proposed education strategies via mobile learning to enhance volunteer spirit for undergraduate students. Mixed method research design was adopted for this study. The participants were 215 undergraduate students and 9 senior experts in the examination strategies. The research instruments was questionnaire survey, which contained five-levels of rating scales. The data were analyzed by using mean, standard deviation and content analysis. Findings of the study were as follows:

1. The problems of mobile learning to enhance volunteer spirit for undergraduate students comprised five aspects: network for interaction, self-directed learning, teamwork skills, problem solving skills, Diversity of learning resources. The mean values as a hole at the high level ($\bar{x} = 4.47$, $SD=0.61$) When each aspect was considered, it was a highest level of these aspects network for interaction ($\bar{x} = 4.61$, SD=0.67) and self-directed learning ($\bar{x} = 4.58$, SD=0.63).

2. The Role of mobile learning to enhance volunteer spirit for undergraduate students comprised five aspects: open mind for social online interaction, caring and sharing, promoting for social interaction and team working, increasing for communication efficiency, changing ways of learning in according to time and social environment. The mean values as a hole at the high level ($\bar{x} = 4.59$, SD=0.76). When each aspect was considered, it was a highest level of these aspects: open mind for social online interaction ($\bar{x} = 4.83$, SD=0.63), caring and sharing ($\bar{x} = 4.64$, SD=0.84), promoting for social interaction and team working ($\bar{x} = 4.62$, SD=0.82).

3. Education strategies via mobile learning to enhance volunteer spirit for undergraduate students comprised 1) education strategies for enhancing self-directed learning, 2) education strategies for promoting volunteer spirit networks 3) education strategies for empowering network leaders 4) education strategies for communication and public relations 5) education strategies for learning 4P comprised: participation, problem based learning, project based learning, public learning for communication.

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Keywords: education strategies, mobile learning, volunteer spirit

1. Introduction
Education is process leading to human resources development and a mechanism for developing economy and society, in prehistory as adults trained the young in the knowledge and skills deemed necessary in their society. In the 21st century the economic system worldwide is gradually entering the trend of “the Fourth Industrial Revolution” and the policy of Thailand 4.0 is a new economic model to develop Thailand into a value-based economy, and will change the country’s traditional farming sector to smart farming, also seeks to promote creativity, innovation, and the application of technology in various economic activities. Education is considered a fundamental factor of human resources development for this change how teachers design technology to promote learning and instruction. Educational technology can be used to support for preparing competent Thai people and a prosperous society for the country.

How the internet has changed behaviour and students interaction in the classroom. The new face in the globalization the world of “Internet of Things” it was found that mobile devices have become an integral part of life for most Thai people. Each day, they use mobile phones or tablet computers to do many different activities from the time get up till their bedtimes. Many begin and end their day by checking out LINE app or e-Mail on mobile devices. The sight of people with their heads bent over smart phones or tablet computers become common at any time in any place. People are spending more time on their phones communicating to those within their social circles and ignoring proximate others and adjacent surroundings. The survey on Thailand Internet User Profile 2016 had an objective of collecting and compiling data on various aspects of the characteristics and behavior of Internet users in Thailand According to the survey finding as: Generation Y\(^2\) spent an average of 53.2 hours a week or 7.6 hours a day on the internet. The first three devices of

Generation Y\(^2\) refers to those who were born between 1981 and 2000, and grew in the era of computers, Internet and IT technology
choice Generation Y people use to surf the net were smartphones (90.5 percent), desktop computers (63.7 percent) and laptop computers (52.1 percent) respectively. In general, most of them used the internet between 12.01-16.00 hrs (83.3 percent).[1] The influence of internet is huge and even greater on teenagers how their interacting in society. It is evident from existing literature that new media technologies impact on the social interaction within households in many different ways and the location of new media technologies can in fact improve social interaction within the household when they are located in a public space within the home. [2] Elizabeth W Gichovi. (2012) found from her study support the idea that the advent of the mobile phone has denied people the opportunity to interact more socially including face to face interactions. People are spending more time on their phones communicating to those within their social circles and ignoring proximate others and adjacent surroundings.[3] This is in contrast of the findings of Aaron Smith. (2012) who found that the impacts of mobile phone were equally balanced between positive and negative. The positive impacts of cell phone ownership, fully two-thirds (65%) of cell owners say that mobile phones have made it “a lot” easier to stay in touch with the people they care about, while just 6% say that their phone has not improved their connections with friends and family at all. The positive impacts their phone has made it at least somewhat harder to forget about work at home or on the weekends; to give people their undivided attention; or to focus on a single task without being distracted. [4] However Molly O Rourke and Peter D. Hart (2004) found from their study, the influence of internet has changed volunteering.[5] The influence of internet and mobile phone were both of positive and negative, therefore this study an attempt to assess the interaction via mobile learning to enhance volunteer spirit for undergraduate students. It was hoped that the findings of the study would be significant to the future planning of educational strategies for classroom management and to those who are concerned with education.

2. Purpose of the Study
The purposes of this study were to (1) analyzed problems and role of mobile learning to enhance volunteer spirit and (2) proposed education strategies via mobile learning to enhance volunteer spirit for undergraduate students.

3. Method

The population and the sample
The population for this study consisted of 485 undergraduate students of Burapha University who studied volunteer spirit for social development course in 2016. A sample size of 215 was considered adequate for the study according to "Krejcie and Morgans' FormulaTable for Determining Sample Size. A total of 215 graduate students were chosen to reflect
problems, role of mobile learning to enhance volunteer spirit by the questionnaire and 9 senior experts in the examination strategies by focus group.

**Instrument**
The questionnaire for collected data focus on problems, role of mobile learning to enhance volunteer spirit consists of three sections. In section A the subjects gave their personal data required for the study. In section B 20 items of problems and in section C 20 items of role of mobile learning to enhance volunteer spirit.

**Data analysis**
1. The questionnaire for collected data focus on problems, role of mobile learning to enhance volunteer spirit were analyzed by using the Statistical Package for the Social Sciences (SPSS). The statistical procedures used for data analysis in this study included mean and standard deviation.
2. The data from 9 senior experts in the examination strategies were analyzed by content analysis.

**4. Results**

**Part 1: Problems and role of mobile learning to enhance volunteer spirit**
This study found that the mean scores and standard deviation from subjects in problems and role of mobile learning to enhance volunteer spirit are shown in table 1, table 2, and figure 1

**Table 1. Mean scores and standard deviation of problems of mobile learning to enhance volunteer spirit**

<table>
<thead>
<tr>
<th></th>
<th>Mean (n=215)</th>
<th>Standard Deviation (n=215)</th>
<th>Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>Network for interaction</td>
<td>4.61</td>
<td>0.67</td>
<td>highest</td>
</tr>
<tr>
<td>Self-directed learning</td>
<td>4.58</td>
<td>0.63</td>
<td>highest</td>
</tr>
<tr>
<td>Teamwork skills</td>
<td>4.45</td>
<td>0.58</td>
<td>high</td>
</tr>
<tr>
<td>Problem solving skills</td>
<td>4.39</td>
<td>0.61</td>
<td>high</td>
</tr>
<tr>
<td>Diversity of learning resources</td>
<td>4.33</td>
<td>0.54</td>
<td>high</td>
</tr>
</tbody>
</table>

|                               | **4.47**     | **0.61**                   | high           |

Table 1 shown that undergraduate students were asked towards problem of mobile learning to enhance volunteer spirit. The scale used was 1 to 5 to agreement scale with each of the perception statements. The scale descriptors were: 1 = Strongly Disagree, 2 = Disagree, 3 = Uncertain, 4 = Agree, 5 = Strongly Agree. The mean values as a hole at the high level (x = 4.47, SD=0.61) and each statement were placed in descending order from
the highest score to lowest score. When each aspect was considered, it was found that was a highest level of these aspects network for interaction \( (\bar{x} = 4.61, \text{SD}=0.67) \) and self-directed learning \( (\bar{x} = 4.58, \text{SD}=0.63) \).

**Table 2 Mean scores and standard deviation of role of mobile learning to enhance volunteer spirit**

<table>
<thead>
<tr>
<th>Aspect</th>
<th>Mean</th>
<th>Standard Deviation</th>
<th>Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>Open mind for social online interaction</td>
<td>4.83</td>
<td>0.63</td>
<td>highest</td>
</tr>
<tr>
<td>Caring and Sharing</td>
<td>4.64</td>
<td>0.84</td>
<td>highest</td>
</tr>
<tr>
<td>Promoting for social interaction and team working</td>
<td>4.62</td>
<td>0.82</td>
<td>highest</td>
</tr>
<tr>
<td>Increasing for communication efficiency</td>
<td>4.45</td>
<td>0.76</td>
<td>high</td>
</tr>
<tr>
<td>Changing ways of learning in according to time and social environment</td>
<td>4.39</td>
<td>0.73</td>
<td>high</td>
</tr>
</tbody>
</table>

Table 2 shown that undergraduate students were satisfied about role of mobile learning to enhance volunteer spirit as a hole at the highest level \( (\bar{x} = 4.59, \text{SD}=0.76) \). When each aspect was considered, it was found that satisfaction was a highest level of these aspects Open mind for social online interaction \( (\bar{x} = 4.83, \text{SD}=0.63) \), Caring and Sharing \( (\bar{x} = 4.64, \text{SD}=0.84) \), Promoting for social interaction and team working \( (\bar{x} = 4.62, \text{SD}=0.82) \).
Part 2: Education strategies via mobile learning to enhance volunteer spirit for undergraduate students
The data from questionnaire focus on problems, role of mobile learning to enhance volunteer spirit in part 1 were analyzed on the strategic decision making process by focus group from 9 senior experts in the examination strategies and this study found that Education strategies via mobile learning to enhance volunteer spirit for undergraduate students comprised 1) education strategies for enhancing self-directed learning. 2) education strategies for promoting volunteer spirit networks 3) education strategies for empowering network leaders 4) education strategies for communication and public relations 5) education strategies for learning 4P comprised participation, Problem based learning, Project based learning, public learning for communication. Shown as figure 2
The purposes of this study were to analyze problems, role of mobile learning to enhance volunteer spirit and proposed education strategies via mobile learning to enhance volunteer spirit for undergraduate students. Therefore this discussion based on the findings of the study as: This study was to analyze problems and role of mobile learning to enhance volunteer spirit findings found that the mean values of problem as a hole at the high level ($\bar{x} = 4.47$, $SD=0.61$). When each aspect was considered, it was found that was a highest level of these aspects network for interaction ($\bar{x} = 4.61$, $SD=0.67$) and self-directed learning ($\bar{x} = 4.58$, $SD=0.63$). This implies that mobile learning position in a wider context, we have to recognize that mobile, personal, and wireless devices are now radically transforming societal notions of discourse and knowledge, and are responsible for new forms of art, employment, language, commerce, deprivation, and crime, as well as learning. With increased popular access to information and knowledge any-where, anytime, the role of education, perhaps especially formal education, is challenged and the relationships between education, society, and technology are now more dynamic than ever. [6] Moreover it shown that defining mobile learning can emphasize those unique attributes that position it within informal learning, rather than formal. These attributes place much mobile learning at odds
with formal learning. My findings therefore, support the idea that propose that mobile devices which are: Social interactivity, Connectivity, to data collection devices, other handhelds, and to networks, Individuality, a “unique scaffolding” that can be “customized to the individual’s path of investigation”. [7]

My results are in agreement with the proposition that M-learning also creates learning opportunities that are significantly different to those provided by e-learning (at a desktop) or paper-based distance learning such as the interactivity of the learning process, the integration of instructional content, the urgency of the learning need.[8] As a result, role of mobile learning to enhance volunteer spirit as a hole at the highest level ($\bar{x} = 4.59$, SD=0.76). When each aspect was considered, it was found that satisfaction was a highest level of these aspects Open mind for social online interaction ($\bar{x} = 4.83$, SD=0.63), Caring and Sharing ($\bar{x} = 4.64$, SD=0.84), Promoting for social interaction and team working ($\bar{x} = 4.62$, SD=0.82). Moreover Fannon (2004) found from their study, although some older learners used their mobile phones to arrange face-to-face meetings to work on assignments or discuss learning issues, younger learners were more comfortable with the thought of using mobile phones for learning, and almost half (45 per cent) of the research group were prepared to use Internet-enabled telephones as their only tool for learning [9]. As Molly O’Rourke, Peter D. Hart (2004), found from their study, How the Internet has Changed Volunteering: Findings from a Volunteer Match User Study as the Internet has made information about volunteering easier to find, volunteers are becoming choosier. Nearly all prospective volunteers responded to more than one opportunity before finding the right place for them to volunteer. [5] As Anderson R. J (1994) stressed that student learning achievement may heavily depend on the teacher’s instructional planning, teaching method selection, and on a variety of learning activities. [10] Related to Venkatesh and Vitalari (1985) found that, new media technologies have created new prospects for individuals within a household by “enhancing different patterns of social interaction, access to information, and allocation of time”. [11] For that reason, mobile learning can play significant role to support instructional activities and classroom management to enhance volunteer spirit.

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A Study of Students’ Critical Media Literacy Changes through Design of Digital Video

Khong Thai Nathan Nexus, PHUA¹

Abstract
This paper discusses the preliminary outcome in the study of sub-degree level students’ critical media literacy transformation through designing a video on dilemma-typed of scenario. The central assumption of dilemma-typed of problem is that it has no clearly-defined scope and solution so multidimensional constructive thinking will certainly be a desideratum. Two students were selected from a community college in Hong Kong for investigation to find out how they have developed critical media literacy. Therefore, this study advocates the relevancy and importance of cultivating augmented self-responsibility and pro-activeness toward media information. Results gathered from this study can attest and contribute to the field of educational enhancement by providing schools, teachers, scholars, researchers as well as policy makers alike specific didactics or instructional guidance, methods, pedagogies, or strategies in developing higher-order or self-reflexive thinking among their stakeholders.

Keywords: Critical media literacy; Dilemma-typed problem; Higher-order thinking; Multimodal texts; Pedagogy.

1. Introduction
Globally, young adults between 18 to 34 years old remained as the heaviest users of the Internet and they used it mostly to access social media (Poushter, 2016). The growing amount

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of time spent on Internet usage only serves to remind us that media messages specifically those available online will assume a more prominent position or influence in today’s society. These available information can have either positive or negative effects on its consumers as the Internet has been widely called a double-edged sword. Mass medium, on one hand, could serve as a platform for promoting democracy or equal opportunities but, on the other hand, could reinforce ‘untrue’ stereotypical representations or violence, inculcate one’s biased worldviews or behavior, and even lead to discrimination or crime as such (Agarwal & Dhanasekaran, 2012; Childs, 2014). In other words, the influence of most or all other conventional socializing elements on people’s lives today is superseded by the media (Buckingham & Domaille, 2009). Family members, friends at school, or religious leaders may not able to exert as much influence as before in teaching values and norms to especially the younger generation.

1.1. Defining Critical Media Literacy
Media literacy may be perceived as a possible solution or even a permanent elixir to eradicate inaccuracies, subjectivity and unfairness if any found in media messages. Currently, there are multiple definitions of media literacy offered by various media-related organizations. For examples,

- “…provides a framework to access, analyze, evaluate, create and participate with messages in a variety of forms — from print to video to the Internet.” (Center for Media Literacy, n.d.)
- “…is the ability to access, analyze, evaluate, create, and act using all forms of communication.” (National Association for Media Literacy Education, n.d.)
- “…the ability to use, understand and create media and communications in a variety of contexts.” (Ofcom, n.d.):

Fung & Howe (2012) quoted Kuhn (1991) defined critical thinking “as including the abilities to differentiate opinion from evidence, to consider alternative opinions or theories, to develop counter-arguments and to weigh up evidence.” If we were to combine this meaning of critical thinking to that of media literacy of access, analyze, evaluate, and create, the definition of critical media literacy could possibly be deduced. On a broader purpose, Kellner & Share
(2005) claimed, “Critical media literacy offers the tools and framework to help students become subjects in the process of deconstructing injustices, expressing their own voices, and struggling to create a better society.” This could be achieved through examining exhaustively into media messages, challenging any dominant beliefs or viewpoints, deciphering all ‘open’ and ‘hidden’ meanings and subsequently producing own media content that advocates alternative perspectives to foster societal well-being (Kellner & Share, 2005; Mason, 2016).

1.2 Four States of Exposure
The theoretical framework of this inquiry is built based on Potter’s Media Exposure Model (Potter, 2009) to understand the various states of exposure a person experienced when processing media information. The four states of exposure are automatic, attentional, transported, and self-reflexive.

In the automatic state, it is being described as people are simply exposed to media messages without deliberately or purposefully looking for them. As people walk along bustling streets where there could be a ‘big’ TV screen in sight or as people walk into stores where the radio is turned on, they are in environments where they are exposed to media messages. In this state, people are automatically or are not making conscious decisions on what of those media messages to screen out. “In the automatic state, people can look active to outside observers, but they are not thinking about what they are doing,” Potter (2009) argued.

The main difference between the attentional and automatic states is that here people are not only exposed to media messages but also they are consciously focusing their attention on them. Attention results in awareness and that is a certain degree of information processing will occur. The degree varies from factors such as how much information needs to be processed and how much mental resources are put in.

In the transported state, people are deeply involved in media messages, possibly having no cognitive resources left over, as though they are already being apart or separated from their physical surroundings. “The person temporarily loses the awareness of self that in normal life often intrudes in consciousness and causes psychic energy to be diverted from what needs to be done,” Potter (2009) explained. In the self-reflexive state, people are not only exposed, attending and aware of media messages, and also they are consciously or fully-involved in information processing. As a result, here people do not lose track of time, and the place they
are in. They even know their status in the social world. In this state, people are exposed or even choose to expose to media messages with a goal and as such, they will be analyzing contents at the same time. They may even question why they interpret media messages in a particular way.

This model is particularly invaluable in serving the purposes of this research because in their study of whom known to be the pioneer of phenomenology, Kaufer & Chemero (2016) wrote Edmund Husserl put forward that exposure is a conscious experience and the purpose of phenomenology is to interpret these experiences.

1.3 Relationship between Critical Media Literacy and States of Exposure
To date, most research studies have attempted in some ways or another to introduce a range of activities or support to help their participants to gain critical media literacy (Gainer, 2010; Hammer, 2011; Kesler, Tinio, & Nolan, 2016; Lotherington & Jenson, 2011; Mills & Levido, 2011; Vraga & Tully, 2015). Ashley (2015) discovered in a survey that 76 percent of media studies instructors included the topic on media literacy in their courses. Citing the respondents, students learnt media literacy through a variety of modes such as lecture, individual or group task, and media analysis or production. Surely, the benefits and value of these activities cannot be minimized. But, these studies seem only to outline the efficacy or significance to include media or multimodal texts as a part of learning but do not suggest ways on how to measure the levels of criticalness of media content users and help them explicitly to arrive at the self-reflexive state. This is to say media studies could have so far pertained only to media literacy rather than critical media literacy.

At the same time, research works might often believe that individuals not only assumed an active role when they were reading media messages and were also aware of their own exposures (Burnett & Wilkinson, 2005; Sokolowski, 2000; Walsh, 2008; Willett, 2005). However, this belief alone raises many questions. Is there a degree of absolute certainty that there is even presence of activeness or awareness at all? If so, how ‘large’ or ‘small’ or to what degree are they?
Augmented Attentional and/or Self-reflexive States (Potter, 2009)

Utilize Support

Two Sub-degree Students

Dilemma-typed of Problem (Jonassen, 2000)

Resolve

**Figure 1 Overview of Research Processes**

Hence, the purpose of this study is to determine critical media literacy transformation and explore the support involved through resolving dilemma-typed of problem (Jonassen, 2000) with a video-making task for two sub-degree students enrolled in a media course (see figure 1).

The results will help to answer the following main and subordinate questions:

*How students’ states of exposure to media are being transformed through dilemma-typed of problem with a video-making task?*

1. What kinds of obstacles impeded students’ transformation?
2. What kinds of support facilitated students’ transformation?

**2. Methods**

A qualitative, multiple case study approach is used for the constructivism or investigation. Case study is a kind of research method that is useful to learn about an individual’s thought processes or experience within a natural setting (Simons, 1996).

**2.1 Samples**

This study made use of convenience criterion-based selection sampling technique, a
non-probability approach, comprising of four participants, who shall all remain anonymous in fulfillment of ethical consideration. Due to the constraint in length of this paper, I would only discuss the cases of Colin and Diane. They had a median age of 19 and studied a two-year sub-degree programme majoring in either design or social sciences. Both of them were enrolled in a fourteen-week general elective subject on media literacy working on the same video task. At the time of data collection, the first batch of graduates of Hong Kong Diploma of Secondary Education (HKDSE) that is equivalent to form seven of the old senior secondary academic structure were studying their first or second year at associate degree level alongside with their counterparts attaining other qualifications such as the Hong Kong Advanced Level Examination and pre-associate degree. This data collection period was significant because different qualifications of students studying in the same cohort only lasted for about two years.

2.2 Stages of Research
This research involves four phases (see appendix 1), Participant Selection, Pre-Interview, Post-Interview, and Data Analysis.

In the third week of a fourteen-week semester, students within a tutorial class, normally consisting of 25 people, were asked by their lecturer to form several groups of four to six persons to work together on a video task assigned to them. After the groups were formed and had learnt the details about the video assignment, the lecturer identified one specific group that was able to meet all the sampling criteria.

Colin, Diane and their group members were identified and later decided on the topic of gay marriage for their video task. Dilemmas, unlike story-based problems with clearly-defined scope and predictable answers most of the time are often used by schools to challenge their students and this type of nurturing may pose greater challenges at work where problems rarely appear structured, often requiring multiple answers or some time could not even be resolved (Jonassen, 2000). Toward the end of the semester, Colin and Diane had to submit their video and a short report providing explanations to points relating to their video such as its target audience, the choice of content elements, and the kind of message intended to their lecturer.

In the following weeks, Colin and Diane were invited by me to take turns within a
two-minute timeframe to explain their positions or perspectives on the chosen controversial social issue in the absence of each other. Concurrently after explaining, each student was shown a set of three photographs using ‘eye trick’. Through the use of “learning object” like this kind or what (Churchill, 2006) would specifically refer to as “simulation object,” it is possible to study the states of exposure individuals experience when reading media messages. During this activity, each participant had to answer which one of three plates contains the most food (see figure 2). They were required to talk-aloud or verbalize their thoughts within two minutes while seeing the photographs. Any participant who remained quiet for more than 15 seconds was asked to keep on talking.

![Figure 2 Which Plate Contains the Most Food?](image)

As participants talked aloud, as an observer and facilitator only in giving out instructions, I rated each comment by assigning a corresponding state of exposure denoted by 1(automatic), 2(attentional), 3(transported), or 4(self-reflexive) respectively. Think aloud enables participants to verbally express their inner heartfelt and unbounded understanding (Aranyi, van Schaik, & Barker, 2012; Sainsbury, 2003). This, according to Ericsson (2002), is simply to say out all the things that come into mind and this is similar to when a person resolves the same problem quietly.

From the period they started working on their video assignment up to their submission deadline, different types of support like biweekly progress reports, a Chinese newspaper article analysis, a list of critical considerations on video-making, and media log sheet were rendered to Colin and Diane by me. After they have completed their video task in week fourteenth, another meeting was arranged by me to isolate Colin and Diane from each other in order to explain their new positions or perspectives if any on the chosen controversial social issue within two minutes. Each of them
was asked to think aloud in two minutes through a set of three given photographs (see figure 3) showing the same object but taken at different angles as well. The main goal of this activity was to let participants guess what the object was. As they talked aloud, I rated each comment by assigning a corresponding state-of-exposure just like in phase two.

![Figure 3. What is the Object?](image)

Finally, all audio or video recordings of the pre-interview, think aloud and post-interview sessions were being transcribed and studied. The students’ video, media log sheet and written report were being analyzed as well. The main goal of this particular phase was to determine the contributing factors and the correlation, if any, between the augmentation of attentional or self-reflexive states-of-exposure and a video-making task. All the participants’ comments and their respective states-of-exposure were triangulated by two other lecturers who taught the same media course. Triangulation is about balancing and empowering the inquiry that on one hand this method can ensure data validity and on the other hand, it helps to avoid biases and subjectivity (Bekhet & Zauszniewski, 2012; Maggs-Rapport, 2000).

3. Results
Comparisons are first made between individuals’ initial and/or new positions and perspectives on a chosen controversial social issue, and then between the two think aloud activities.

3.1 Student One: Colin
Colin participated in this research when he was still pursuing his final year of study in applied social sciences majoring in social welfare. He was a HKDSE graduate. Colin was born in
Hong Kong and has never lived or studied in another country. When asked to rate his own computing and video-editing skills, he concurred that both were at an intermediate level.

Table 1 Sum of Counts for Each Think Aloud Activity in ALL the States (Colin)

<table>
<thead>
<tr>
<th></th>
<th>Self-reflexive (4)</th>
<th>Attentional (2)</th>
<th>Transported (3)</th>
<th>Automatic (1)</th>
<th>Sum of (2) &amp; (4) Counts</th>
<th>Sum of (1) &amp; (3) Counts</th>
<th>Sum of Counts</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre-Stance</td>
<td>4</td>
<td>5</td>
<td>0</td>
<td>2</td>
<td>9</td>
<td>2</td>
<td>11</td>
</tr>
<tr>
<td>Post-Stance</td>
<td>1</td>
<td>3</td>
<td>5</td>
<td>1</td>
<td>4</td>
<td>6</td>
<td>10</td>
</tr>
<tr>
<td>Pre-Test</td>
<td>0</td>
<td>3</td>
<td>1</td>
<td>1</td>
<td>3</td>
<td>2</td>
<td>5</td>
</tr>
<tr>
<td>Post-Test</td>
<td>1</td>
<td>6</td>
<td>1</td>
<td>10</td>
<td>7</td>
<td>11</td>
<td>18</td>
</tr>
</tbody>
</table>

Although Colin’s overall total number of counts for his ‘pre-stance’ and ‘post-stance’ remained almost the same, there were distinct differences among the individual state (see table 1). Colin exhibited a high level of assessment when evaluating the topic on gay marriage as indicated from his self-reflexive state particularly in ‘pre-stance’.

“In terms of human rights, they [gay people] should have equal opportunity to get married.”

As such, Colin’s attentional state in ‘pre-stance’ also recorded more counts probably due to his increased thinking and familiarity of the controversial social issue.

“Gay love is a kind of sexual orientation and they are no different from other people.”

The transported state saw a larger total number of counts in ‘post-stance’ as compared to ‘pre-stance. Many of his comments in this state were recollection of his acting experience for the video.

“When filming, I was one of the actors. There were many people looking at us. Some of them were laughing as though they were watching a movie.”
Colin performed much better in his ‘post-test’ than ‘pre-test’. There was even a comment related to the self-reflexive state.

“I don’t need it [the shown object] but I appreciate the innovative idea of Japanese.”

His automatic state was also much higher in the same test which probably meant that he was spending a lot of time considering various aspects directly connected to the given object.

“There’s also a band for handheld carry. I see the tip of the tube has holes.”

Needless to say, as discussed earlier the augmented amount of efforts made in figuring out what the given object was has resulted in more counts appearing in the attentional state of his ‘post-test’.

“I think it is medical equipment and it can be extended or retracted.”

Ultimately, the wide gap for the sum of counts in all the states between these two tests explained that the level of information processing was higher for Colin’s ‘post-test’ in which he committed more mental resources in doing so.

### 3.2 Student Two: Diane

Different from Colin, Diane was a first-year student. Before that, she had completed her pre-associate degree. As a current student of an associate degree in product design, she rated the level of her own computing skills as intermediate whereas her video-editing skills as basic. She was born in Hong Kong and has never lived or studied in another country.

#### Table 2 Sum of Counts for Each Think Aloud Activity in ALL the States (Diane)

<table>
<thead>
<tr>
<th></th>
<th>Self-reflexive (4)</th>
<th>Attentional (2)</th>
<th>Transposed (3)</th>
<th>Automatic (1)</th>
<th>Sum of (2) &amp; (4) Counts</th>
<th>Sum of (1) &amp; (3) Counts</th>
<th>Sum of Counts</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre-Stance</td>
<td>2</td>
<td>3</td>
<td>0</td>
<td>2</td>
<td>5</td>
<td>2</td>
<td>7</td>
</tr>
<tr>
<td>Post-Stance</td>
<td>0</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>4</td>
<td>6</td>
</tr>
</tbody>
</table>
By examining Diane’s ‘pre-stance’ and ‘post-stance’, there was not so much of a difference as seen in the number of counts in her automatic and attentional states (see table 2). The stark disparities were found in her self-reflexive and transported states in these two stages. There were two comments made concerning the self-reflexive state in Diane’s ‘pre-stance’ which might reflect that she had some prior knowledge on the topic of gay marriage. One of those comments reads as follows:

“If the society continuously exerts constraints on a person’s since birth to school, it limits progress and suppresses human emotions.”

Her original position on gay marriage might have been enhanced or altered after the video task and implementation of support. It was possible too she might be unwilling to repeat the same pieces of information in the self-reflexive state of her ‘post-stance’. However, this was unlikely as she recalled and stated in the transported state of ‘post-stance’ that heightened contact with external sources was one of the reasons to explain the shift.

“It’s because of exposure to more resource materials, I understand more about the issue.”

Diane’s exposure in ‘pre-stance’ and ‘post-stance’ could be described as her relying either more on knowledge indicated by a higher sum of attentional and self-reflexive states in the earlier stage or experience demonstrated by a higher sum of automatic and transported states in the latter stage.

Diane also showed improvement in her overall states-of-exposure after the video task though there was no count recorded for her self-reflexive state. The number of counts in her attentional state of ‘post-test’ was two times more than ‘pre-test’.

“I think it’s a tool for experiment for testing sodium oxide. If I focus on it, it’s for curling eye lashes.”

Diane’s only count for her transported state in ‘post-test’ might be resulted from her understanding of people and culture after being told what the object was.

“Only Japanese and Taiwanese people will have the habit.”

The total number of counts in the automatic state of Diane’s ‘pre-test’ and ‘post-test’ were

<table>
<thead>
<tr>
<th>Pre-Test</th>
<th>0</th>
<th>3</th>
<th>0</th>
<th>4</th>
<th>3</th>
<th>4</th>
<th>7</th>
</tr>
</thead>
<tbody>
<tr>
<td>Post-Test</td>
<td>0</td>
<td>6</td>
<td>1</td>
<td>5</td>
<td>6</td>
<td>6</td>
<td>12</td>
</tr>
</tbody>
</table>
almost similar. It also meant that the degree in which she was not processing or thinking about information varied inconsiderably

4. Discussion

Till now, each case has been treated as an independent variable. If all the cases show an augmented attentional and/or self-reflexive state-of-exposure in their ‘post-test’, it can be deduced that support through resolving dilemma-typed of problem with a video-making task has successfully transformed students’ states-of-exposure or according to Yin (2014), “literal replication” is being achieved in this instance as the “the overall pattern of results” matches with the research assumption.

4.1 Pre-stance vs. Post-stance

By comparing the total number of counts for Colin’s and Diane’s ‘pre-stance’ and ‘post-stance’ on gay marriage, it is evident there is no significant variation. Both students had no prior contact with gays or lesbians and this is likely why their transported state for ‘pre-stance’ is also zero. In the same state of ‘post-stance’, both students, with Colin recorded higher number of counts, recounted experiences involving in the video making either in the actual filming or researching processes. In tandem, it proves the efficacy of a video-making task in affecting a person’s thinking process and possibly constructing or contributing to his or her augmented attentional and/or self-reflexive state-of-exposure in the later ‘post-test’.

Referring to their automatic and attentional states-of-exposure, the differences remain relatively small or unchanged for ‘pre-stance’ and ‘post-stance’ on gay marriage. As we are seeking for opinions on a controversial social issue here, it is predictive that a person will be feeling either strongly, moderately or neutrally about it depending on a consumer’s cultural, educational, family backgrounds and so on and so forth (Gainer, 2010).

This also helps to explain in either or both their ‘pre-stance’ and ‘post-stance’, Colin and Diane exhibits the self-reflexive state-of-exposure as shown in tables 1 and 2. Colin was a student who had already majored in social sciences for nearly four semesters in his two-year associate degree level and therefore it is fair and fitting to acknowledge that he should have opportunities to be exposed or even to confab and evaluate various controversial and noncontroversial social issues during his studies. Similarly, Diane could provide
self-reflexive state of responses was a result of completing subjects such as ‘gender issues’ and ‘popular culture’ during her one-year pre-associate degree although she was an associate degree in design student at the time when data was collected. At the same time, it is overt that majoring or more exposures to social sciences issues the related knowledge is deeply rooted in Colin as he even made one comment showing the self-reflexive state in his ‘post-stance’ versus Diane’s zero count for the same state.

Although the states-of-exposure of an individual in ‘pre-stance’ and ‘post-stance’ which were subjected likely to one’s biases (Gainer, 2010) could not accurately reflect critical media literacy, the pertinent role of these two stages could neither be undermined as they did assist in developing improved or critical media literacy among Colin and Diane. Vraga & Tully (2015) said, “If students receive media literacy education in their classrooms, small ‘injections’ of media literacy in their lives could help these individuals apply critical thinking skills more regularly, thus extending the effectiveness of their education.” Support or “the provision of frameworks and ladders” rendered to younger learners is essential in critical media literacy education (Cheng, 2009). Thus, relationship between the need for more recursive and multilayered activities, and critical media literacy is fundamentally inseparable.

### 4.2 Pre-test vs. Post-test

For both students, the number of counts for their automatic state in ‘post-test’ is higher than ‘pre-test’. Students’ willingness, Colin in particular, to verbalize more direct, simple and straightforward statements also demonstrates that more mental resources are devoted on route to make sense of the given ‘learning object’. It is perfectly normal for participants during think aloud to express every single step or inner thought until a given question is answered (Ericsson, 2002). Apparently, past memories did not affect Colin and Diane hugely as shown in their transported state of ‘pre-test’ and ‘post-test’.

Hence, their attentional and self-reflexive states will determine whether students can develop critical media literacy after the video-making task. Although not far-reaching enough, Colin provided one self-reflexive state-related comment and it was certain that he was once not only exposed, attending and aware of when reading the given ‘learning object’ in his ‘post-test’, and also he was possibly consciously or fully-involved in information processing. Colin’s self-reflexive-related response after being told the function of the object reads, “I
don’t need it but I appreciate the innovative idea of Japanese.” As a complete sentence comprises of various clauses of ideas linking together, it would be inaccurate and invalid to break it up into parts when analyzing. Use of the conjunction ‘but’ in Colin’s statement shows that a comparison was made. The background or basis of his comment, as such, stems from that he will not purchase the product which is clearly indicated in the preceding clause before the conjunction. However, he has another consideration on top of that when exposed to the given ‘learning object’. Then, the key idea of Colin’s statement which could be said to contain in the succeeding self-opinion “…I appreciate the innovative idea of Japanese” following the conjunction which was likely caused by him noticing the word ‘Panasonic’ printed on the product at the early stage of the ‘post-test’. As the researcher and the other two lecturers who helped in data triangulation unanimously observed and agreed, if Colin would only opine “…the innovative idea of Japanese,” this particular idea would be similar to the comment “Only Japanese and Taiwanese people will have the habit” made by Diane in the same test which displays solely the transported state as both quotations contain parts of a recollection of past experiences or memories. The phrase “…I appreciate” tells that Colin not only saw somewhere and even learnt that Japanese people and/or their products are innovative and he also welcomed their creative or constructive contributions to the well-being of mankind. This means that Colin was able to analyze self-reflexively both above and beyond the given media message itself and considered a point which was associated but not only in direct relation to the ‘learning object’ in his ‘post-test’.

As for their attentional states, there are supporting evidences that the two students did acquire augmented critical media literacy after the video-making task. A difference of three counts is consistent among Colin and Diane.

4.3 Media Literacy Redefined
From the results gathered in this study, it proves the efficacy of a video-making task in resolving dilemma-typed of problem affected participants’ thinking processes and constructed or contributed later to the augmented attentional and/or self-reflexive state-of-exposure in their ‘post-test’. Evidently, all students recounted instances of their involvement in acting, filming, producing, or researching for the video-making task in the transported state of their ‘post-stance’.
Whether it is the writing of media log sheet and biweekly progress reports, analyzing a newspaper article, or deliberating on the critical considerations on video-making, the interplay of all these forms of support in leading up to an individual’s augmented attentional and/or self-reflexive state-of-exposure can be said, as such, is closely dependent on one another or tightly interwoven. Both students have acquired critical media literacy which fundamentally aligns with the understanding of media literacy as the ability to access, analyze, evaluate and create contents (Center for Media Literacy, n.d.; National Association for Media Literacy Education, n.d.; Ofcom, n.d.) after their video-making task. Cambridge Dictionary defined the words ‘analyze’ is “to study or examine…” and ‘evaluate’ is “to judge or calculate…” (Cambridge University Press, 2017).

What is lacking insofar as in this understanding of media literacy is criticalness when exposed to media messages. Potter (2009) highlighted, “The process of making good meaning constructions begins with assessing the amount of information one has to address the immediate task of meaning.” One more step on ‘assess’ is hereby suggested to be included in the conventional definition of ‘media literacy’ in order to properly and sufficiently defines the term ‘critical media literacy’. ‘Assess’ is “to judge or decide…” (Cambridge University Press, 2017). For instance, making decisions hypothetically or on which heuristics or shortcuts to use that can best reflect a current state is part of the media exposure process (Potter, 2009). Judging from the results drawn from this research, ‘critical media literacy’ is therefore being defined as a person’s ability to access, analyze, assess, evaluate, and create when exposed to media messages.

5. Conclusion
All the questions set forth in the beginning of this paper have been answered.

5.1 Implication & Recommendation
Media instructors who look to nurture critical ability among their course participants can replicate the teaching and learning tactics or strategies introduced in this explanatory study. They can ask students to make a video to resolve dilemma-typed of problem and in the process, render them with the relevant support such as the writing of media log sheet and biweekly progress report, analyzing a newspaper article, or reflecting on the critical
considerations on video-making. Evidently, Colin and Diane who have experienced similar pedagogies attained augmented attentional and/or self-reflexive states-of-exposure.

As observed earlier, critical media literacy or higher-order thinking is not likely to be constructed only through the completion of one video-making task. Such a teaching practice would be effective and productive if it is implemented regularly and also widely. Thus, it is recommended that such video-making task can be applied extensively and should not be constrained only to the learning of media but should also be inclusive of learning other subjects as well.

In sum, this paper could aptly contribute to the field of educational enhancement and expansion by providing schools, teachers, scholars, researchers, as well as policy makers alike specific didactics or instructional guidance, methods, pedagogies, or strategies in developing higher-order or self-reflexive thinking among their stakeholders.

5.2 Limitations

There are several limitations to this research. First, the small sample size in this research may not be able to provide a generalizable or holistic view that a video-making task could develop augmented critical media literacy when applying the same exploratory study on a larger population. Second, there were only one male and one female who participated in this research and it lacks the quantity to determine if gender difference is a factor which will or will not affect the development of critical media literacy. Third, other controversial social issues or dilemma-typed of problems could be investigated as the perception on each topic varies among individuals and may be influenced by numerous personal factors, and in turn may affect the outcome of critical media literacy education. The final point is that this research is conducted solely in the context of Hong Kong. Therefore, the results in this study may or may not be applicable to other parts of the world. Thus, it will be beneficial to explore if the research methodology introduced in this paper will yield similar results elsewhere.
RESEARCH DESIGN FRAMEWORK

DATA COLLECTION

3RD WEEK

5TH WEEK

14TH WEEK

OTHER WEEKS

PARTICIPANT SELECTION (Phase 1)

PRE-INTERVIEW (Phase 2)

POST-INTERVIEW (Phase 3)

DATA ANALYSIS (Phase 4)

Select 2 participants between 18-20 years old currently studying associate degree & an elective subject on media literacy working together on a video-making task as cases. Participants to sign ethics clearance & acceptance form. The interviewees will be informed that the research is an independent study & as a result will not have any conflict-of-interest on their academic performance.

Each participant will be interviewed to check basic background & level of computer literacy. They will be given 10-minute to decide on a controversial social issue for their video-making task. After which, they will be asked to construct & explain their storyboard. Each participant will then explain within 2-minute his/her position(s) toward the issue & use another 2-minute to talk-aloud while exposed to a set of 3 photographs. The whole session will be recorded in both audio & video formats.

Shown the list of reflective questions & be given media log sheet, brochur progress report & newspaper article analysis.

Participants will report as a group the following:
1. Their current position(s) on the chosen theme;
2. Factors contributed to a change in position(s) if any;
3. The research processes involved;
4. The value or lessons learnt from the video project and etc.
Each participant will then explain within 2-minute his/her position(s) toward the issue & use another 2-minute to talk-aloud while exposed to another set of 3 photographs. All the sessions will be recorded in both audio & video formats.

Audio or video files i.e. the pre-interview & post-interview sessions will be transcribed and studied. Data including the students’ video, media log sheet and written reports are being analyzed as well to determine the significant aspects & the correlation, if any, between the augmented attentional and/or self-reflexive states, and a video-making task.
Acknowledgements:
This paper is based on the work of a doctorate degree study in Education at the University of Hong Kong. I am grateful to my supervisor, Dr. Daniel Churchill, for his continuous support and insightful guidance. My appreciation also goes to my College and two former colleagues who have assisted in data triangulation.

References


101-111.
Kingdom: Cambridge University Press.
Students' perception of MOOCs in National University of Mongolia: a survey study

Otgontsetseg Sukhbaatar¹, Zorig Badarch², Lodoiravsal Choimaa³, Tsuyoshi Usagawa⁴

Abstract

Massive Open Online Course (MOOC) is the most attractive recent developments in education, which offers new learning opportunities to deliver learning content online to anyone, no limit on attendance. There is ongoing debate about its educational value and significance. This study is to assess the awareness, perception and experience of using MOOCs among undergraduate students of National University of Mongolia. We employed quantitative methodology using a web-based survey, which covers 35% (5921) of the total undergraduate students of the university. In this paper, we will present findings of the survey, including the state of knowledge, attitude toward MOOC, as well as the barriers for enrollment and completion of the course.

Keywords: e-learning, National University of Mongolia, perception of MOOC

1. Introduction

With an increased availability and usage of Information and Communication Technologies (ICT), e-learning became a popular delivery method for education in teaching and learning activities. ICT integration plays important role in higher education, since effective use of the technology in delivering the curriculum has obvious improvements and benefits in daily activities at universities. An emergence of notable Massive Open Online Course (MOOC) providers like Udacity, Coursera and edX in 2012, many universities around the world started developing MOOCs, moreover, their own MOOC platforms. MOOC is an online free course which is available for anyone.

Over last few years, MOOCs have been popular topic in educational institutions with ongoing studies and discussions over MOOCs significance and academic value in higher education. Abeer and Miri evaluated students’ preferences through qualitative methodology, survey and interviews after experience of using MOOC (Abeer & Miri, 2014). Many researchers looking deeper on motivations for MOOC enrollment, their impact on the engagement, retention and completion of MOOCs (Anderson et al., 2014; Murray, 2014; Wang & Baker, 2015; Hone & Said, 2016). Blended learning experiment using MOOC as

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learning resource, introduced categorization scheme for the couplings between in-class and online components (Bruff et al., 2013).

MOOCs are proclaimed as a solution for providing high quality education for developing countries, like Mongolia. However, the portion of MOOC participants from developing countries is low, even number of MOOCs are increasing rapidly. This might be due to many reasons, such as lack of awareness of MOOC concept, ICT literacy or language barrier. Students’ MOOC experience of medical schools in Egypt have been investigated and one-fifth of the students have heard about MOOC (Aboshady et al., 2015). And other study showed that majority of the students think MOOC is not a good source of information and is not of the same quality with traditional on-campus courses (Cole & Timmerman, 2015).

The purpose of this study is to examine the state of knowledge, perception and experience toward MOOCs among undergraduate students of National University of Mongolia (NUM). Motivation for enrollment, completion limitations, as well as, future preference for enrollment has been included.

2. Background
While e-learning technology introduced relatively late in Mongolian universities, they didn’t pass over the movement toward e-learning. NUM was named one of three non-American universities, which applied blended learning using edX courses in 2014 (Agarwal, 2014). From 2012, School of Engineering and Applied Sciences (SEAS) of NUM penetrated blended, credit-eligible courses into the curriculum using Small Private Online Courses (SPOC) from edX. This pilot study showed reduced course drop rate, increased engagement and better success rate compared to average course outcome in that semester. Results from the study identified that students’ learning style and self-sustainability affects e-learning effectiveness considerably (Sukhbaatar & Choimaa, 2015). There were less issues in terms of IT literacy, hence students were from engineering faculty. The courses were offered as selective, therefore, it most likely attracted students with better self-studying and language skills. Therefore, it was crucial to evaluate e-learning readiness to successfully implement e-learning in faculty scale. In 2013, the authors conducted a study to evaluate e-learning readiness of NUM with 400 participating students, which showed that it’s important to consider students’ independent learning, self-management skills rather than technical requirements (Sukhbaatar et al., 2014). In a meanwhile, another pilot study started in SEAS, where 7 undergraduate courses were splitted into 2 control groups in order to compare flipped classroom model with traditional classroom learning (Sukhbaatar et al., 2016).

3. Methodology
In this study, data collection method using web-based self-administered questionnaire was employed.
3.1. Questionnaire
In the survey, we used 13-item questionnaire, which consists of 9 items with 5-point Likert-type scale responses (“strongly agree”, “agree”, “neutral”, “disagree” and “strongly disagree”) and 4 items with selected response for gathering detailed information. The questionnaire was developed through literature review and built with changes according to the students’ circumstances in Mongolia. Questionnaire items were prepared in Mongolian and interpreted as easy as possible to help the respondents to understand clearly what was being asked. MOOC experience questioned in basic level, where state of knowledge, usage and limitation reasons were considered.

3.2. Study population
A total of 6119 students, which is 35% of undergraduate students of National University of Mongolia (NUM) involved in the survey. Survey took a place in December 2016. Questionnaire is asked to be filled to all students, who were logged into the university’s information system. Through data validation, 198 students’ cases were eliminated due to biased response making total population of the study to 5921.

4. Result
Statistical analysis was performed using the R studio, version 1.0.136.
The survey included 2297 (38.8%) male respondents and 3624 (61.2%) female respondents. 3023 (51.1%) respondents were freshmen and number of sophomores, juniors, seniors and fifth-years were 1072 (18.1%), 939 (15.9%), 837 (14.1%) and 50 (0.8%), respectively. All faculties of NUM has been involved in the survey, including 5 component schools in Ulaanbaatar city and two branch schools in Zavkhan and Orkhon province. Participants’ demographics shows that students lack of awareness about MOOC, where 3112 (52.6%) students didn’t know what MOOC is. 2809 (47.4%) of the

<table>
<thead>
<tr>
<th>Faculty</th>
<th>Portion of participated students</th>
<th>Aware of a MOOC</th>
<th>Enrollment in MOOCs</th>
<th>Completion of a MOOC</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total</td>
<td>5921 (100%)</td>
<td>2809 (47.4%)</td>
<td>2178 (36.8%)</td>
<td>1684 (28.4%)</td>
</tr>
<tr>
<td>Faculty</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Engineering and Applied Sciences</td>
<td>1406 (23.7%)</td>
<td>724 (51.5%)</td>
<td>585 (41.6%)</td>
<td>479 (34.1%)</td>
</tr>
<tr>
<td>Arts and Sciences</td>
<td>2382 (40.2%)</td>
<td>1062 (44.6%)</td>
<td>818 (34.3%)</td>
<td>615 (25.8%)</td>
</tr>
<tr>
<td>Law</td>
<td>450 (7.6%)</td>
<td>222 (49.3%)</td>
<td>166 (36.9%)</td>
<td>128 (28.4%)</td>
</tr>
<tr>
<td>Int’l Relations, Public</td>
<td>282 (4.8%)</td>
<td>142 (49.3%)</td>
<td>100 (36.9%)</td>
<td>64 (22.7%)</td>
</tr>
</tbody>
</table>
Table 2. MOOC enrollment motives (N=2178)

<table>
<thead>
<tr>
<th>Reason</th>
<th>Fraction</th>
</tr>
</thead>
<tbody>
<tr>
<td>Instructor asked to enroll the course</td>
<td>426 (20%)</td>
</tr>
<tr>
<td>Curiosity</td>
<td>904 (42%)</td>
</tr>
<tr>
<td>Advance of professional skills</td>
<td>352 (16%)</td>
</tr>
<tr>
<td>Enhance knowledge of related subject</td>
<td>415 (19%)</td>
</tr>
<tr>
<td>Other</td>
<td>81 (4%)</td>
</tr>
</tbody>
</table>

students were aware of MOOC and 77.5% (2178) of them had tried at least one course. It was quite impressive to see that 77.3% (1684) of the enrolled students completed at least one MOOC, despite covering one-fourth of the total participated students. Corresponding students numbers for different faculty, student-year and gender are shown in Table 1. Table 2 shows reasons for enrolling to MOOCs at first place covering 2178 students, which had a prior knowledge of MOOC. 904 students (42%) tried MOOCs out of curiosity, which
was identified as the main reason. About the half (45%) of the students have taken 1-2 MOOCs which can be reasonable where the main reason is identified as ‘curiosity’. 13% of the students claimed that they tried more than 5 MOOCs.

The overall attitude toward MOOC for all respondents shown in Figure 1, where responses were classified to agree, neutral and disagree. Majority of the students think that MOOC is good source of knowledge (60%) and had a positive influence in their learning experience (64%). Majority of the students (4283, 72%) want to enroll and use, if the university implements a MOOC. 2589 (44%) students think that MOOCs are equal quality with on-campus courses, where 1033(17%) students answered that they don’t agree with the statement. Notably, great number of students didn’t know whether MOOC is same as for-credit on-campus courses (2299, 39%), or even reliable (2411, 41%). Moreover, 2573 (43%) students think that MOOCs are not convenient to use and lack of face-to-face communication.

Figure 1. Students’ attitude toward MOOC (N=5921)

Figure 2. MOOC enrollment limitations (N=631)
interaction. Figure 2 shows MOOC enrollment limitations in case of 631 students, who didn’t use any MOOC even though had a knowledge about it. Majority of the students didn’t use MOOC due to preference of physical classroom, lack of spare time and no face-to-face interaction. On the other hand, barriers for MOOC completion has been investigated and main reasons were identified as time management difficulty and overload at university study as shown in Figure 3. Authors didn’t include accessibility barriers, because 74.6% (4415) of the students does have a computer with internet connection at home.

5. Conclusion

We have taken an initial step toward gathering evidence about the students’ perception and experience of using MOOCs in Mongolia. Findings from this study clearly show that students don’t have enough knowledge about MOOC, it’s operation, educational opportunity and benefits. Half of the responding students have heard about MOOC and only one-third had an actual experience of using MOOC. Remaining students reported that they didn’t choose to use MOOC due to preference for physical classroom learning and lack of spare time. But in addition, it can be a language barrier for undergraduate students, since all major MOOC providers’ courses are in English.

The majority of the students think that MOOCs are reliable source of information and, if university implements one, they’re willing to enroll the course. However, more effort is needed to raise an awareness of the courses among students.

Acknowledgement

Part of this work was supported by JSPS KAKENHI Grant-in-Aid for Scientific Research 25280124 and 15H02795. The authors would like to thank the Students Affairs Office and Center for Management of Information Technology of National University of Mongolia, for the assistance in the survey conduction.
References


The Development of Hybrid Instructional System to Enhance Code of Ethics in Line with Teachers Professional Standards for The Faculty of Education Students

Uthit Bamroongcheep¹, Pakwipar Phosri²

Abstract

The purposes of this research were: 1) to developed hybrid instructional system to enhance code of ethics in line with teachers professional standards for the Faculty of education students 2) to compare code of ethics in line with teachers professional standards between before and after learning activities by using the hybrid instructional system. 3) to compare the pretest and the posttest learning achievement score, and 4) to study the Faculty of education students satisfaction toward learning activities by using the hybrid instructional system that constructed by researcher.

There were 2 groups of populations. The first group consisted of 10 educational technologist experts, selected by the purposive sampling technique. The second group were 280 students who enrolled in the 400102 Principles of Teaching Profession course, second semester of 2015 academic year, Faculty of Education, Burapha University. The subjects for the experiment phases was 30 students who were selected by simple random sampling. Data were analyzed using mean, standard deviation, and dependent samples t-test.

Results of the research were shown as follows: of hybrid instructional system to enhance code of ethics in line with teachers professional standards for the Faculty of education students should be included of the 5 zones components (analyze zone, teaching technique zone, SAENSOOK hybrid learning zone, communication & experience zone, evaluation zone and reflection zone) which are the 8 principal components SAENSOOK (S:Setting ideas and select problem topic, A: Analyze and access learning resources, E: Experience co-creation and experiment, N: New idea checklist, S: Storing and classified information, O:Opinion building and sharing knowledge, O: Outcome presentation, and K: Knowledge evaluation). The efficiency of the hybrid instructional system was 91.22/92.05 which follows the criteria. The specialists’

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opinions about the components of the hybrid instructional system are in the level of “very much” (\( \bar{X} = 4.53, SD = 0.58 \)). It was found that the posttest score was higher than the pretest score at .05 level of significance. After learning from the hybrid instructional system the students code of ethics in line with teachers professional standards score was higher than before learning at .05 level of significance. The subjects’ satisfaction toward the hybrid instructional system was at “high” level.

**Keywords:** Hybrid Instructional System, Code of Ethics, Teachers Professional Standards

### 1. Introduction

In Thailand, education is considered a fundamental factor of human resources development and a mechanism for developing the Thai economy and society. Educational Innovation and Technology with the role and importance of educational management in the 21st century. Additionally, 21st century tools allow teachers to communicate effectively with parents and provide teachers with the ability to give education students immediate feedback about how they’re performing. The policies and plans at all levels to focus on the production and development of a good teachers, talent teachers, quality teachers and code of ethic teachers. Furthermore, the teachers must have the competency and capability of technology applications in teaching and learning which the part of Thai people development to good, talent and happiness person. But the problems of the teachers in Thailand is currently facing several problems, including the development of teachers. Those who do not mind a teacher development system and produce effective teachers continued and the lack of care and attention to seriously disrupt the teacher has not been developed systematically. Furthermore, ICT studies have shown that lack of knowledge in educational technology for application and deploy used in the process of teaching and learning in Thailand was less level. (Office of the Education Council, 2010) \[13\]. The Suan Dusit Poll indexed teacher that Thailand (Sukoom Chalaisub, 2007) \[19\] would be the year 2006 by a survey of people of all professions across the country found that the characteristics of the teacher that Thailand needs is ranked first teacher was a code of conduct in the teacher, the second are those who are knowledgeable and attentive Faculty of Education students ranked third.

Thus, must have the role of the teacher production. Preferably with the development of teaching and learning using a variety of techniques appropriate to the era in 21st century. In addition Rabah J.(2015) \[18\] suggests that the benefits and challenges of ICT integration is a powerful and flexible tool for learning.
Which the teaching of the use of learning resources on the internet to design and create an environment to learn in different ways, with a variety that can be adapted for use blended learning with traditional face-to-face classroom. Which are gaining popularity today is the "Hybrid Instructional System". The hybrid instructional system is combining face-to-face and online education activities, some performed synchronously, some asynchronously. As such, blended learning provides the flexibility to address a broad range of curricular and institutional needs, opportunities, and goals. (Diaz and Brown, 2010). [5] In addition, proportion of content delivered online 30 to 79 percent. (Boettcher, Judith V. 2010) [3] According related to the roadmap for teacher and educational personnel development of Thailand 2013 – 2015. (Office of the Education Council, 2012). [14] Moreover, the features and components that associated with hybrid learning environment are interactive, open system, online search, global accessible, online resource, electronic publishing, self learner contained, collaborative learning combining face-to-face activities.

All of these are the reasons of the researcher who has the objectives in studying 1) to construct and develop hybrid instructional system to enhance code of ethics in line with teachers professional standards for the Faculty of Education students, 2) to compare pretest and posttest of ethics in line with teachers professional standards and learning achievement of the Faculty of Education Faculty of Education students 3) to study the Faculty of Education students satisfaction toward the hybrid instructional system. The result of researching is the way to develop the hybrid instructional system style in Thailand and teacher development for the reform of teacher profession to the high class career and new generation in 21st century teachers characteristics.

2. Literature review

2.1 The teachers professional standards

The Ministry of Education has played major roles in this regard, providing supervisory and co-coordinating functions so that the institutions responsible for production and development of teachers, faculty staff, and educational personnel shall be ready and capable of preparing new staff and continually developing in-service personnel, including sufficient funds allocated by the State for the budget required for development of teachers, staff, and educational personnel. The Secretariat Office of the Teachers’ Council of Thailand is an organization for teachers, educational institution administrators, and educational administrators that has the power and duty for setting professional standards; issuance and withdrawal of licenses; overseeing the maintenance of professional standards and ethics; and developing the profession of teachers, educational institution administrators, and educational administrators. Then, teachers, administrators of educational institutions, educational administrators and other educational personnel of both the state and private sectors shall have professional licenses as provided by the law. The Teachers’ Council of Thailand was incorporated with the principal objective to determine professional standards, issue and
revoke licenses, supervise and monitor compliance with the profession standards and code of ethics, including professional development, so that education professional practitioners, (those who are licensed to practice the teaching profession, educational institution administrators, educational administrators and other educational personnel such as educational supervisors) shall have knowledge and understanding in the practice of the education profession which is a licensed profession under the National Educational Act.

(i) Standard of Conduct or code of ethics in line with teachers professional standards --

There are 4 main standards required for teachers. (Secretariat Office of the Teachers’ Council of Thailand, 2013) [15].

(ii) Standards of Teachers’ Knowledge -- A teacher must have minimum qualifications with a Bachelor’s degree in education or the equivalent or other degrees as accredited by the Teachers’ Council of Thailand, with knowledge in the following areas: language and technology for teachers, curriculum development, learning management, psychology for teachers, educational measurement and evaluation, classroom management, educational research, educational innovation and information technology, and teacher ship.

(iii) Standards of Teachers’ Experience -- A teacher is required to have completed teaching functions in educational institutions under an educational degree curriculum for a minimum of one year and passed the criteria for evaluation of the teaching functions in accordance with the rules, procedures, and conditions as set by the Teachers’ Council of Thailand Board as follows:

2.1 Training on professional practice during study.
2.2 Teaching functions in educational institutions on specific subjects.

(iv) Standards of Teachers’ Performance

(v) Standards of Conduct

- A teacher is required to adhere to the following standards of conduct: Personal ethics- Professional educators must always have self-discipline, self-development in the profession, personality and vision to keep abreast of educational, economic, social and political developments.
- Professional ethics: Professional educators must have love, faith, honest and responsibility for the profession and must be an upstanding member of the professional organization.
- Client ethics-- Professional educators must treat students and service end-users equally with love, compassion, concern, help, and support; professional educators must promote the creation of learning, skills, and good habits to students and service end-users in tandem with the role and duty to the fullest potential and with sincerity; Professional educators must behave and be a role model physically, verbally and psychologically; Professional educators must not act with antagonism regarding the physical, mental, psychological, emotional and social growth of students and service end-users; Professional educators must equally and
sincerely give services without requesting or accepting benefits through the abuse of title and position.

- Collegial ethics-- Professional educators shall constructively give help and support one another holding on to the system of morality and unity of the group.
- Societal ethics-- Professional educators shall act as a leader in the conservation and development of the economy, society and religion, art and culture, local wisdom, the environment, public common interests and adhere to the democratic ruling system with the King as the Head.

(vi) The Hybrid Instructional System
The blended, adjunct, or hybrid teaching model is a mixture of classroom and online instruction that has an abundance of academics proclaiming its benefits. Hybrid courses blend face-to-face interaction with online learning and customarily involve the delivery of curricular materials, access to resources, submission of assignments, diversity learning techniques, activities that support higher order thinking, and online discussions that may be asynchronous or synchronous in nature. Moreover, hybrid learning by using proportion delivered online 30 to 79 percent. (Boettcher, Judith V.,2010) [3] In order for a class to be considered hybrid some actual student learning and learning assessment must occur online and a percentage of in-class time is forfeited to make up for the weight put on the online learning activities. In addition, from the hybrid courses evaluated differently then traditional and fully online learning experiences (Carnevale ,2000) [4] found that regardless of the learning format, Faculty of Education students took into consideration knowledgeable instructors, interaction with instructors, and additional features that create a sense of community when evaluating courses for merit. The importance of technological preparedness, willingness, and the overall mindsets of Faculty of Education students has also been acknowledged by educators as playing a crucial role in both the hybrid and online learning equations. Sanders D. and Morrison- Shetlar (2002) [16] cited the importance of student attitudes toward technology as a significant determining factor in the educational benefits of online learning resources and experiences.

2.3 Techniques or instrument for measurement code of ethics were as shown in table 1:

|-------------------------------|-----------------|-------------------------------|

Table 1. The synthesize of techniques or instrument for measurement code of ethics via Hybrid Learning System Evaluation.
<table>
<thead>
<tr>
<th>Ethical Characteristics</th>
<th>Techniques or Instrument for Measurement</th>
<th>System Evaluation</th>
<th>measurement</th>
</tr>
</thead>
</table>
Finally, from the above mentioned documents and research, they are the backgrounds and rationales which interest the researcher to do this research to developed hybrid instructional system to enhance code of ethics in line with teachers professional standards for the Faculty of education students, to compare code of ethics in line with teachers professional standards between before and after learning activities by using the hybrid instructional system, to compare the pretest and the posttest learning achievement score, and 4) to study the Faculty of education students satisfaction toward learning activities by using the hybrid instructional system that constructed by researcher.

3. Research Methodology

(i) There were 2 groups of populations. The first group consisted of 10 educational technologist experts, selected by the purposive sampling technique. The second group were 280 students who enrolled in the 400102 Principles of Teaching Profession course, second semester of 2015 academic year, Faculty of Education, Burapha University. The subjects for the experiment phases was 30 students who were selected by simple random sampling.

(ii) This research is the research and development. There are several research activities included:

• Need problems and analysis, which is followed by stating the instructional goal of learning
• Designing learning objectives, lesson planning, learning resources, learning strategies, tasks, learning material research based on a hybrid instructional system
• Development of an instructional approach, learning outcomes, assessment instruments for hybrid instructional system
• The implementation steps reflects of the hybrid instructional system to make sure high efficiency and positive effects which use sample group with education student, Faculty of Education
• Evaluation steps into three parts: Pretest-Posttest, Formative, Summative and satisfaction toward the hybrid instructional system which the statistics used were percentage, mean, standard deviation and t-test.

(iv) Research conceptual frameworks are shown as this figure 1:
4. Results of Research

4.1 The developed hybrid instructional system to enhance code of ethics in line with teachers professional standards for education students should be included the 5 zones components (analyze zone, teaching technique zone, SAENSOOK hybrid learning zone, communication & experience zone, evaluation zone and reflection zone) which are the 8 principal components SAENSOOK and the researcher has analyzed by interviewing the specialists. It is able to show in figures 2. The specialists’ opinions about the components of the hybrid instructional system are in the level of “very much” ($X = 4.53$, $SD = 0.58$). Shown as in figure 2.
Figure 2. The hybrid instructional system to enhance code of ethics in line with teachers’ professional standards for the Faculty of Education students

The efficiency of the hybrid instructional system was 91.22/92.05 which follows the criteria. Shown as in table 2.

Table 2. Result of the efficiency of the hybrid instructional system to enhance code of ethics in line with teachers’ professional standards for the Faculty of Education students.

<table>
<thead>
<tr>
<th>The Efficiency of the Hybrid Instructional System to Enhance Code of Ethics in Line with Teachers’ Professional Standards</th>
<th>N = 30</th>
<th>Criteria : E1/E2 = 90/90</th>
</tr>
</thead>
<tbody>
<tr>
<td>The Efficiency of the Hybrid Instructional System</td>
<td>91.22</td>
<td>92.05</td>
</tr>
</tbody>
</table>

Posttest score of the learning achievement and the ethics in line with teachers professional standards of the hybrid instructional system was higher than the pre-test score at .05 level of significance. Shown as in table 3-4.
Table 3. The Faculty of Education students’ learning achievement measured by using the hybrid instructional system

<table>
<thead>
<tr>
<th>Learning Achievement Tests</th>
<th>N</th>
<th>X</th>
<th>SD</th>
<th>t</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pretest</td>
<td>30</td>
<td>22.90</td>
<td>3.66</td>
<td>14.38*</td>
<td>.00</td>
</tr>
<tr>
<td>Posttest</td>
<td>30</td>
<td>31.37</td>
<td>1.82</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Statically significant at .05

Table 4. The Faculty of Education students’ code of ethics in line with teachers professional standards measured by using the hybrid instructional system

<table>
<thead>
<tr>
<th>Tests : Code of ethics in line with teachers professional standards</th>
<th>N</th>
<th>X</th>
<th>SD</th>
<th>t</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Personal Ethics</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>▶ Pretest</td>
<td>30</td>
<td>15.60</td>
<td>2.32</td>
<td>18.18*</td>
<td>.00</td>
</tr>
<tr>
<td>▶ Posttest</td>
<td>30</td>
<td>23.67</td>
<td>2.12</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Professional Ethics</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>▶ Pretest</td>
<td>30</td>
<td>17.87</td>
<td>2.01</td>
<td>12.53*</td>
<td>.00</td>
</tr>
<tr>
<td>▶ Posttest</td>
<td>30</td>
<td>23.36</td>
<td>1.84</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Client-centered Ethics</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>▶ Pretest</td>
<td>30</td>
<td>16.23</td>
<td>2.35</td>
<td>15.33*</td>
<td>.00</td>
</tr>
<tr>
<td>▶ Posttest</td>
<td>30</td>
<td>23.60</td>
<td>2.01</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Collegial Ethics</td>
<td></td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>▶ Pretest</td>
<td>30</td>
<td>17.53</td>
<td>2.44</td>
<td>13.15*</td>
<td>.00</td>
</tr>
<tr>
<td>▶ Posttest</td>
<td>30</td>
<td>23.57</td>
<td>1.81</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Societal Ethics</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>▶ Pretest</td>
<td>30</td>
<td>17.54</td>
<td>3.05</td>
<td>13.51*</td>
<td>.00</td>
</tr>
<tr>
<td>▶ Posttest</td>
<td>30</td>
<td>23.93</td>
<td>2.33</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Statically significant at .05

4. The Faculty of Education students who were the experimental group had high level positive satisfaction toward the hybrid instructional system.

5. Data analysis

The statistics were used in this research study are as follows:
5.1 The basics statistics are the Mean and the Standard deviation.
5.2 The statistics for the assessment of the instruments’ quality were:
   - the value difficulty and the discrimination for analyzing the achievement test.
   - the reliability “Alfa Coefficient” for analyzing the achievement test.
5.3 The statistics for assessing the experiment were the mean, the standard deviation and the t-test for dependent (One-Group Pretest Posttest Design)

6. Discussion

The finding on using the hybrid instructional system to enhance code of ethics in line with teachers professional standards found that 5 zones components (analyze zone, teaching technique zone, SAENSOOK hybrid learning zone, communication & experience zone, evaluation zone and reflection zone) which are the 8 principal components SAENSOOK (S:Setting ideas and select problem topic, A : Analyze and access learning resources, E: Experience co-creation and experiment, N : New idea checklist, S: Storing and classified information, O:Opinion building and sharing knowledge, O: Outcome presentation, and K : Knowledge evaluation). Its activities were developed systematically by using system approach and instructional design and development. In addition, the activities of the model are like the problem based learning, project based learning, case based learning and collaboration which supports the learning by doing style (hands-on). The hybrid instructional system is under the learning environment, the diversity, to have the choices and the congeniality or the good social interaction. Furthermore the synchronous or asynchronous collaborative and self-paced asynchronous are any where any time learning environment for support hybrid instructional system. The synchronous and asynchronous collaborative environments support constructivist, share knowledge and open social learning strategies. Moreover, the learner can easy access, learner mobility and self-actuated. All of these are reasons to the learner learned with the hybrid instructional system it can make the learning achievement of the learner to be in progress and the ethics in line with teachers professional standards. In addition the results of quality assessment of hybrid instructional system that is body of knowledge to enhance Faculty of Education students in 21st century skills which relate to factors affecting self-development according to ethical codes of professional teacher career of teachers in schools. The study’s found that constructivist by individual performed from situation and attitude towards teacher profession at high level. (Prapit Kullabude, 2012). [17] Furthermore, related that education report: teacher education and development in Thailand (Office of the Education Council, 2015) [16] which found that "new generation teacher " should have three main roles: being a facilitator (Guide / Coach) and co-learner /Co-investigator is not the only teacher who has the role of "instructor". Additionally, the teacher students attending were able to gain career-related experience from the teaching problem situation tasks they undertook about the ethics in line with teachers professional standards real life in schools.

The Faculty of Education students who were the experimental group had high level positive
satisfaction toward the hybrid instructional system because the lecturer let the teacher students individual practice which helped the teacher students increase their knowledge and perceive the contents correctly. The lecturer supervised, suggested, and gave consultancy, as well as facilitating according to the instructional and learning principles of the learners center. Moreover, SAENSOOK hybrid learning activities can use step for collaborative knowledge sharing, online and face to face observations of real-world phenomena, discovering exercises (personal, partnered, team-based) and problem-solving exercises which related to creating learning environments for Thai learners. (Johnson, Christopher, 2007).
[9]Activities that allow this to take place include: journaling, case study analyzes or paraphrasing conceptual materials in order to add meaning to them. According to the observation and record of process learning, code of ethics in line with teachers professional standards and learning achievement test of the education students towards The hybrid instructional system, it has to be applied by focusing on the education students’ participations as much as possible. It can be done by active environment from the audience, such as interactive online presentations or face to face active presentation. Furthermore, it could be learner preparation such as positive suggestions, learner benefits statements, creating a positive emotional environment, raising questions and posing problems, arousing curiosity and creating interest. Finally, we can use freeware on cloud service for write mind-mapping tools greatly enhances brainstorming to code of ethics holistic learning.

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A Study of Newly Appointed Teachers’ Thinking  
and their uses of Educational Technologies  
at an International School in Hong Kong  

Saeed Rahman¹

Abstract  
This study examines the pedagogical technology integration and decision making practices of a group of newly appointed teachers, at an international in Hong Kong. Though such schools are often seen as exemplary and well resourced, as far as teacher access to technological resources and support is concerned, research suggests that teachers generally are still experiencing challenges with the integration of technology in their teaching, most specifically at higher-levels (An, Y.-J., & Reigeluth, C., 2012). The pedagogical decisions teachers make, are often influenced by their private theories (Senge, 1990). Though there is a significant body of research on teacher beliefs however studies looking holistically at teachers’ private theories in a technology context are few and far between.  
A case study methodological approach was used, involving five newly appointed teachers who represented different subject disciplines in the secondary division. The goal of this study was twofold; firstly to determine the private theories of newly appointed teachers, and how they impact the pedagogical decision making practices in context to the curricular integration of technology. Secondly, determine the effect of an instructional intervention on modifying private theories. Preliminary findings reveal that these teachers (1) were more focused on meeting the immediate demands of their teaching role (developing familiarity with the curriculum, assessment etc), rather than explore and further their integration of technologies, (2) were not familiar with the school's vision of technology integration, and thus were not entirely familiar with expectations of how to integrate technology (3) held strong views to personalising their digital learning environments (4) having access to centralised technology support, who could either provide on demand assistance or delegate to other specialists, was critical in developing a positive mindset.  
It is anticipated that findings from the study will ultimately help school policy makers articulate and ensure that teachers are adequately supported with the institutional expectations when they arrive at the school. Furthermore, the findings aim to inform

¹ The University of Hong Kong, HKSAR, China
literature on teacher thinking, and changes through the adoption of educational technologies.

**Keywords:** teacher private theories, teacher beliefs, technology integration, teaching thinking, instructional decision-making

1. **Introduction**

Over the past decade, private international schools in Hong Kong have introduced major strategic reformational measures within their curricular offerings, in what is considered a highly competitive and saturated market. Such schools are typically abundantly resourced and appear to have a greater degree of financial, operational and curricular autonomy within their governance. Technology has been a major source of investment both in terms of capital and operational expenditure, with funds for example, going towards acquisition of computers, servers, internal networks, Internet access and bandwidth and projectors. Furthermore, a sizeable proportion of that spending has gone into providing professional development for teachers in order to equip them with the necessary technical and pedagogical skills to address learning outcomes. As a consequence, these teachers are expected to incorporate the use of technologies within their teaching, and align such practice to the overall strategic goals of the institution. When approached correctly, such goals are usually guided by mission and vision statements that are part of a core strategic direction and informed through a whole school approach. The prerequisite conditions (access to technological resources, training and support) for teachers to integrate technology have largely been met, yet studies still suggest that many teachers continue to experience intrinsic challenges (referred to as second-order barriers) in achieving a successful routine of technology integration within their classrooms. Research also indicates that high-levels of technology use, that is use which is aligned to the needs of students, reinforced by constructivist pedagogy, is still evidently low (An, Y.-J., & Reigeluth, C., 2012; Blackley, S., & Walker, R., 2015). These second-order barriers are often cited as being more challenging to address, and relate to the pedagogical belief systems that teachers hold (Ertmer, P. A., 1999; 2005). Beliefs have been considered as “the best indicators of the decisions individuals make throughout their lives” (Pajares F. M., 1992, p. 307). An empirical understanding of these belief systems, is of paramount importance if the end goal is to modify teaching practice (Nespor, J. K., 1985). Much of what teachers do in the classroom is influenced by their beliefs (Brown, B. B., & Webb, J. N., 1968; de Vries, S., van de Grift, W. J. C. M., & Jansen, E. P. W. A., 2013), however researchers have found conducting studies based on such a construct, a “formidable concept” to address (Pajares F. M., 1992, p. 308), that doesn’t lend itself easily to empirical research.

Pajares (1992) further argues that in order to form a better understanding of the diverse nature and origin of beliefs, there needs to be clear understanding and conceptualisation of such a
phenomenon. He supports the notion that there is a ‘strong relationship between teachers’ educational beliefs and their planning, instructional decisions, and classroom practices’ (p. 326). Such beliefs originate from preconceptions, practical knowledge, personal knowledge and experiential knowledge (Anderson & Bird, 1995; Marland, 1994; as cited in Handal, B., 2004). Examples include prior teaching experiences, schooling and upbringing, all of which contribute to the development of a personal worldview of a teacher’s pedagogical decision making practice, and essentially informs how they teach. When considered holistically, this paradigm is referred to as teachers’ private theories. Private theories reflect personal knowledge, knowing and understanding (Handal, B., 2004), and act as foundation for instructional beliefs (Nespor, J. K., 1985). Private theories are formed from the complex nature of intrinsic beliefs that teachers develop over time, and relate to a broad range of “personal and cultural experiences [and] cognitive insights” (Shifflet, R., & Weilbacher, G. 2015, p. 368) and personal knowledge, knowing and understanding (Handal, B., 2004). Teachers’ private theories influence teaching practice, and ultimately manifest in the decisions teachers make in context to teaching and learning.

Though it has been long established that much of what teachers do in the classroom is determined by their beliefs, these decision making practices are not isolated to teaching in a traditional sense. Researchers also extend this view to teachers’ pedagogical use of technology (Hadley, M., & Sheingold, K., 1993; Veen, W., 1993; Pajares F. M., 1992). Churchill (2006), suggests that “teachers hold cognitive constructs, beliefs, guiding principles, theories or preconceptions, which determine their instructional decisions and technology integration” (p. 1). This suggests that beliefs are only one dimension, though a significant one, of teachers instructional decision making practice when using technology.

2. Context and Background
The purpose of this study is to understand how newly appointed teachers at a private international school engage with and consider technology within their teaching practice. Moreover, how their private theories explicitly inform the decisions they make relating to the integration of technology within teaching practice, and to broadly focus on their private theories and if they are transformed through a learning design framework intervention approach.

In order to address gaps in the body of research on factors which support and impede the pedagogical application of technology by newly appointed teachers in schools, and to provide a focus for the study, a research question and sub questions were formed. The main research question centred around identifying and explicating the private theories that newly appointed teachers base their decision making practices upon when using technology in their teaching. The overarching research question that guides this study is as follows:

How does newly appointed teachers’ thinking mediates their use of educational technologies at an international school in Hong Kong?
In order to expand upon and address the main research question of this study, the following sub-questions will be explored:

1. What private theories of a newly appointed teacher mediate his/her educational technology use on initial arrival at the school?
2. How does this teachers private theories transform as he or she integrates in the school’s culture and context over the first year?
3. How does a learning design framework affects teacher thinking and use of educational technologies?

In order to establish the framework of the study, private theories from literature needed to be identified. These theories included (1) assessment, (2) management, (3) student learning, (4) support, (5) teaching and (6) technology. Table 1 shows the different areas of private theories derived from the literature.

<table>
<thead>
<tr>
<th>Area</th>
<th>Broad Definition</th>
<th>Source</th>
</tr>
</thead>
</table>
Technology  |  Confidence in using a wide range of digital technologies  |  Cox, et al., 2004; Ertmer, 1999

3. Methodology

3.1. Research Setting
The author was a teacher within the school where the study was conducted. A secondary part of his role was working with teachers and students across the entire school in the capacity of a technology coach. Students at the school represent K-12 (through train), with the enrolment figure at approximately 1840 students. The school offers all three International Baccalaureate (IB) programmes (Primary Years (PYP), Middle Years (MYP) and Diploma (DP)) and thus is recognised as an IB World School. Students in grades 11 and 12 also take the Ontario Secondary School Diploma (OSSD) alongside the IB Diploma. Furthermore, the school is seen as a role model for exemplary teaching and learning practices both within Hong Kong and throughout the South East Asia region, and is accredited as an Apple Distinguished School, one of only two schools in the region. The Apple Distinguished School status is given to schools which have a large deployment of Apple technologies (such as MacBooks and iPads), demonstrate innovation and have a vision of how technology is used to support teaching and learning.

All teachers are issued with laptop computers (MacBook Pro’s) which are refreshed on a three year cycle. Teachers use their computers for instructional planning, development and delivery. All students in grades 4-12 own a self-purchased MacBook Pro. Grade 4-6 students’ laptops remain at school, primarily stored in purpose built cabinets within their classrooms. Students in grades 7-12 carry their devices between classes, and use them as an when required, which for most of the subjects is on a daily basis. Classrooms are equipped with modern short throw projectors combined with Apple TV installations, allowing students and teachers to project their screens wirelessly.

During the second half of 2013, the school decided to migrate away from FirstClass, a groupware application which was mainly used for email and class conferences. It was determined that G Suite for Education (formerly known as Google Apps for Education) was the best replacement, and the school fully transitioned from FirstClass over to Google Suite over the course of a year. G Suite Education is currently used school-wide for email (GMail), internal conferences (Google Groups), collaborative documents (Google Drive), and scheduling (Google Calendar). Furthermore, given the the culture of empowering teachers to explore with using technologies in their teaching and learning, certain teachers are using Google Classroom, a service that facilities discussion and submission of assessments and feedback.
3.2. Research Participants

This exploratory case study focused on five newly appointed teachers, who transitioned from schools in Beijing (China), Singapore and Hong Kong. In an international school context, these newly appointed teachers tended to be experienced within their teaching disciplines, and have usually been exposed to a rich diversity of experiences, institutional policies and practices with the pedagogical use of technology. The study aimed to respond to the question of how newly appointed teachers’ thinking mediates their use of educational technologies at an international school in Hong Kong, with an initial focus on specific dimensions of private theories.

The participants were all newly appointed Upper School teachers for the 2015/2016 academic year. It was determined that limiting the participation to this group would (i) result in a broad subject representation which is not possible with teachers in the PYP, as these teachers are general classroom teachers who teach across subjects, (ii) availability of technology for student use was not as ubiquitous in the lower primary programme as opposed to the secondary school and (iii) accessing the research participants by the researcher would be easier due to no timetabling conflicts (the primary school follow a different daily timetable). Participation in the study was voluntary, and an informed consent form was required to be signed by all participants. This informed consent form outlined the expectations of all the participants and the researcher, as pertained to the ethics review requirements of the Human Research Ethics Committee (HREC), of the University of Hong Kong.

Out of a total of 14 potential teachers, six expressed interest with one deciding to withdraw his participation during the early stages of data collection. Subsequently, all collected data was destroyed and he was removed as a participant from the study. Table 2 shows the demographical information for each of the remaining teacher participants (pseudonyms used).

<table>
<thead>
<tr>
<th>Participant</th>
<th>Age</th>
<th>Teaching Experience (Years)</th>
<th>Subject Expertise</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cassie</td>
<td>47</td>
<td>22</td>
<td>English, Drama, History, Theory of Knowledge</td>
</tr>
<tr>
<td>Alana</td>
<td>36</td>
<td>10</td>
<td>General Science, Chemistry, Mathematics</td>
</tr>
<tr>
<td>Michelle</td>
<td>35</td>
<td>11</td>
<td>Drama</td>
</tr>
<tr>
<td>Jason</td>
<td>50</td>
<td>4</td>
<td>Business, Economics, Math</td>
</tr>
<tr>
<td>Jack</td>
<td>37</td>
<td>11</td>
<td>Social Studies, Science, Humanities, Mathematics</td>
</tr>
</tbody>
</table>
Of the five participants, three (Alana, Michelle and Jack) had opted to enrol in the State University of New York (SUNY) aligned and school issued Certificate of Educational Technology (CET) programme at the new school. This programme was partly subsidised by the school. Participants had the option to complete additional credit courses in order to obtain a Master's degree. The focus of the programme was to offer students a research oriented perspective on the use of technology in education. Furthermore, the CET programme, allowed a holistic exploration of some of the different pedagogical approaches and best practices to technology integration in teaching and learning.

### 3.3. Research Design

In order to address the research outcomes of the study, an appropriate study design was needed that allowed for the collection and interpretation of data in context to the requirements of answering the research question(s). A number of qualitative research instruments (or methods) can be used to collect data in order to gauge understanding of a phenomena being explored. According to Creswell (2009), the four different instruments of significance to the methodological collection of data in qualitative studies are (1) observations, (2) interviews, (3) review of documents and (4) production audio-visual materials.

Research instruments that were used consisted of semi-structured interviews, participant reflection journals and lesson observations. Data collection within the study was conducted over six phases in order to gain an in depth understanding of the teacher participants’ thinking and the related effects of the introduction of a learning design framework.

#### 3.3.1. Preliminary Phase

**Stage 1** — The purpose of this initial phase was to share and explain the goals of the research, the researcher's role and commitment, the teacher's role within the study and to further understand and get to know the participant, their background and experience. This was also an opportunity to really understand the potential anxieties these newly appointed teachers face during this period of transition.

**Stage 2** — The second stage of the data collection related to addressing sub-question 2. This process involved interviewing the participants, the purpose of which was to determine how their thinking and specifically beliefs that they embody about teaching and learning influenced their use of technology.

#### 3.3.2. Pre-Intervention Phase

**Stage 3** — During the third stage of the data collection process, lesson plans were reviewed (which act as a form of methodological triangulation (Guion, 2002)) of teacher practices in order to further understand the considerations that the participant has made in context to the educational use of technology. A pre-planned lesson will be reviewed by the teacher and researcher. This will help the researcher understand, and the participant to articulate how their thinking aligns to practice. The lesson will be delivered by the teacher, with the researcher
observing. This will be followed up by an interview to discuss the lesson plan, expected and actual outcomes and to ultimately develop an understanding of the practical considerations to relate back to the interview conducted in Stage 2.

3.3.3. Intervention Phase

**Stage 4** — An intervention in the form of the RASE learning design framework was introduced at this point of the study. The participant focus group convened and the researcher explained the nature and purpose of the framework. This helped the researcher in ensuring that the key elements of the model were understood by all participants, and how it could help in their area of teaching.

**Stage 5** — The participant teacher and researcher co-planned a lesson integrating the use of the RASE learning design framework. The researcher ensured that the key elements of the model were incorporated into the lesson. The lesson will then be delivered by the participant teacher which was be observed by the researcher.

3.3.4. Post Intervention & Evaluation Phase

**Stage 6** — Final focus group and individual interviews were conducted to allow the researcher and teacher participants to reflect on how they progressed with the use of technology, and to determine how their thinking had progressed over the course of the year. The outcome of the discussions will help to understand how the use of a learning design framework affects teacher thinking and the educational use of technology.

Throughout the course of data collection period, participants were be required to keep an online journal for periodic reflections on what they think and feel during their first year at the school. This helped aid in helping both the researcher and participants in understanding and articulating how their thinking has developed over the course of year.

3.4. Pedagogical Learning Model

The empirically founded RASE pedagogical model (Churchill, D., Fox, B., & King, M., 2011) provides opportunity for a constructivist student-centred approach to using technology within teaching and learning. The model emphasises a holistic approach to using technology with each quadrant representing (1) resources, (2) activity, (3) support and (4) evaluation. It is argued that all four quadrants are essential within a digitally supported learning environment that fosters independent learning and problem solving (Churchill, D., King, M., Webster, B., & Fox, B., 2013; Churchill, D., 2017).

4. Findings

The study sought to determine the private theories towards technology mediated teaching and learning of newly appointed teachers at leading international school in Hong Kong. Moreover,
how these private theories affect decision making processes when considering the use of technology for teaching and learning. Table 3 shows an overview of the post-intervention private theories of all participants.

In order to improve the validity of the interpreted data, multiple strategies were used to ensure that the data was reported accurately and objectively. After an initial thematic analysis of the data, it was submitted to a group of individuals who suggested minor changes to the themed data. These changes were made, however they were largely in agreement with the researcher's classification of the data. Secondly, a member check process was used, whereby the participants were given copies of the aforementioned edited document. In addition to making minor edits to thematic classifications, the participants also completed a section on how each area of thinking pertained to the significance of their instructional planning, with regards to using technology.

Table 3. Participant Pre-Intervention Private Theories

<table>
<thead>
<tr>
<th>Private Theory</th>
<th>Significance to Instructional Planning</th>
<th>Area of Private Theory</th>
</tr>
</thead>
<tbody>
<tr>
<td>Access to the Internet resources greatly increases language learning opportunities</td>
<td>Critical</td>
<td>Student Learning</td>
</tr>
<tr>
<td>Consistent access to technology is imperative to fulfil learning objectives</td>
<td>Critically Important</td>
<td>Technology</td>
</tr>
<tr>
<td>Technology has allowed the teacher to facilitate dialogue and allow students to reinforce understanding of concepts</td>
<td>Critically Important</td>
<td>Student Learning</td>
</tr>
<tr>
<td>Teachers should be given autonomy to select the appropriate technology to support student learning</td>
<td>Very Important</td>
<td>Technology</td>
</tr>
<tr>
<td>With students being immersed within the Google environment, this is the best technology to explore the implementation of online process journals</td>
<td>Somewhat Important</td>
<td>Assessment</td>
</tr>
<tr>
<td>Purpose driven, learning value oriented use of technology</td>
<td>Critically Important</td>
<td>Student Learning</td>
</tr>
<tr>
<td>Prefers to use cloud based technologies, resulting in learning resources being easily accessible</td>
<td>Very Important</td>
<td>Organisation</td>
</tr>
<tr>
<td>Private Theory</td>
<td>Significance to Instructional Planning</td>
<td>Area of Private Theory</td>
</tr>
<tr>
<td>----------------</td>
<td>--------------------------------------</td>
<td>------------------------</td>
</tr>
<tr>
<td>Feels that technology could be a distraction to students, and that the teacher needs to manage technology use as part of their classroom routines</td>
<td>Critically Important</td>
<td>Management</td>
</tr>
<tr>
<td>Focuses on learning outcomes, and uses technology to support these</td>
<td>Critically Important</td>
<td>Student Learning</td>
</tr>
<tr>
<td>Does not feel technology is always the best choice. Does not agree with institutionalised technology expectations, without respecting teacher judgement</td>
<td>Critically Important</td>
<td>Teaching</td>
</tr>
<tr>
<td>Technology is great resource for tracking things (e.g. assessments) electronically</td>
<td>Very Important</td>
<td>Assessment</td>
</tr>
<tr>
<td>Feels that technology can disengage students (can sometimes result in a barrier), thus managed technology use</td>
<td>Critically Important</td>
<td>Management</td>
</tr>
<tr>
<td>Feels limited in creatively presenting information to students (Google Docs)</td>
<td>Very Important</td>
<td>Management</td>
</tr>
<tr>
<td>Being part of a supportive department determines how and the extent in which she uses technology as a teacher</td>
<td>Important</td>
<td>Support</td>
</tr>
<tr>
<td>In order to successfully integrate technology, teachers need access to technology which works, and timely and accessible support upon any issues</td>
<td>Very Important</td>
<td>Support</td>
</tr>
<tr>
<td>Lack of common planning time limits the extent to which they (department) can plan the use of technology in their programme</td>
<td>Critically Important</td>
<td>Teaching</td>
</tr>
<tr>
<td>Teachers should be given freedom of choice to select the appropriate technology to support student learning</td>
<td>Somewhat Important</td>
<td>Technology</td>
</tr>
<tr>
<td>Teachers need to be familiar with the</td>
<td>Very Important</td>
<td>Management</td>
</tr>
</tbody>
</table>
Throughout their teaching careers, the participants had been exposed to a broad range of experiences with using technologies. Generally, the availability of technology at their previous school was not as ubiquitous as the current school they were at. It’s important to note, that of the five participants, three had been at schools where the use of technology was extensively controlled and managed by the school or government policies that were institutionally adopted by the school, and thus these teachers felt overwhelmed with the sheer ability just to have access and choice of using technologies within their practice, and difficulty in adapting.

Other than becoming versed in the systems that were immediately required within their first week of teaching (e.g. attendance), the participants had to become familiar with the adoption of Google tools and services. The use of Google Apps (Drive, Documents, Forms Slides and Sheets) was a new experience for them, and most of them faced initial challenges in adopting these tools. Given that the use of Google Apps was highly pervasive throughout the school and adoption was not a choice, some of these challenges faced related to the expectations of use (e.g. when and how often should I use these tools), understanding the nuances of sharing and collaboration functionality (e.g. ensuring that resources are shared correctly, with the right audience and with the correct privileges, how to change sharing permissions), document organisation (e.g. how do I structure my drive, labels vs folders).

The pre-intervention private theories demonstrated by the participants were quite diverse. The dominant area of private theory that was evident amongst the participants upon their arrival at the school was classified as management of technology use. The scope of this private theory varied widely, relating to teachers being concerned with the way information was presented to their students (aesthetic control), unfamiliarity with the school’s vision of technology use, feeling that technology was used to an extent where it disengaged students and that technology was potentially a distraction, and thus resulted in the teacher managing technology use in the classroom.

Furthermore, the participants determined that these private theories were either critically important or very important to their considerations when making instructional planning and
learning design decisions. This indicates that they took these factors as highly significant in their approach to integrating technology into their teaching.

The introduction of RASE pedagogical design model allowed participants to synthesize their understanding of using technology. There was overwhelming consensus that the model reinforced best practice, and reaffirmed what it meant by “good teaching” when using technology for teaching and learning.

The teachers had by this time, developed the initial conceptualisation and personal capacity to using Google Apps, one of the main technology tools used throughout the institution. All of the participants had made the decision not to adopt Moodle within their teaching. Three of the participants (Alana, Michelle and Jason), had trialled the use of Google Classroom, and at the time of concluding the data collection, Michelle and Jason were still using it as part of their classroom teaching approach, focusing on the submission of assessments, feedback and support. Michelle who had completed an action research project as part of her final assessment within the SUNY CET programme, had implemented the use of electronic process journals using Google Classroom, Google Docs, Doctopus (document management addon) and OrangeSlice (rubric addon). Part of her approach was guided by the inefficiencies of the existing assessment strategies within her subject area, which was determined by her private theories. Thus, she instigated change through a team based departmental approach.

The participant post-intervention private theories (Table 4) revealed that the dominant area of private theory was on student learning, which aligns with research on higher-levels of technology integration being more representative of teachers who demonstrate constructivist, student-centered learning practices (Blackley, S., & Walker, R., 2015).
<table>
<thead>
<tr>
<th>Private Theory</th>
<th>Significance to Instructional Planning</th>
<th>Area of Private Theory</th>
</tr>
</thead>
<tbody>
<tr>
<td>Considers using Google Apps as his primary ‘go to’ tool because it is easy to share and collaborate on resources</td>
<td>Critically Important</td>
<td>Technology</td>
</tr>
<tr>
<td>Does not prefer the use of Moodle, as he does not have control over the look and feel of this environment</td>
<td>Very Important</td>
<td>Student Learning</td>
</tr>
<tr>
<td>Participating in the SUNY programme, has allowed them to explore different options and strategies to integrating technology to address learning needs of students</td>
<td>Very Important</td>
<td>Student Learning</td>
</tr>
<tr>
<td>Still hesitant about adoption of new technologies without comprehensively testing first</td>
<td>Critically Important</td>
<td>Technology</td>
</tr>
<tr>
<td>Prefers a “clean and simple” minimalist setup as far as his digital learning environment is concerned. Feels that he cannot achieve this through Moodle, therefore he has adopted extensive use of Google Drive</td>
<td>Critically Important</td>
<td>Student Learning</td>
</tr>
<tr>
<td>The use of Google has allowed him to manage student learning more effectively. He is able to support students better as they collaborate on work. Indicates that he “doesn’t have to be walking as much”</td>
<td>Important</td>
<td>Management</td>
</tr>
<tr>
<td>Fearful of “technology taking over the whole course” and “doesn’t want to see [students] on screens all the time”</td>
<td>Critically Important</td>
<td>Student Learning</td>
</tr>
<tr>
<td>Felt that the RASE model provided a opportunity to reflect on good teaching with technology</td>
<td>Very Important</td>
<td>Student Learning</td>
</tr>
<tr>
<td>Found that the RASE model has allowed</td>
<td>Very Important</td>
<td>Student Learning</td>
</tr>
<tr>
<td>Private Theory</td>
<td>Significance to Instructional Planning</td>
<td>Area of Private Theory</td>
</tr>
<tr>
<td>--------------------------------------------------------------------------------</td>
<td>---------------------------------------</td>
<td>------------------------</td>
</tr>
<tr>
<td>him to change his strategy as far as support is concerned</td>
<td>Very Important</td>
<td>Student Learning</td>
</tr>
<tr>
<td>Providing support as defined through the RASE model is not always necessary through technological means</td>
<td>Very Important</td>
<td>Student Learning</td>
</tr>
<tr>
<td>Technology proves a distraction for the students, therefore ensures there is a good balance</td>
<td>Very Important</td>
<td>Student Learning</td>
</tr>
<tr>
<td>Technology has a bigger role for formative assessment than summative assessment</td>
<td>Important</td>
<td>Assessment</td>
</tr>
<tr>
<td>Technology has to be of interest to him, in addition to students before he will consider adopting within teaching</td>
<td>Very Important</td>
<td>Teacher Preference</td>
</tr>
<tr>
<td>Becoming more confident on the availability of technology and personal choice</td>
<td>Important</td>
<td>Technology</td>
</tr>
<tr>
<td>Does not consider the use of Moodle within her teaching and learning. This was an initial dilemma, however departmental direction steered her into setting up an integrated environment where all her learning resources are linked from Google Drive</td>
<td>Important</td>
<td>Technology</td>
</tr>
<tr>
<td>Does not like the look of feel of Moodle. Suggests it is ‘clunky’. Too many options, which they will never use. Prefer a minimalist environment</td>
<td>Very Important</td>
<td>Student Learning</td>
</tr>
<tr>
<td>Determined learning needs of students, and satisfied those with the use of Google Drive. Does not feel the need to proactively search for other technologies</td>
<td>Somewhat Important</td>
<td>Technology</td>
</tr>
<tr>
<td>Private Theory</td>
<td>Significance to Instructional Planning</td>
<td>Area of Private Theory</td>
</tr>
<tr>
<td>--------------------------------------------------------------------------------</td>
<td>---------------------------------------</td>
<td>---------------------------</td>
</tr>
<tr>
<td>Felt that the RASE model allowed her use technology in a way which addresses learning outcomes in a systemised manner</td>
<td>Very Important</td>
<td>Student Learning</td>
</tr>
<tr>
<td>Lack of time to fully “vet” technologies before implementation</td>
<td>Very Important</td>
<td>Technology</td>
</tr>
</tbody>
</table>
5. Discussion

5.1 Affecting Change - Theory, Policy & Practice
Through interviews and observations, it was determined that the private theories (both pre and post intervention) of these newly appointed teachers were inherently complex. The participants within this study were highly able, experienced educators, and expert practitioners within their academic disciplines. Findings from the study largely reveal that the natural disposition of newly appointed teachers' private theories within the first year of appointment, were more aligned to "survival" rather than “discovery”. It’s important to recognise that “discovery” in this context, is referring to the process of pro-actively seeking opportunities with the vision of enhancing their pedagogical approach to using technology, in a manner which consistently aligns to their vision of a technology integrated classroom. It could be argued that they were indeed “discovering”, using new technologies, familiarising themselves with institutionalised approaches, with new curricula, embracing a new institutional culture, familiarisation with societal expectations and ultimately finding their “place” in a new school. However, all of this was perceived as a means to an end - that is to survive the beginning weeks, months and year at the school.

Given the demands upon these teachers, the data from this study generally suggests that they didn’t have much opportunity, time nor inclination to start establishing this vision within the first year of their appointment. Once the participants were over the hurdle of the first year, had developed aptitude with technologies, and established routines which supported technology integration within their classrooms, some were more inclined to explore and move towards a “discovery” based approach.

5.2 Establishing a Shared Vision
It has been argued that teachers’ philosophical beliefs are a critical to the success of technology integration initiatives (Albion & Ertmer, 2002). In order for teachers to effectively integrate technology within their classrooms, who use technology as part of a student centred learning approach, thus addressing the higher-levels of technology integration that is often referred to in literature, a duality of vision needs to be established. Researchers suggest that teachers need to formulate their own vision of a technology integrated classroom, or develop a “personal meaning” (Gao, P., Wong, A. F. L., Choy, D., & Wu, J, 2011, p. 221 ), yet more often than not, this is a challenging concept to define (Ertmer, 1999). More importantly, teachers also need to have clear expectations to work towards; expectations that are aligned to a shared vision of the institution (Lim, C. P., Zhao, Y., Tondeur, J., Chai, C. S., & Tsai, C.-C., 2013), that is effectively communicated (Ertmer, 1999) and embraced. Senge (1990) describes the connection between a personal and shared vision by highlighting that both personal and institutional representations of the vision are only considered as shared, when there are similarities between both. Furthermore, he mentions that a shared vision results in trust highlights the need for commitment and a need to be “bound by a common aspiration” (p. 192). Both the teacher’s personal vision and shared institutional vision are not considered as
mutually exclusive, and need to be aligned in order for sustained success - “a shared vision is a vision that many people are truly committed to, because it reflects their own personal vision” (Senge, 1990, p. 192).

5.3 Professional Growth Opportunities
The three teacher participants who were enrolled in the SUNY CET had great things to say about the programme, enhancing their knowledge and understanding of pedagogical approaches to using technology, and exposure to new tools. Yet very little of those experiences manifested in a change within their approach to using technology during the first year. But, the SUNY CET programme had a positive impact in giving the participants the opportunity to see how core institutional technologies were being modelled and the breadth of application, and thus allowed them to develop aptitude within those technologies, at a much faster pace than those participants which did not enrol into the programme.

In order to affect change within teachers’ beliefs, literature generally suggests that “experience, reflection, and support” (Ma, Y., Lai, G., Williams, D. C., & Prejean, L., 2000, p. 14) are considered. They go on further to suggest a practical approach to modifying teacher beliefs, for practitioners to “…observe other teachers’ technology integration experiences” (p. 14). Schools need to make sure that such opportunities exist for teachers, and to institute time for teacher self-reflection, which has been shown as an indicator for promoting change (Dexter, S. L., Anderson, R. E., & Becker, H. J., 1999).

5.4 Establishing a Culture of Support
These teachers faced immense pressures, not just from the transition to a new school, but in most cases a new city, teaching a new curriculum framework, technology integrated teaching and learning, and a new school culture, all of which compounded the challenges faced. As with most educational institutions, a comprehensive orientation programme was in place to assist the teachers with settling in upon their arrival and covered various aspects of living in Hong Kong (e.g. setting up establishing accounts, housing) and school life (e.g. reporting, attendance taking). The technology orientation is guided by a technology readiness checklist that is used to guide new teachers with the technology essentials at the school (e.g. access email, connecting to projectors etc). Specific aspects of the orientation programme which introduced teachers early on to school based technologies, and which was purported to be guided by school policy and direction, was later deemed as being something which the teachers could choose not to adopt. This resulted in mixed messages to the participants, ensuing confusion on expectations vs choice, and eventually resulted in an approach which was either determined or influenced by their departments, colleagues or personal choice. Arguably, there needs to be consistency in direction and messaging to staff, to ensure that There was unanimous agreement amongst the participants that access and availability of support was instrumental in them exhibiting a positive mindset to technology use. Ertmer (1999) provides a definition of “support” focusing on the administrative and technical dimensions, which are one of the key requirements of addressing first-order barriers to
technology adoption, and that often gets quoted in the literature on successful integrated technology programmes. However, little is mentioned of the fact that “support” in its true sense as required in technology rich environments, is multifaceted and not just limited the immediate technical nature of institution wide technology programmes.

The institutionalized support structures that the school had in place to support new teachers was reported as better than what experienced in previous schools where digital support was considered as being more disjointed and difficult to access. However, “follow-up support” which has been cited as a precursor to transformational technology integration practices was inconsistent (Ertmer, P. A., 2005). The participants spoke highly of the efficiency and ease of access to support staff, in addition to support from departmental colleagues. Where the support staff could not always provide immediate support due to the diversity of digital services at the school, they would always delegate queries and due to the structures in places, most queries were responded to in a timely manner. As the school year progressed, with people becoming preoccupied in their teaching routines, the teachers reported fewer trips to the digital service centre. These trips increased in frequency whenever a major deadline approached that involved the use of school based systems (e.g. reporting).

Participants agreed that generally too much information was disseminated into the initial orientation week for new staff, and some of what was covered (e.g. reporting) during the technology related orientation was irrelevant to their immediate and initial teaching days and weeks in the classroom. The fact that teachers could get timely and accessible support, mitigated some of shortcomings of parts of the orientation week. As discussed previously, the participants required a greater degree of technical and administrative support during the major school reporting periods, and thus their reflection on the orientation week was that it could be been structured better in order to not add to the overwhelming nature of their transition.

6. Summary and Recommendations

This research was conducted through a qualitative methodological framework, based on a case-study approach, with five newly appointed teacher participants. The levels of technology competency upon arrival at the school, varied between the participants, yet at the outset, technology never seemed to be the end goal for them. There was a strong voice of ensuring balance and purposeful use of technology in the classroom, with a focus on student learning. Emerging from the data is a strong relationship between the way teachers adopted an institutionally centralised technology, developed proficiency, and then progressed to thinking about personalisation. Rather than considering a systemic approach, the teachers would lean towards personalising their digital environments. Though this was very much a personal preference, and one which was diversely represented within the participant group, it was interesting to note the participants aligned this to how they thought students learned best. They preferred working with technologies which they had most control over, rather than ones which lacked the ability to control how information was presented to students.

Though much was established from this study, further research avenues could be explored. Future research may consider looking at how newly appointed teachers transition to new
environments, and how their private theories relate to the use of technology. Furthermore, research suggests that what teachers believe, and what they practice is not always consistent (Mama, M., & Hennessy, S., 2013; Chen, C.-H., 2008). Looking at this from the context of newly appointed teachers, and their private theories will help support research on technology mediated teaching and learning.

Practical strategies are needed to address teacher beliefs on technology integration. It would be of value to determine empirically supported professional learning models that could be used to address the broad range of teachers’ private theories. Furthermore, it would be of benefit to look at how schools can develop approaches to support teachers with their vision of technology integration, and align this to this shared institutional vision.

The findings from the study will add to the growing body of literature on teacher thinking and the integration of technology within learning environments. Moreover, such findings will provide policy makers with strategic direction on the approaches they should consider for teacher professional growth and support. A comprehensive adoption of expectations that are pedagogically aligned and clearly mapped to an organization's vision and culture, is required in order to provide direction and support for teachers’ integration of technology to support learning. Furthermore, it is anticipated that the findings will result in much needed discussion on re-aligning institutional support structures, policies and procedures with researched best practices on the pedagogical integration of technology to support the goals of student learning, whilst responding to the complexity of teachers’ private theories.

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Preparing Bilingual Teacher Candidates to Adopt Sociocultural Approaches to Mobile Learning

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Abstract

This paper is a cooperative inquiry into how teacher education faculty prepare preservice bilingual teachers to adopt sociocultural approaches to mobile learning (SAML) in their undergraduate field-based courses. This study provides insight into how teacher education faculty prepare their preservice teachers to use mobile learning to address the linguistic and cultural needs of diverse learner populations. The authors assert that SAML is not just a strategy but a belief that teaching is about empowering students, being responsive to their cultural and linguistic needs, and making learning relevant and authentic—and, mobile technologies can be used to support these strategies.

Keywords: sociocultural approach to mobile learning, culturally and linguistically diverse learner populations, teacher preparation

1. Culturally and Linguistically Diverse Learner Populations in the United States

Learner populations in public schools in the United States are becoming increasingly diverse, culturally and linguistically (Cohn & Caumont, 2016). Approximately 23% of the US population is from an ethnic/racial minority group with that number projected to become the majority within the next 50 years (Cohn & Caumont, 2016; U.S. Census Bureau, 2015). The US Census shows that 20% of its population speaks a language other than English at home. These changing demographics have a direct impact in the classroom. With this growing diversity, it has become important to prepare teachers to respond to the cultural and linguistic needs of all students by making learning authentic and relevant.

Historically, in the US, students from different cultural and linguistic backgrounds have been traditionally marginalized (Nieto, 2000). Jim Crow laws were implemented in the 19th to early 20th century in the US to segregate Black populations from White populations, which resulted in inferior services, such as education, for the former. In Texas, segregation also occurred based on students’ native language. Specifically, the English-only law (1918-1970) made it a criminal offense to teach in a language other than English (Blanton, 2007). These

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policies resulted in linguistic oppression of several generations of Spanish-speaking Americans whose schooling experiences included multiple instances of punishment for speaking Spanish. For educators to undo the institutional oppression of the past century, it takes significant amount of work. Critical educators have made a call to challenge curricular structures, processes, and discourses that continue to disregard minority children’s linguistic and cultural capital (Yosso, 2002). Specifically, educators are urged to challenge dominant ideologies by placing communities’ lived experiences at the center of the process of knowledge construction.

1.1 LCM@UTSA
Our university’s bilingual education teacher preparation program has been committed to preparing teachers to work with culturally and linguistically diverse (CLD) children. One initiative we have created to address the needs of CLD children is through La Clase Mágica (LCM), an after-school technology program that focuses on underserved areas of the local Latino community. Since its inception in 1983, LCM provided a space in which bilingual Latino children and their amigos [friends], undergraduate students or aspirantes [teacher candidates] collaborated in project-based endeavors (Vasquez, 2003). These informal learning environments provide a flexible space in which teacher education faculty can prepare their bilingual teacher candidates (BTCs) to be culturally efficacious educators. Digital literacy and technology integration are major components of LCM@UTSA. Specifically, mobile devices have been used throughout this program to engage children in critical 21st century learning skills. This paper investigates how teacher education faculty prepare their BTCs to adopt a sociocultural approach to mobile learning (SAML) to address the needs of their CLD learner populations.

2. Sociocultural Approach to Mobile Learning (SAML)
A sociocultural approach to mobile learning “promotes meaningful uses of mobile devices within formal and informal learning settings in order to bridge students’ school and class lives” (Prieto et al., 2015, p. 346). Mobile learning is used to bring students’ everyday lives into the classroom and vice versa. Its foundation is based on sociocultural learning theory, culturally responsive pedagogies, generative themes, and multiple contexts.

2.1 Sociocultural Learning Theories
Sociocultural theories provide a lens for studying literacy, learning, and development of culturally and linguistically responsive practices across a variety of contexts. In SAML, mobile technologies mediate and facilitate these processes across contexts. Sociocultural theories focus on learning as a socially mediated activity, and its view of language as the preeminent meaning-making tool links mind, language, and society (Vygotsky, 1978). By using language as a tool, people acquire knowledge in contexts that are culturally and socially
organized. The theory also emphasizes the importance of the relationship between the individual and their sociohistorical contexts (Wertsch, 1988). In sociocultural learning theory, learning occurs first in the interpersonal plane and then in the intrapersonal plane. Rogoff (2008) conceptualizes this principle as a process of apprenticeship whereby newcomers to a community acquire knowledge in interaction with more experienced others who scaffold their learning. A related concept is that of the zone of proximal development which is defined as the distance between what a novice can do by themselves and what they can do in collaboration with more expert others (Vygotsky, 1978). It is important to keep in mind that novice and expert roles are not static, but are dynamic and bidirectional, which means that adults can also learn from children. Another way to view this shift is one from margin to center—a perspective that attends to dynamics of power and privilege. As scholars of critical pedagogy point out, issues of power, control and privilege are central to understanding social dynamics and social practices (Darder, 1997; McLaren, 2015).

2.2 Culturally Relevant Pedagogies

Recently, teacher educators have promoted the need to infuse culturally relevant pedagogies into the CLD classrooms (Ladson-Billings, 2009). To meet this need, teacher education programs must prepare teachers to become culturally efficacious (Flores, Clark, Claeyys, & Villarreal, 2007) and responsive to the needs of their increasingly diverse learner populations (Gay, 2010; Ladson-Billings, 2009) rather than the traditional and historical deficit approaches to working with communities of color. Paris (2012) has expanded the notion of culturally relevant pedagogies by calling for a “culturally sustaining pedagogy” that focuses on practices that “support young people in sustaining the cultural and linguistic competence of their communities while simultaneously offering access to dominant cultural competence” (p. 95). Other culturally responsive approaches to embracing CLD students’ backgrounds, knowledge, and experiences include: funds of knowledge (González, Moll, & Amanti, 2005) where students’ home-based household knowledge and practices are embraced and utilized in the classroom; the work by Gay (2010) on “using the cultural knowledge, prior experiences, frames of reference, and performance styles of ethnically diverse students to make learning encounters more relevant to and effective for them” (p. 31); and culturally efficacious teaching (Flores et al., 2007) where teachers demonstrate a strong ethnic-cultural identity, critical reflection, self-determination, positive efficacy, sociocultural competence, and transformative teaching. Connections between CLD children’s home cultures and the pervasive school culture can be made through mobile devices. Mobile devices can empower students to critically examine their own worlds and become agents of change.
2.3 Generative Themes
Sociocultural learning and culturally relevant pedagogies rely on making learning relevant and authentic to students, which requires knowledge of students’ own culture, backgrounds, and everyday lives. A generative theme is a specific issue, topic, or word that emerges from student culture and is suitable for generating new discussions, inquiries, and actions. Shor (2012) emphasized the provocative nature of themes and their connection to unresolved social problems. A distinctive feature in sociocultural approaches to learning is the purposeful connection with issues and topics relevant to children’s lives. Freire (2004) suggested that an investigation of generative themes can genuinely occur through a methodology in which both, teacher educators and students explore, identify, and co-investigate critical issues in their context. This problem posing and project-based focus, is at the core of the multiple mobile learning after-school projects in which BTCs, teacher educators, and the community dialogue, investigate, and carry out culturally relevant, initiatives (Arreguín-Anderson, 2015; Prieto et al., 2015). From generative themes in SAML, students become agents of changes through the use mobile devices, which bring attention to the issues within their communities as well as possible solutions.

2.4 Multiple Contexts
Since students are inherently mobile, the type and number of contexts in which they interact with other people, surroundings, and tools is varied and complex. Students’ mobility across multiple contexts is key to the design of mobile learning activities. Sharples, Milrad, Sanchez, and Vavuola (2009) argued that “learning undertaken in one context, for instance informal discussions, can become a resource for other contexts, such as a seminar or a workplace” (p. 236). SAML strategies, especially those embedded within project-based approaches, provide opportunities to problem-pose and transform. Under a SAML approach, teacher educators are interested in the knowledge gained from interactions across multiple contexts. Mobile devices can facilitate in capturing codes or codifications of CLD children’s worlds. When students capture images of relevant people, objects, and events in their lives, they engage in situated learning. Kitchens (2009) argues that a situated pedagogy “attends to specific place, but this attention is not merely as the foci of discursive analysis or student inquiry, but as the spaces for action, intervention, and perhaps transformation” (p. 249). Therefore, mobile devices can potentially become a tool with which to gather evidence of problems identified wherever they may be.

2.5 SAML for Teacher Education
SAML facilitates CLD students’ academic development alongside their personal and cultural advancement and digital literacies/biliteracies development (Prieto et al., 2015). Teachers must be adequately prepared to integrate mobile learning in a way that is responsive to the needs of their students. Teacher education faculty play a crucial role in equipping bilingual teacher candidates (BTCs) with SAML strategies to work with CLD students using SAML.
This paper investigates how three teacher educators prepared their BTCs to incorporate SAML to address the needs of their CLD learner populations. The research question driving this inquiry was: How and why do teacher education faculty prepare BTCs to adopt sociocultural approaches to mobile learning?

3. Methods
This study followed a cooperative inquiry in which people, as participant-researchers, come together to engage each other in reflective and transformative practices on shared interests and experiences (Heron, 1996). Cooperative inquiry stimulates dialogue between participant-researchers as part of a reflective process, which leads to transformative actions and practices, which then leads to additional reflections and inquiry regarding the original topics. Heron (1996) notes that this process can be cyclical--meaning that the final reflection can lead to another iteration of cooperative inquiry.

3.1 Participant-Researchers
In this participant-researcher approach of cooperative inquiry, people are brought together based on their shared interests and experiences. Shared reflections and dialogues are important aspects of cooperative inquiry as one of the motivations is for researchers to learn from shared experiences and take action (Heron & Reason, 2006). This cooperative inquiry was self-initiated by the participant-researchers, who have collaborated as facilitators of after-school clubs used to engage CLD children. Authors have been working together on these after-school clubs for over seven years and engaged in ongoing dialogues about research design, teacher preparation, children’s bilingualism, biliteracies, and digital literacies as well as parental involvement. As digital literacies with CLD children are a recurring theme throughout these clubs, many of these dialogues have taken place within the context of sociocultural approaches to mobile learning with mobile technologies being the current platform for technology integration. The first author is an instructional technology faculty member who designed and facilitated technology integration in these after-school clubs, and served as the facilitator of this cooperative inquiry. The last three authors are faculty members who prepare BTCs and serve as the participant-researchers. And, it is their shared interests and experiences this study explores.

3.2.1 María G. Arreguín-Anderson
Dr. María G. Arreguín-Anderson is an Associate Professor of Early Childhood and Elementary Education at UTSA. Her research focuses on dyad learning and dialogue, mobile learning, critical science pedagogy, and the intersections of language and social justice. The courses in which Dr. Arreguín-Anderson has infused SAML as part of the instructional design include Approaches to Teaching Science and Language and Discourse Development in Early Childhood.
3.2.2 Lucila Ek
Dr. Lucila Ek is an Associate Professor in the Department of Bicultural-Bilingual Studies at UTSA. Her research examines Latinas’/os’ bilingualism and biliteracy within schools, homes, and churches. Dr. Ek teaches a course on language arts in bilingual programs to undergraduate bilingual preservice teachers that integrates sociocultural theories of learning and development including SAML in teachers’ fieldwork in after-school technology programs.

3.2.3 Patricia Sánchez
Dr. Patricia Sánchez is Associate Professor in the Department of Bicultural-Bilingual Studies at UTSA. In her research, Dr. Sánchez uses a sociocultural lens to examine issues related to globalization, transnationalism, and immigrant students and families. She teaches a course to undergraduate pre-service bilingual teachers where SAML is infused; this course integrates social studies, math, and science bilingual teaching approaches.

3.3 Instruments
A survey was used to gather data from the participant-researchers on how they approached SAML as part of preparing BTCs. As part of the cooperative inquiry, the participant-researchers came to a consensus on what types of questions should be asked of each other (Heron, 1996). Thus, all participant-researchers had input on the research question as well as the types of questions being asked before they completed the survey. The survey questions were:

• What is your philosophy in preparing bilingual preservice teachers to be responsive to the needs of culturally and linguistically diverse (CLD) learners in the 21st century?
• How have you implemented SAML into your preparation of BTCs? What was your rationale or justification for integrating mobile learning into your preparation of BTCs?
• What were the outcomes of the SAML activities on your BTCs and/or their students?
• What were the challenges in integrating culturally relevant mobile learning activities into your preparation of BTCs?
• What have you learned, as a teacher educator that prepares BTCs to work with CLD students, with regards to SAML?

Participant-researchers were instructed to write a 50-300 word response for each question in which they were highly critical and reflective of their practices.

3.4 Analysis
A general qualitative inductive approach was used to analyze the survey data (Thomas, 2006). In this analysis, the researcher closely reads through the entire text and then systematically codes each piece of data. Whereas general qualitative data analysis is usually more open, this coding process was more directly guided by the research questions. The first author, who was not a participant-researcher, analyzed the data using this general inductive
approach in the first pass, and then it was reviewed and revised by the participant-researchers. As a continuing part of the cooperative inquiry process, member checking and consensus building were automatically built in (Heron, 1996; Lincoln & Guba, 1985).

4. Results
Results are organized by the main topics of each survey question.

4.1 Philosophy in Preparing BTCs
The core theme was that the participant-researchers’ philosophies on teaching take a critical pedagogical stance in that they recognize the inequities, from their own experiences as Latina teachers and/or students, that CLD students face in this country. They view teaching as connected to the community rather than in a vacuum. As Arreguín-Anderson stated, “[M]y practices are grounded on the assumption that learning is a social activity, culturally-situated, and ultimately shaped by the uniqueness inherent in all individuals.” Similarly, Ek indicated that teacher preparation is about “providing pre-service teachers with tools with which to analyze language uses, choices, and ideologies both their own, their students’, and the larger society.” Knowing that there exists a digital divide in which minority children, particularly in low socioeconomic status areas, do not have access to technology, Sánchez tries “to prepare bilingual teachers that can bring the real power of the Internet and technology to their students—something that mainstream middle class homes in the US already do.”

Authentic learning was a recurring theme in which BTCs should teach students how to understand their own positionality and investigate how they can use their own cultural capital in their learning. For bilingual students, who are navigating their own bicultural identities, “it’s important for them to interrogate these language ideologies because they work with students and families whose languages and identities are stigmatized and devalued. They also come to see the inextricable link between their ways of speaking and their culture(s)” (Ek). The participant-researchers talked about the importance of listening to their CLD children’s voices and highlighted the need to value their cultural and linguistic backgrounds. They believed that mobile devices can be used as tools to mediate the connections between CLD children’s academic and home lives while also questioning broader societal issues and effecting change in their communities.

4.2 Implementing SAML into BTC Education
Implementing SAML resulted in projects that were contextualized within generative themes that spanned multiple contexts. The participant-researchers reported that SAML did yield projects that were contextualized within generative themes from the community (e.g., health, community garden, family), and spanned multiple contexts that connected academic topics to home life. A wide variety of SAML projects were implemented by the participant-researchers in which they had their BTCs work with children in LCM to create technology projects surrounding community issues using mobile apps. These projects included using mobile apps
for audio/video recording, constructing media presentations (e.g., fotonovelas), texting, and web searchers (Prieto et al., 2016). Both Arreguín-Anderson and Sanchez noted that inquiry-based and project-based approaches were influential frameworks supporting SAML since these approaches enabled students to ask and explore self-generated guiding questions that connected to their home lives.

The participant-researchers guided their BTCs to facilitate these types of self-generating questions. Arreguín-Anderson reflected that the “these projects resulted in preservice teachers’ deeper awareness of their role as cultural agents and brought to the table discussions related to implications of these projects to their practice as future educators. They concluded that connections between the academic curriculum and historically accumulated knowledge involves deliberate and systematic planning.” Ek stated that she “also push[es] teachers to develop their own and their students’ multiple literacies, multi-modal literacies, biliteracies, and digital literacies...The teachers are able to integrate mobile learning best in the LCM context and mobile learning is a part of the acquisition of digital literacies.” This approach allowed the BTCs to express their own sense of bilingual identity.

As language is an important aspect of one’s cultural and linguistic background, Sánchez noted that “Of course, all of these projects implemented Spanish, local cultural contexts and artifacts as well as bilingual expressions.” For example, students created multimedia presentations with their mobile devices in Spanish or English, depending on their own preference. Presentations often involved generative themes that were related to something within the students’ communities (e.g., community health issues, community garden). As Arreguín-Anderson pointed out, SAML needs for “academic curriculum” to be aligned to the funds of knowledge in the community.

4.3 Outcomes of the SAML Activities on BTCs and/or their Students
The participant-researchers reported that the implementation of SAML was successful in helping BTCs understand and appreciate their CLD children’s bilingualism and bicultural capital. Further, they reported that CLD children, under the mentorship of the BTC, self-generated themes and navigate between the multiple contexts as described by the SAML framework. The participant-researchers took pride in seeing the connections their BTCs made with the children in LCM@UTSA. The BTCs not only understood more about their CLD students’ backgrounds, but also their own home lives and communities. One of Arreguín-Anderson’s students stated la ciencia y las matemáticas se pueden encontrar donde quiera [science and math could be found everywhere]” and also said the use of “technology to connect with students’ prior knowledge is very important for today’s learner” and should be a required element in all lesson plans.’

The participant-researchers described how these SAML technology projects helped form these connections between the BTCs and their students in the LCM clubs. Arreguín-Anderson stated that “according to preservice teachers, mobile technology, specifically the use of iPads facilitated parental engagement in the context of this after school project and just
as importantly, mobile devices extended learning over time and physical space.” That is, in addition to spanning multiple contexts, SAML also extends learning over time—-not just within the allotted LCM time. In fact, Ek mentioned that “[the BTCs’] weekly field notes of their interactions with the children reveal that they learn how to integrate culture, technology, and play to develop the children’s bilingualism and digital biliteracies in Spanish and English. They learn to integrate technology in their design of learning centers for the traditional classroom.” BTCs are now considering integrating SAML into the formal classroom setting. Sánchez also reported one instance where a student stated that she plans to integrate mobile learning into her future classroom based on her experience as a BTC. One of Sánchez’s students recounted her experience during these SAML projects: “It is never a dull moment when I am with my group. I think they have enjoyed working on our project and I can’t believe how engaged they have been. My students are always eager and willing to try new things.” Such feedback from their BTCs shows that technology integration, particularly the mobile devices used, were engaging and relevant for the students. The outcomes that the participant-researchers reported showed that BTCs were successful in guiding their CLD children in SAML activities; they were able to self-generate themes while navigating multiple contexts. They noted that their BTCs saw the potential for creating authentic and meaningful learning opportunities for their CLD children through the use of mobile devices that purposefully infuse their funds of knowledge.

4.4 Challenges in Integrating SAML Activities
With any technology integration in a public classroom, there are always challenges that teachers and students face. Each participant-researcher focused on a different aspect of challenge. Both Ek and Sánchez described more of the logistical challenges of implementing SAML, such as: “access to wifi and certain Internet sites that the schools would otherwise block. That requires a lot of negotiation with the school and school district. Our first site for LCM was very responsive to our needs. But for every new school we work with, we have to go through this.” In order to use any technology that requires internet connection, there could be major problems with very strict firewalls. Ek also mentioned her own challenges in having to keep up with learning all the new technologies: “As a professor I don’t have enough time to learn or attend trainings on newer technology.” She suggests that teacher educators should have some release time “to push our learning to the next level,” which is poignant as technology integration and digital literacies are an important aspect of today’s education system. Sánchez also noted challenges with the limited storage on mobile devices as well as iOS devices not being able to display Flash-based applications. Arreguín-Anderson described the conceptual challenges of implementing SAML: “preservice teachers’ mobility of technology and mobility in physical space became integral parts of the course design. The expectation was that students would use a variety of mobile devices at their disposal and that they would explore physical spaces that were part of their daily routines in search of opportunities to connect with a given assignment. This was a challenge
because in traditional academic environments, learning is not dispersed over time or space. Assignments generally begin and end in a classroom or in front of a laptop/desktop computer at home.” Her concern brings up an important aspect related to the paradigm shift of what is learning: in SAML, learning spans multiple contexts, which blurs the boundaries of the classroom. Case in point, “when preservice teachers were asked to complete assignments that required exploration, connectivity, and focus on a given topic, they felt that the boundaries of their personal time/life and their academic responsibilities became blurred.” For both teacher education faculty and BTCs, this transformation requires a paradigm shift from the traditional teacher-centered classroom model of education to one that is more open and responsive to the needs of CLD children. Based on the technical challenges reported by Ek and Sánchez, teacher education faculty also are continuing to learn new technologies, integration strategies, and ways to mediate the challenges of integration. Therefore, lifelong learning is not just an essential part of 21st century learning for the BTCs and CLD children, but also the teacher education faculty who use SAML.

4.5 How SAML has Informed Identity and Practice for Teacher Educators

As teacher educators, the participant-researchers recognize the value that SAML brings to CLD students. As their responses show, SAML only re-affirms as well as strengthens their beliefs in sociocultural approaches to learning and teaching. Implementing SAML has also informed their own identity as teacher educators in having them reflect on how, when, and where learning actually occurs. Sánchez said that she has “learned that any teaching and learning that we expect bilingual pre-service teachers to carry out must indeed include socio-cultural approaches [SA]. SA does not stop in language arts, in math, in science, or social studies---so why would it stop when you work with mobile devices or technology?” Ek echoes this sentiment: “I’ve learned about the need for projects that incorporate mobile learning because it can develop children’s bilingualism and biliteracy in ways that are key to empowering them as digital literates, particularly when children don’t have access to newer technologies.” As a science teacher educator, Arreguín-Anderson compared the exploratory nature in SAML to inquiry-based learning in science education: “I have learned that SAML is closely congruent with an inquiry science approach that is centered on explorations and conversations in multiple contexts. In this sense, it is important for teacher educators to infuse the instructional design with opportunities to use mobile devices as learning tools both in and out of the classroom.” The participant-researchers talk about learning in both formal and informal environments with mobile learning having a role in both (concurrently or separately). Arreguín-Anderson summarizes this goal of SAML as “it is important to embrace mobile learning, not necessarily as an additional approach, but as a tool to promote learning possibilities anytime, anywhere.” Lastly, the participant-researchers value and recognize the need for CLD students to develop their digital literacies, which could be applied across academic areas. Sánchez models these
technology integration strategies with her own BTCs: “[E]ach semester, my pre-service bilingual teachers are more and more technologically inclined: they prefer texting over email; they come to class with their own mobile devices. This means that the professional and working relationships that I establish with my students necessitates “SA” that are one-click away. I use text-based apps to maintain and strengthen our communication; I use emoticons to offer encouragement; I tweet their accomplishments in local districts’ Twitter feeds.”

5. Discussion

The purpose of this cooperative inquiry is to discover how and why do teacher education faculty prepare BTCs to adopt sociocultural approaches to mobile learning in teaching culturally and linguistically diverse populations. There are three main themes as to how and why teacher education faculty implement SAML in teacher preparation: 1) strong identity rooted in social justice and mobile devices can be used to empower CLD children, 2) engaging CL children in authentic learning that supports generative themes through multiple contexts, and 3) mobile devices support essential 21st century skills.

5.1 Strong Identity in Social Justice

Integration of SAML begins with a strong teacher identity rooted in social justice. The teacher education faculty exhibit a critical consciousness (Freire, 2003) that permeates through their beliefs and practices as they advocate and empower CLD children from marginalized groups. A strong identity in which educators understand and respect ethnic and cultural identities of their CLD children is an essential component to being culturally efficacious (Flores et al., 2007) and responsive (Gay, 2010; Ladson-Billings, 2009). As Latinas, the teacher education faculty have developed a critical consciousness in which they are deeply aware that students from minority and low socioeconomic populations receive less or inferior resources and opportunities. They adopt a critical pedagogical approach to empower their students to challenge the status quo by bringing up issues within their own communities while also embedding the required academic skills (Freire, 2003). They guide BTCs to develop the same strong identity rooted in social justice and critical consciousness in working with CLD children. As part of being culturally efficacious, the teacher education faculty view mobile devices as a platform through which CLD children can learn more about their own environments both in and out of the classroom, problematize their realities, dialogue with others, and take action.

5.2 Authentic Learning

Teacher education faculty believe in sociocultural learning which is based on situatedness and language as a mediating tool. The participant-researchers shared a common philosophy of learning and teaching based on sociocultural theory: learning is situated and interactive, and that mobile devices support all the tenets of this theory. Above all, learning is authentic and should have an impact in CLD children’s everyday lives Mobile learning supports this
approach through facilitating the creation of generative themes (Arreguín-Anderson, 2015; Prieto et al., 2015; Shor, 2012). Faculty believe that mobile devices allow students to become even more situated about their environment by learning more about their immediate contexts. Ultimately, the integration of SAML is deliberate and purposeful in drawing from the cultural and linguistic capital present in their communities and their home while infusing it with academic topics from the classroom.

5.3 Essential 21st Century Skills
Teacher education faculty recognize the need for mobile learning as part of 21st century learning. They align their objectives with the knowledge and skills associated with 21st century learning (Partnership for 21st Century Skills, 2009) and living in a digital society. As examples, CLD children were able to critically think about community issues through the data gathered with their mobile devices, create media-rich projects using a variety of apps and media captured through their mobile devices, and communicated their findings both face-to-face and electronically to their BTCs and families wherever at school or home. The teacher education faculty in this study found that mobile devices were effective in addressing the needs of CLD children. In terms of communications, the artifacts generated with the mobile devices were created using any language the students were most comfortable using (i.e., in English or Spanish). Further, mobile devices allowed for various forms of communication, such as texts, images, and videos that students created and shared. BTCs reported to the teacher education faculty that the CLD children surpassed their expectations in learning how to use the mobile devices, which showed they were engaged in lifelong learning of skills needed to use information-communication and mobile technologies.

5.4 Summary
Incorporating SAML into teacher preparation begins with the teacher education faculty’s own identity and philosophy of teaching and learning. The recurring theme across the participant-researchers’ responses for all questions is a strong belief in empowering CLD students to take charge of their own learning and become agents of change in their communities. Several years of using mobile devices in LCM have re-affirmed their own beliefs that mobile devices can be used to equip BTCs with pedagogies that are sensitive to the local context and that address the linguistic and cultural needs of their diverse learner populations in the 21st century.

6. Conclusion
This paper provides useful insight on how mobile learning can become part of formal teacher education in the 21st century. Though these SAML activities were implemented in after-school clubs, they can also be used in regular classroom environments where the same objectives can be addressed in pre-established curriculum. In fact, participating LCM children who were involved with SAML activities demonstrated better mastery of the related
state standards for science in comparison to children who did not participate. Because these after-school clubs were held in public schools, the experiences and challenges described by the participant-researchers may be applicable to SAML in a formal classroom environment. This collaborative inquiry investigated how teacher education faculty prepared bilingual teacher candidates to use sociocultural approaches to mobile learning in culturally and linguistically diverse elementary learner populations. The findings show that SAML is not just a strategy but a belief that teaching is about empowering students, being responsive to their cultural and linguistic needs, and making learning relevant and authentic through mobile technologies. Teacher education faculty and teacher candidates must share these same beliefs and goals in order for SAML to be successful with CLD students.

Acknowledgements:

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References


On models of openness in education

Christopher C. Tisdell

Abstract

Motivated by the need for more clarity in openness in education, this paper aims to add to the theoretical basis that underpins our ideas of openness. A range of simple models for openness are introduced together with some critical perspectives regarding them. The discussions are grounded within the theories of: scientific model building; semantics; and logic. In particular, we advocate for the importance of simple approaches to modelling openness based on the theoretical approach of Occam’s razor and Box’s aphorism “All models are wrong, but some of them are useful”. We see that relativity has an important role to play in the modelling openness and call on scholars interested in the application of these models to continue testing them in various situations.

Keywords: Models of openness; digital education; ebooks; clopen; critical perspectives

1. Introduction

The notion of openness in education emerged in the 1950s and 1960s (Paul, 1993, p114), and openness appears to have “no shortage of definitions” (Rumble, 1989, p29). Consequently, and paradoxically, the term “eludes definition” (MacKenzie et al, 1975) through misinterpretation and misuse within educational contexts and, more broadly, in social, economic and political environments. For example, Rumble (1989) shows how the term openness “is capable of a range of interpretations using criteria related to access, place and pace of study, means, structure of the learning programme and the support services provided” (Lewis, 1990, p3).

Over 40 years after the work of MacKenzie et al (1975) we still lack clarity regarding openness. For instance, recent literature argues that the field of openness remains under-theorised (Knox, 2013, p882) and sub-scrutinised (Bayne et al, 2015; Edwards, 2015) despite the recent rise in the popularity of open education in digital forms, such as Open Educational Resources and MOOCs.

Motivated by the need for more clarity in openness in education identified in the aforementioned works, this paper aims to add to the theoretical basis that underpins openness. A range of simple models for openness are introduced together with some critical perspectives regarding them. The discussions are grounded within the theories of: scientific model building; semantics; and logic. A key argument herein is to appeal to the work of the

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statistician Box (1979, p2) and his aphorism “All models are wrong, but some of them are useful” in establishing and critically evaluating our models. In particular, we advocate for the importance of simple approaches to modelling openness based on the theoretical approach of Occam’s razor.

Indeed, our models serve as mere estimations to reality, guided by the mathematician von Neumann’s principle that “truth...is much too complicated to allow anything by approximations” (von Neumann, 1947).

In discussing and scrutinising our models, we thus aim to illuminate our understanding of openness and to identify useful elements of the theory, rather than pursuing absolute accuracy and truth in the models.

To make the theoretical discussions herein concrete, a model is applied within the context of a series of free, popular, multimedia etextbooks. In particular, we see that relativity has an important role to play in modelling openness.

2. Models of openness

In this section, we present a range of models regarding openness in education. The theoretical basis is that “All models are wrong, but some of them are useful” (Box, 1979, p2) and we advocate for the importance of elementary models in openness despite their inherent limitations. For a given model, Box elaborates through the reasoning “For such a model there is no need to ask the question ‘Is the model true?’ If ‘truth’ is the be ‘the whole truth’ the answer must be ‘No’. The only question of interest is ‘Is the model illuminating and useful?’” (Box, 1979).

Thus, the approach begins in very simple terms and moves to slightly more complex models. Critical perspectives are provided along the way by identifying benefits and limitations.

2.1. Binary opposition approach

A system of thought is labelled as binary if it is only composed of two, mutually exclusive parts (Elbow, 1993). In logic, this is known as the law of the excluded middle, that is, no third possibility is given.

Ferdinand de Saussure defines binary opposition as the “means by which the units of language have value or meaning; each unit is defined against what it is not” (Fogarty, 2005).

One approach to binary opposition in the context of education assumes the terms open and closed are opposite in meaning and cannot occur simultaneously. In probability theory we call them mutually exclusive. There is no third alternative – either a system is open, or it is closed.

We may describe this through the binary model:

\[ 0 = \text{closed}; 1 = \text{open}. \]

A more logically precise approach that is a better fit with Saussure’s definition “each unit is defined against what it is not” is to appeal to the work of Derrida (Fogarty, 2005) by introducing the negation of the terms open and closed, instead of interpreting them as opposites. Thus, we can form binary models using the terms: open and not open; or closed and not closed to form the following:
Benefits of the above binary models involve their simplicity in the style of Occam’s razor, that is, they form simple and evocative models (Box, 1979). All education systems and artefacts fit into one of two categories. If something does not fit into one category, then it must fit into the remaining category. We conclude that these binary models appear reasonably simple to apply.

One of the limitations embedded within these binary models is that there may indeed be a third case to consider. That is, rather than an either/or situation of open / closed, there may be at least one additional option, say, a system that is partially closed and partially open, like a door that is ajar (Weeks, 2017).

Another limitation of these binary models involves bias, where one side is privileged over another. For instance, because of the ordering of numbers in mathematics, there may be a tendency to privilege 1 over 0 by valuing something over nothing.

In addition, only employing an open / not open binary model and excluding a closed / not closed model could be interpreted as favouring openness (and vice versa). If we acknowledge Derrida’s lines of employing negation with that of Saussure’s opposition, then we raise the possibility of forming a quaternion model: open / not open / closed / not closed.

### 2.2. Graded antonym approach

This approach assumes there is a continuous, graded spectrum between open / closed and closed / not open. This is analogous to the colour spectrum being represented with shades of grey lying between black and white.

#### 2.2.1. Bounded and graded approach

In this approach, we assume the open-closed spectrum is bounded (say, between 0 and 1). Zero represents total closedness (in the absence of any openness); and 1 represents complete openness (in the absence of any closedness). Positioning an educational artefact at $A$ on the interval, which is to the right of an educational artefact $B$, would signify $A$ has more openness than $B$, see Figure 1. Thus, we can see the importance of relativity through this approach.

![Figure 1. Bounded, graded model of openness](image)

One advantage of this model is that its spectrum avoids an either/or situation of open/closed by accommodating the in-between cases. This model theoretically retains some of the binary thinking of our previous models by assuming the extremities of absolute closedness and total openness at the end of the interval are achievable (0 and 1, respectively). However, this is also a limitation, as recognised by Paul (1993) that “educational provision could not be
completely open in all its aspects for practical, economic and educational reasons.” (Edwards, 2015, p254)

2.2.2. Unbounded and graded approach
In this model, our interval is unbounded and infinite in length. Similar to the bounded and graded approach, the continuous spectrum is retained; however, *pure* openness and *pure* closedness are unachievable and are thought of as merely symbolic ideas. This is similar in thought to the idea of infinity and negative infinity with respect to a number line, which we can never reach.

![Figure 2. Unbounded, graded model of openness](image)

This model moves away from complete openness and complete closedness, representing them as only an imaginary situation that cannot be reached. In doing so, it serves as yet another useful reminder of the recognition of Paul (1993) that “educational provision could not be completely open in all its aspects for practical, economic and educational reasons” (Edwards, 2015, p254).

One limitation of this model concerns the orientation of these intervals. In scientific models, moving from left to right is the norm, for instance, time moves forward from left to right. As we move from left to right on the number line, the (positive) numbers dominate those to their left. When we examine the orientation in Figures 1 and 2, there may be privileging of the left-right orientation, with those “to the right” (more openness) favoured over those “to the left” (more closedness).

2.3. Model of Clopenness
In this model we extend openness and closedness to two dimensions. We call this a *model of clopenness*, with the term *clopen* signalling that open and closed properties may (or may not) both be present. Rather than restricting our thinking along the lines of Edwards (2015) where openness and closedness are claimed to be necessarily interwoven: “all forms of openness entail forms of closedness” (Edwards, 2015, p253); we consider these as two independent variables, see Figure 3.
Figure 3. A model of clopenness

Figure 3 explores variations in the presence and absence of openness and closedness through a range of quadrants. We make the semantic assumptions that open and not closed are not the same in meaning (and similarly with closed and not open).

It is interesting to consider what happens at the boundaries of the rectangle in Figure 3. For example, we can speak of highly open and highly closed educational systems, placing them in the upper right hand corner of the rectangle in the first quadrant. In addition, specific educational artefacts may be slightly open and slightly closed, placed closer to the origin in the same quadrant.

The inclusion of the not open and not closed quadrant (ie, the third quadrant) raises an interesting theoretical question: Are there systems that are neither open, nor closed in education?

Similarly, the second quadrant in Figure 3 could represent open and not closed systems.

As we can see from the above discussion, benefits of this system include its potential to generate a range of discussions regarding our understanding and concept of openness.

On the other hand, one of the limitations in this abstract model is in its multidimensional nature, for as Box (1979) puts it: “overelaboration and overparametrization is often the mark of mediocrity”. This is based on the idea that due to simpler models being wrong in the first place, no amount of excessive abstraction will create a correct one.

3. Are the models useful?

Let us now consider some specific examples of educational artefacts under one of our models on openness.

The etextbooks by the author (Tisdell, 2013; 2014; 2015) share some commonalities regarding openness. For example, the PDF format and associated YouTube videos are common features to all. Readers are not charged money for downloading any of these
etextbooks from the internet. Thus, the argument may be made that these artefacts are more open than, say, etextbooks that readers must pay for.

There are, however, some differences that are interesting to explore in the context of openness. For example, the publication (Tisdell, 2015) has embedded instructional videos that feature dedicated closed captions (not to be confused with closed in the sense of this paper). This feature differentiates it from the works (Tisdell, 2013; 2014), whose videos do not have this element. The captioning enables learners to watch the videos in noisy places, or may appeal to those who are non-native speakers of English. Thus, the claim is made that the captions embed more openness in (Tisdell, 2015) than the other two etextbooks.

Based on above discussion, we may represent the openness of these works relative to each other in Figure 4. Note that: $A = (\text{Tisdell, 2013})$; $B = (\text{Tisdell, 2014})$; $C = (\text{Tisdell, 2015})$; and $D = \text{a “for sale” etextbook without captions}$.

![Figure 4. Openness of etextbooks](image)

Once again, we see the importance of relativity in Figure 4.

### 4. Conclusion

Motivated by the concept of open education being under-theorized, in this article we introduced and critically discussed a range of models for openness in education. The discussions were grounded within the theories of: scientific model building; semantics; and logic.

In establishing and then critically evaluating models of openness in education, we appealed to the work of the statistician Box (1979, p2) and his famous aphorism “All models are wrong, but some of them are useful”.

Provided we do not ignore the limitations and biases of basic models, we advocate for an Occam’s razor approach regarding the modelling of open education. Indeed, we accept that our models are wrong, however simple models can still be useful for providing illuminating views of openness in education. In addition, these models add to the debate on our understanding of the essence of openness in education and to identify gaps in our comprehension.

We invite scholars interested in the application of these models to continue testing them in various situations. While all models are wrong, a practical question is “how wrong do they have to be in order not be useful?” (Box, 1987). In addition, “Models should not be true…never finally accepted, only on trial” (Rausch, 1960, pp37-38). Thus, we see benefits in scholars “ranking models from very useful, to useful, to somewhat useful, finally, essentially useless” (Burnham and Anderson, 2002) in open education.
References


SPOC with Game Based Learning of Project Management

Richard W. C. Lui¹ and Y. C. Kong²

Abstract

There is a growing interest in the use of educational games in teaching and learning in recent years. This paper presents a small private online course (SPOC) for an undergraduate project management course with the use of a simulation game as learning activity. A set of animated video are created to supplement the learning with a project management simulation game. The effect of using animated videos during the debriefing session on students is studied. A focus group session is conducted to study the students’ learning experience with the game and the impact of the animation during the game based learning process.

Keywords: SPOC, Game Based Learning, Educational Animation, Project Management

1. Overview

Traditional lectures only allow students to learn passively (Griffin and Cashin, 1989) and it may be difficult to ensure the students have acquired the knowledge and able to implement what they have learnt (Abedi, 2011). There is a growing interest in the use of using educational games in teaching and learning in recent years (Deterding et al., 2011; Freire et al., 2014). Studies have shown that game-based learning can reinforce the students’ knowledge (Navarro & van der Hoek, 2007) and increase students’ engagement and learning motivation (Rosas et al., 2003; Williamson, 2009). Successful management of software projects requires theoretical project management knowledge as well as practical experiences. However, many of the students (in particular undergraduate students) do not have project related work experience. As a result, it is more difficult for them to connect the knowledge they learn in class to real world projects management practices. Simulation based training provides students with a hands-on approach to explore the complexity of managing projects through rapid and inexpensive experimentation. PMS is a computerized simulation game that helps students acquire quasi-experience of management in software projects (Lui et al., 2015a; Lui et al., 2015b). There are two game scenarios in PMS. The time attack scenario requires students to make

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management decisions to complete the project as early as possible. The normal scenario requires students to balance between time, scope, morale and stakeholders’ satisfaction. Screenshot of the game is shown in Figure 1 and the major learning objectives of the game are summarized in Table 1.

![Figure 1. PMS Game Screenshot](image)

**Table 1.** Major learning objectives of PMS game

<table>
<thead>
<tr>
<th>Knowledge Area</th>
<th>Learning Objectives</th>
</tr>
</thead>
<tbody>
<tr>
<td>Time Management</td>
<td>The player should identify and manage the project’s critical path to shorten the project duration</td>
</tr>
<tr>
<td>Human Resources</td>
<td>The player should understand ways to maintain team members’ morale, teamwork, and project knowledge to increase productivity.</td>
</tr>
<tr>
<td>Management</td>
<td>The player should analyse stakeholders’ requirements and expectation on the project, and to communicate with them timely and proactively.</td>
</tr>
<tr>
<td>Scope Management</td>
<td>The player should select appropriate requirements for project implementation based on stakeholders’ requirements and the availability of time and resources.</td>
</tr>
<tr>
<td>Stakeholder management</td>
<td>The player should understand ways to maintain good flow of project information among team members and stakeholders</td>
</tr>
</tbody>
</table>

In recent decades, there has been significant development in massive open online courses (MOOCs) (Shah, 2015). Small private online courses (SPOCs) emerge as a combination of MOOCs and traditional teaching (Fox, 2013). SPOCs limit the number of
learners and have a higher flexibility in mapping the course in small class. SPOCs also facilitate flipped classroom approach (Talent Development Magazine, 2015). Students are required to review the lecture materials at home and then come to class to participate in-class activities like group discussions and case studies (Hughes, 2012; Bishop & Verleger, 2013). Students, as a learner, are able to learn the concepts of the course and doing quizzes at their own pace (Seaton et al., 2013). Some recent studies showed that SPOC can improve students’ understanding and performance on learning (Zappe et al., 2009; Jinlei & Baohui, 2013), increase interaction in class (Xu et al., 2014) and promote active learning (Huang et al., 2016).

This paper presents a SPOC to supplement the game-based learning of project management with PMS. A set of interview and animated videos are produced to discuss the project management concepts and demonstrate good project management practices in real world. The content of the animated videos is aligned with the learning objectives of PMS. A study is conducted with a group of undergraduate students in a project management course at Hong Kong Polytechnic University to investigate the use of the animated videos to scaffold the game based learning process. Debriefing sessions are performed during the game based learning session to help student connect the game to the learning objective of the game. The students in different lab sessions are assigned into two groups: Verbal debriefing and animated videos (Group 1) or Verbal debriefing only (Group 2). The students’ perceived usefulness, attitude, behaviour intention to use, and the perceived learning outcome of the game based learning exercise are evaluated with post-game questionnaire. The students’ game performance among the two groups are also compared.

This paper is organized as follows. In section 2, related studies on SPOC, game-based learning, animation design and research model will be introduced. In section 3 and 4, research methodology, including SPOC design, teaching experiment and research results will be examined. In the last section, summary and future research will be discussed.

2. Literature Review

2.1 Prior Knowledge and Debriefing in Game Based Learning
Some studies have found that learner’s prior knowledge and learning strategies would affect learners’ flow experience, learning outcomes and cognitive load (Shen and Chu 2014; Baek et al., 2015) and positive effects on declarative knowledge and affects students’ game performance (Chen & Huang, 2013). Apart from that, debriefing also takes an important role in game-based learning to help learners what was learned and how that learning can be connected to previous learning and experience (Nicholson, 2012). A recent study investigates the effect of different debriefing strategies in terms of grouping (self vs. team) and timing (in-game vs. post-game). The study demonstrates that in-game debriefing is better than post-
2.2 Animation for Education

Animation can be used to visualize abstract concepts and complex examples (Lowe & Schnotz, 2008). Some studies reveal that learning with animation is easier when learning dynamic subject matter and difficult concepts (Pedersen, 2011), for example, in electronics (Gero et al., 2012) and business studies (Etim et al., 2016). Animation provides a clear presentation and attractive interface and students may find it more interesting to learn the subjects (Hwang et al., 2012; Rosen, 2009). In addition to that, animation is intended to support students’ cognitive processes that ultimately results in improving their educational effectiveness (Mayer & Moreno, 2002). Recent research also shows that animation has effectively improved students’ academic performance (Madar & Hashim, 2011).

In animation creation, writing script is an important step in story design to demonstrate the plot of the story. After creating the plot, characters and storyboard, animation can be created by following the storyline (Mou et al., 2013). Another important element in a story is character. Strong characters can make a weak story tolerable and a good story better. The story is like a puzzle which should connects everything together, including plot, background, characters, script, movements and props, etc. (Wells, 2007; Beiman, 2012).

Lee (2013) suggests that making a 5-minutes video will be the best practice. In a survey based on students’ perception about the willingness of watching a long video, less than 40% of the interviewees would accept the video is less than 10 minutes (Wagner et al., 2013). Therefore, the video length of each clip should be less than 5 minutes in order to maintain students’ engagement in active learning. The content in each video should also be clear and concrete, include real-world context, use an active approach, make it interactive and link to the course (Andrade, 2016).

2.3 Technology acceptance model for Game based learning

Technology Acceptance Model (TAM) is used for analyzing the behaviour intention and outcome in adopting a particular technology (Ramayah & Ignatius, 2005; Davis et al., 1989). Based on users' perceived ease of use and perceived usefulness, their intent to use and actual use of the technology is predicted (Brown & Charlier, 2013). Some recent researches demonstrate that TAM can be used to investigate students’ technology acceptance of game-based learning (Cheng et al., 2013; Giannakos, 2013; Cheon, 2015). The result reveals that the association between different constructs are positive and statistically significant.
3. SPOC Design

3.1 SPOC Structure

Our SPOC consists of 5 modules, including “Overview of Project Management”, “Project Monitoring and Control”, “Project Risk Management”, “Interview with Project Management Professional” and “Project Management Case Study”. For each module, students can check their understanding by answering questions and interact with other students by joining the discussion forum. Animated videos for the various project management knowledge areas are created using GoAnimate (Stratton et al., 2014). The concepts and knowledge introduced in the videos are aligned with the learning objectives of PMS. In “Overview of Project Management” module, project management concepts, such as triple constraint and stakeholders, are introduced. While in “Project Management Case Study”, a set of story-telling animated videos are used to illustrate how project management knowledge can be applied from project initiation to project completion in an IT project. In addition, an interview video with project management professional is created and made available in the SPOC to discuss the various project management concepts issues related to PMS. The interview video aims to help students gain insight into how project management knowledge can be applied in the real world. Screenshots of our SPOC is shown in Figure 3-6.
3.2 Animated Video Design Process

Figure 7 shows the design process for our animated videos. Based on the various learning objectives of the PMS game, we first identify the project management knowledge and concepts that should be covered by the animated videos. Examples include project trade-off between triple constraints (time, scope and cost), importance of managing critical path to shorten project duration, stakeholder identification with stakeholder power/interest grid, requirement prioritization, common communication channels in projects (E.g. meetings, status reports) and project change control. The concepts can provide the background knowledge for understanding the various decisions and events that may happen in PMS in order to facilitate students’ decision making in the game. Next, we design the storyline and the characters in the animated videos. Characters are an important element in animation. Strong characters can make a weak story tolerable and a good story better. Audience can easily recall the story by remembering the characters. After that, a storyboard will be drawn to visualize the scenes. The scenes will be connected to show the whole picture of the animation. We also need to design the background, characters and props for every scene. Then, we write the script for the characters and narrator for delivering the project management concepts and knowledge. After that, we make use of GoAnimate for implementation of the animated videos. The created animated video and the script will be reviewed and refined multiple times to improve the clarity and the interestingness of the animation.
Figure 7. Animation Design Process

4. Teaching experiment

4.1 Methodology
The process of game based learning is shown in Figure 8.
1) Pre-Game Self-Learning: Students watch the animated videos before the game based learning session.
2) Game Play (Time Attack Scenario): Students play the time attack scenario in PMS for around 45 minutes. They may play the game multiple times to improve their game score.
3) Post-Game Debriefing (Time Attack Scenario): A 10-minute post-game debriefing session is held to review the lessons learnt in the game.
4) Game Play (Normal Scenario): Students play the normal scenario in PMS for around 45 minutes. They may play the game multiple times to improve the game score.
5) Post-Game Debriefing (Normal Scenario): A 10-minute post-game debriefing session is held to review the lessons learnt in the game.
6) Post-Game Survey: After the game play, students complete a post-game survey for the game based learning session.
7) Learning after Class: Students can continue to play the game to further improve their game score after class. They can also watch the animated and interview videos in SPOC to connect the game play experience with the project management knowledge and concepts.

Figure 8. Process of game based learning
Students in tutorial sessions are assigned into two groups, Verbal debriefing and animated videos (Group 1) or Verbal debriefing (Group 2). Post-game survey includes items for students’ perceived ease of use of the game, perceived usefulness of the game-based learning, attitude towards game-based learning, behavioral intention to use, and the perceived learning rating as “5: Very Good”, “4: Good”, “3: Medium”, “2: Poor”, and “1: Very Poor”. The questionnaire and construct for group 1 is shown in Table 2. The questions for group 2 is same as group 1 except that we exclude the word animation.

4.2 Results

75 students from an undergraduate project management course from Faculty of Engineering at Hong Kong Polytechnic University have learnt with the PM game in tutorial sessions around two-third of the semester. The respondents consist of 57 male students (76%) and 18 female students (24%). There are 52 students (69.3%) in group 1 (verbal debriefing with animation) and 23 students (30.7%) in group 2 (verbal debriefing). The survey results are summarized in Table 3. Overall, the students perceive that the game-based learning and debriefing section is useful (m=4.00, sd=0.68), positive towards learning with the game (m=4.11, sd=0.62) and learning outcomes (m=4.00, sd=0.49).

The post-game survey results and students’ game performance of the two groups (Verbal debriefing with animation vs verbal debriefing) are compared in Table 4. Two-sample independent t-test shows that there is a significant difference in the perceived learning outcome (LO) between group 1 (m=4.08, sd=0.51) and group 2 (m=3.82, sd=0.41); t(73)=2.22, p=0.03. Students in group 1 (verbal debriefing with animation) have significantly higher perceived learning. The students in group 1 also have more positive attitude towards game-based learning but the difference is not significant. The difference between the average highest game score achieved in time attack and normal scenario (out of 100) by the students in the two groups is also not significant.
<table>
<thead>
<tr>
<th>Constructs</th>
<th>Question Items</th>
<th>References</th>
</tr>
</thead>
<tbody>
<tr>
<td>Perceived Ease of Use</td>
<td>• The game is easy to use</td>
<td>Park (2009), Davis (1989), Ramayah, and Ignatius (2005)</td>
</tr>
<tr>
<td></td>
<td>• Using the game to learn project management knowledge is easy</td>
<td></td>
</tr>
<tr>
<td>Perceived Usefulness</td>
<td>• The game enhances my project management knowledge</td>
<td>Park (2009), Davis (1989), Ramayah, and Ignatius (2005)</td>
</tr>
<tr>
<td></td>
<td>• Debriefing with animation helps improve my game performance</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Debriefing with animation is useful for learning project management concepts behind the game</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Overall, the game is useful for me to learn about project management</td>
<td></td>
</tr>
<tr>
<td>Attitude Toward Using</td>
<td>• I am positive toward learning with the game</td>
<td>Park (2009), Davis (1989), Ramayah, and Ignatius (2005)</td>
</tr>
<tr>
<td></td>
<td>• Interacting with the game is fun</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• I enjoy learning with the game</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• I enjoy learning with animation during the game debriefing session</td>
<td></td>
</tr>
<tr>
<td>Behavioral Intention to Use</td>
<td>• I would like to play the game after today’s class</td>
<td>Park (2009); Lee, Yoon, &amp; Lee (2009); Davis (1989) Ramayah &amp; Ignatius (2005)</td>
</tr>
<tr>
<td></td>
<td>• I would like to learn with the game in the future</td>
<td></td>
</tr>
<tr>
<td>Learning Outcome</td>
<td>The experience of project management game help…</td>
<td>Hamari (2016)</td>
</tr>
<tr>
<td></td>
<td>• acquire better understanding of project definition, project characteristics and project life cycle</td>
<td></td>
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<tr>
<td></td>
<td>• establish my ability to identify project variables (e.g. cost, time…) and adopt appropriate practices for project success</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• prepare me for project planning, cost/resources estimation, evaluate and monitor project progress in future</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• establish my ability to propose project management solutions for different project objectives and project constraints</td>
<td></td>
</tr>
</tbody>
</table>
### Table 3. Descriptive statistics of the post-game survey results

<table>
<thead>
<tr>
<th>Construct</th>
<th>n</th>
<th>Mean</th>
<th>Standard Deviation</th>
<th>Cronbach’s Alpha</th>
</tr>
</thead>
<tbody>
<tr>
<td>Perceived Ease of Use (PE)</td>
<td>75</td>
<td>3.78</td>
<td>0.76</td>
<td>0.72</td>
</tr>
<tr>
<td>Perceived Usefulness (PU)</td>
<td>75</td>
<td>4.00</td>
<td>0.68</td>
<td>0.84</td>
</tr>
<tr>
<td>Attitude towards using (AT)</td>
<td>75</td>
<td>4.11</td>
<td>0.62</td>
<td>0.74</td>
</tr>
<tr>
<td>Behavioral Intention to Use (BI)</td>
<td>75</td>
<td>3.85</td>
<td>0.72</td>
<td>0.73</td>
</tr>
<tr>
<td>Learning Outcome (LO)</td>
<td>75</td>
<td>4.00</td>
<td>0.49</td>
<td>0.83</td>
</tr>
</tbody>
</table>

### Table 4. Post-game survey results and game performance across groups

<table>
<thead>
<tr>
<th>Construct</th>
<th>Group 1</th>
<th>Group 2</th>
<th>t</th>
<th>df</th>
<th>Sig. (2-tailed)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(Verbal debriefing with animation)</td>
<td>(Verbal Debriefing only)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Perceived Ease of Use (PE)</td>
<td>Mean = 3.78; SD = .85</td>
<td>Mean = 3.78; SD = .50</td>
<td>-.20</td>
<td>73</td>
<td>.98</td>
</tr>
<tr>
<td>Perceived Usefulness (PU)</td>
<td>Mean = 4.01; SD = .77</td>
<td>Mean = 3.96; SD = .40</td>
<td>.43</td>
<td>73</td>
<td>.67</td>
</tr>
<tr>
<td>Attitude (AT)</td>
<td>Mean = 4.18; SD = .70</td>
<td>Mean = 4.03; SD = .39</td>
<td>1.71</td>
<td>73</td>
<td>.09</td>
</tr>
<tr>
<td>Behavioral Intention to Use (BI)</td>
<td>Mean = 3.85; SD = .83</td>
<td>Mean = 3.87; SD = .43</td>
<td>-.16</td>
<td>73</td>
<td>.87</td>
</tr>
<tr>
<td>Learning Outcome (LO)</td>
<td>Mean = 4.08; SD = .51</td>
<td>Mean = 3.82; SD = .41</td>
<td>2.22</td>
<td>73</td>
<td>.03*</td>
</tr>
<tr>
<td>Highest score of time-attack scenario</td>
<td>Mean = 78.8; SD = 16.98</td>
<td>Mean = 79.6; SD = 9.31</td>
<td>-.267</td>
<td>73</td>
<td>.79</td>
</tr>
<tr>
<td>Highest score of normal scenario</td>
<td>Mean = 71.1; SD = 23.41</td>
<td>Mean = 78.22; SD = 10.31</td>
<td>-1.84</td>
<td>73</td>
<td>.07</td>
</tr>
</tbody>
</table>

*p < 0.05
4.3 Focus Group

Five students who have participated in game based learning with PMS and have access to the SPOC were invited to be the interviewees of the focus group. All of them were from the group 1 where verbal debriefing with animation is conducted. Overall, they mentioned that they enjoyed playing the game and the game was useful for them to learn project management.

With respect to the role of animation during the debriefing, one student mentioned the animation related to stakeholders which is played at the end of the debriefing session for the time attack scenario. She noticed that stakeholders play an important role in the game and decided to spend more effort on communicating with stakeholders after watching the animation. Meanwhile, two of students have recalled the animation related to the kick-off meeting and project change and mention that those videos were attractive and had caught their attention during the debriefing session. However, two of students expressed that they did not pay too much attention to the debriefing session because they were focusing on the playing game so as to get better game score. One of them suggested that the animation could be played as an introduction at the beginning of the class, as an overview. This approach may better catch students’ attention and raise their interest.

6. Summary and Future Research

This paper presents the study on SPOC with game-based learning of project management. From the results of the post-game survey, students in general are positive towards game based learning and perceives the use of PMS helps facilitates their learning of project management. The debriefing with animation in game-based learning has significant effect on students’ learning outcome and attitude.

From the focus group study, using animation in debriefing may raise students’ attention and awareness of project management knowledge during game based learning. However, the attention of different students during debriefing may vary. Since debriefing is important to connect the game to the learning outcomes of the game, this may affect the effectiveness of the learning during game based learning. Also, from the comparison of the game performance across the two groups, we observe that the impact of the animation in debriefing is not significant. One possible reason is that our debriefing and animated videos focus on discussing project management concepts behind the game but not the game strategy in details. Some of the students may not be able to transfer the project management concepts in debriefing and apply it in the game. To increase the effectiveness of the debriefing, we may increase the debriefing time and ask more questions related to the game (Kriz, 2010). By listening to students’ answer, we can check their understanding and understand their difficulty instantly.

For future research, we will extend our study on the use of SPOC and animated videos to scaffold game based learning activities. We will also experiment with other debriefing
strategy to study their impact on game based learning of project management and other subjects.

References


The Potential Impact on Learning of Differences in Social Media Applications between China and the US

Xiaozhe Yang¹, Lin Lin² and Xue Yang³

Abstract
There are regional differences in users, communication and collaboration functions, and mobile payment functions using social media applications between China and the US. These differences are likely to have a potential impact on learners’ behaviors, such as the regionalization and globalization of users’ reception of information, the bundling and separation of social media behaviors and learning behaviors, and the provisioning of knowledge services to individuals and organizations.

Keywords: social media; mobile learning

1. Introduction
With the increasing popularity of smart phones, society has begun to enter the era of the mobile Internet from the Internet era. China, the United States, and India are the largest per capita Internet users in the world. Because of the unique nature of the Chinese Internet and the special significance of the US Internet for the world, a huge difference in social media applications exists between the two countries, and these differences are having a huge potential impact on public learning behaviors.
2. Background

An application program (app or application for short) is a software application designed to run on mobile devices such as smartphones and tablet computers. According to statistics, Android users were able to choose between 2.2 million apps. Apple's App Store remained the second-largest app store with 2 million available apps.

Social media are computer-mediated technologies that allow the creation and sharing of information, ideas, career interests and other forms of expression via virtual communities and networks (Obar, Jonathan A & Wildman, Steve 2015). Social media applications, in contrast, “are a group of internet-based applications that build on the ideological and technological foundations of Web 2.0 and that allow the creation and exchange of user-generated content” (Kaplan & Haenlein, 2010).

China and the United States are mobile Internet “power users”. According to recent statistics, the number of Chinese Internet users recently reached 710 million. Online Internet users average 3.8 hours a day online (Shaohui, 2016). While 286 million users in the US average 2 hours a day online.

3. Literature: Social media application use in daily lives in China and in the U.S.

Social media applications in China and the United States show the following three differences.

3.1. Regional user differences

China's Internet has a very unique place in the world. The Chinese government banned the implementation of certain network platforms and applications in China. Google, Facebook, and Twitter, were not allowed to operate in China in the normal way. Because of this long-term "network wall" policy, China and the United States’ social media application users have big differences.
3.2. Differences in exchange of collaborative functions

Social media applications in China and the United States focus on the timely sharing of graphic features. Twitter and Weibo limit the number of words in a user instance, but can also be used with pictures. Facebook and WeChat from within a circle of friends is nearly the same as each app encourages the sharing of pictures. However, China's social media applications pay more attention to integrated textual communication. In particular, social media applications such as WeChat can be very user-friendly, with the ability to create a group chat, and share most kinds of documents (Koetse, 2014).

3.3. Differences in mobile payment functions

Within China the payment for services function was not a required feature for social media applications. Social networking applications in China are not only a platform for people to share experiences, but are also about life, work, and learning. A WeChat payment and “Alipay” have become the most commonly used method of payment for Chinese Internet users. Since social media applications evolved after the online payment system in the US, the primary payment system in the US is still the iconic US banking credit card payment system (JR. Jiang 2016).

4. Implications for learning

The differences in social media applications between China and the United States have resulted in three main differences in learning behaviors among the two massive groups.

4.1. Receiving information on a Regional or Global Scale

Learning is a process that requires nearly constant contact with external information sources for the purposes of assimilation and self-internalization. China's social media application user base, which led to the participation of the Chinese public in the software platform, receives
sourced information largely from the Chinese people themselves. US social media applications, in general, are more global, and Americans seem to be more receptive to global information input and communication with them.

4.2. Bundling and separating social media and learning behaviors

Social media behaviors emphasize sharing and communication, while learning behaviors emphasize knowing, understanding, applying, evaluating and innovating. The evolving behaviors of the two are quite different. China's social media applications feature a richer, more comprehensive series of work, entertainment, life and learning. Social behavior and learning behavior in China's social media applications is almost a bundle of the state. The US social networking applications still do not provide quite as many seamlessly integrated extensions, and because such a large number of US Internet users still have the habit of using email, Google products, and the series of Microsoft collaborative Office Suite support products, apart from Apple products, the United States has evolved more focused and independent social networking platforms based on company legacy products.

4.3. Providing knowledge services to individuals and organizations

Chinese social media applications have an independent network of payment methods. This subtle difference for the Chinese Internet users began to form a network of smaller payment habits. On the other hand, China still has a certain lack of protection for copyrights, trademarks, and intellectual property, while the United States has been very rigorous in this regard. Americans are accustomed to paying to listen to songs, watch TV, and view movies. And these payments are actually personal payments to the companies, and the companies and banks bear the cost of service charges and financial security. Chinese netizens have not yet formed this habit, and these functions are replaced by a new personal payment function
shaping the individual's habits. This user-friendly approach and increasing scaling factor have inspired more individuals to provide knowledge services.

5. Conclusion

In summary, the differences in the social media applications between China and US do have a potential impact on the learning behaviors of different user groups. The parsing and feeding of user information by region, nation, or globally changes the effective learning reach of a single individual, the bundling and separation of social media behaviors with learning behaviors effects the quality and speed of learning, and the differences in seamless integration of the required payment and support services effects the overall pervasiveness and presentation of knowledge services between entrepreneurial individuals and organizations. The world will continue to be diverse, and no one user solution will work for everyone. Designers will need to stay flexible and adopt the necessary mechanisms as they evolve, learning the benefits and limitations of all applications based on the requirements of the user base. Observations indicate that the differences from the social media applications are already deeply imprinted on the users, the providers, and the security system, and it will be necessary to exploit our differences, and try newer patterns of interconnected behaviors in order to optimize our learning systems.

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The Use of Technology in the Classroom: Upgrading of Reading Ability of Selected e-Learning Students
Marikina Science High School

MAY C. FRANCISCO1*, CECILIO S. VOLANTE III2

Abstract
The purpose of this study was to determine what reading strategies in the module exercises heighten the reading ability of the Grade 7 E-Learning students of Marikina Science High School, School Year 2015-2016 which will be the basis for upgrading the reading ability of E-Learning students through the modification module exercises.

The study specifically sought to answer the following questions:
1. What are the learning competencies in reading of the E-Learning students need to be enriched?
2. What reading skills need to be improved based on the results of module exercises of the E-Learning students?
3. What reading strategies in the module exercises enhance the reading ability of the E-Learning students?

The researchers used the descriptive research methodology. Results in the module exercises were gathered to check the frequency of errors committed in each module exercise. This was done to identify learning competencies which need to be enriched. The statistical tools utilized were frequency and weighted mean. The results of the study revealed that E-Learning students find it difficult to use structural, lexical and contextual devices in deriving the meaning of unknown words, ambiguous and information-dense discourse. The E-Learning students need to be given more comprehensive module exercises emphasizing different ways in identifying sense and reference of words in written discourse.

Keywords: Online Learning, Technology in the Classroom, Reading Ability, Modules, Lexicons

1. Introduction

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Reading is one of the macro skills in a curriculum which students should learn while enrolled in school. Reading as noted by Bachman [8], is a vital part in the academic affairs and is also tantamount to academic contexts of people. This means that in everyday life of people reading is inevitable and considered a part of daily life.

Reading is defined by the National Assessment of Educational Progress [10], “which is an active process that involves understanding written text, developing and interpreting meaning and using meaning as appropriate type of text, purpose and situation”. This definition of reading given by the NEAP is appropriate to the everyday activities done by students.

Reading encompasses comprehension, skills, strategy, ability and proficiency. These words are terms teacher encounter in their English Reading classes. The level of mastery of the learning competencies of students in Reading is gauged using exercises from modules or workbooks be it regular class or online classes. Reading materials are substantive in the mastery of learning competencies of students. The features of text have a big effect on comprehension [3,7] Reading is not only extracting the meaning of the words used in the text but also get the surface code (exact words), the text base (the meaning the word it denotes) and exemplification of the mental constructs entrenched in the text [3]. Therefore, there are certain processes that a person undergo before getting the meaning of a certain word.

However, in the classroom setting, students most of the time find it difficult to understand words used in a reading text presented in the class. In addition to this dilemma, there are readers who have the impression that they can fully understand a text if they know the content words and some sentences [4]. A study by Ponteras [5] revealed that Word Vocabulary Workbook enhances the development of comprehension skills of students. Another study by Ilustre [6] that strategies such as metacognitive reading strategy yields to text understanding in reading tasks. According to the study of Gillaco [9], also attribute the word recognition to reading comprehension level of students. If students cannot recognize the meaning of the words, this becomes a problem in facilitating the mastery of learning competencies in a reading class. There may be strategies in deriving the meaning of a text, still there are hindrances in the mastery of learning competencies.

This problem of not achieving the optimal level of mastery of learning competencies in reading with all the reading strategies available is the primary dilemma of the students as well as teachers. This study explored the effective reading strategies were utilized in the modules of the E-learning students and identified the learning competencies which needed enhancement when it comes to reading.

2. Scope and Limitations of the Study

This study was focused on the assessment of the Use of Technology in the Classroom to Upgrade Reading Ability of Selected E-Learning Students in Marikina Science High School, Marikina City. The respondents of this study were selected Grade 7 students enrolled in the E-Learning Program of the school, School Year 2015-2016. The facets explored in this study were limited to reading competencies, E-Learning English Modules, exercises and reading strategies.
3. Research Paradigm
The input consists of the 30 E-Learners as respondents of the study. Included also are the modules used in the study and school documents in identifying the respondents of the study and some other factor that can be of help to the researchers in the conduct of the study. The process of the study consists of the retrieval of module exercises results, statistical treatment of the data and the analysis and interpretation of data. The model that guided the conduct of the study follows the Input, Process and Output approach (I-P-O) and is shown in paradigm form in Figure 1.

4. Methods of Research Used
Descriptive research method of research was used in this study. According to Mallick and Verma, “descriptive method of research is primarily concerned with portraying the present”[2]. Descriptive method of research has the purpose to depict the present position of a given situation [2]. In addition, descriptive research method not only goes beyond simply collecting and tabulating of factual data [2]. A quantitative descriptive method reports the data in raw form [1]. The researcher groups the data and presents it in tables and figures [1]. The data reported are organized to provide a suitable overall picture at a glance [1]. Most of the time statistics like means, standard deviations, and others are used for useful description of data presented in tables or matrices [1]. Descriptive research method was used to identify the number of frequency of errors committed in the module exercises in the corresponding learning competencies of Grade 7 E-Learning students in Marikina Science High School, School Year 2015-2016. The research also extrapolated on the efficiency of the module exercises in reading used for the E-Learners.
5. Sources of Data
The sources of the data for this study are seen in the tables below which were divided into seven main competencies of Grade 7 E-learners for reading and the reading strategies used in the learning competency which got the highest frequency of error.

Table 1. Learning Competencies

<table>
<thead>
<tr>
<th>Learning Competencies</th>
<th>Number of Students</th>
<th>Frequency of Error</th>
</tr>
</thead>
<tbody>
<tr>
<td>Get information from the different parts of a book, current information from newspapers and data from general references in the library</td>
<td>30</td>
<td>12</td>
</tr>
<tr>
<td>Use different reading styles (scan, skim, read closely, etc.) to suit the text and one’s purpose for reading</td>
<td>30</td>
<td>10</td>
</tr>
<tr>
<td>Use non-linear visuals as comprehensive aids in content texts</td>
<td>30</td>
<td>5</td>
</tr>
<tr>
<td>Use ideas and information gained from previous readings and personal experiences to better understand a text</td>
<td>30</td>
<td>2</td>
</tr>
<tr>
<td>Conduct a covert dialogue with the writer as a basis for formulating and modifying hypotheses</td>
<td>30</td>
<td>15</td>
</tr>
<tr>
<td>Use varied text types to develop extensive reading skills</td>
<td>30</td>
<td>12</td>
</tr>
<tr>
<td>Use structural, lexical and contextual devices in deriving the meaning of unknown words and ambiguous and information-dense discourse</td>
<td>30</td>
<td>24</td>
</tr>
</tbody>
</table>

Table 1 shows the frequency of errors of in each learning competency in reading. It can be gleaned from the table that there are more students who need more exercises for structural, lexical, and contextual devices in deriving the meaning of unknown words and ambiguous and information-dense discourse since they committed more errors in this learning competency. This also reveals that students have problem in identifying vocabulary words in texts given during reading classes.

Table 2. Reading Strategy in Identifying Meaning of Unknown Words

<table>
<thead>
<tr>
<th>Reading Strategy in Identifying Meaning of Unknown Words</th>
<th>Number of Students</th>
<th>Frequency of Error</th>
<th>Weighted Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td>Morphemic Analysis (prefixes, suffixes, root words)</td>
<td>30</td>
<td>13</td>
<td>2.30</td>
</tr>
<tr>
<td>Contextual Analysis (meaning of words based on how it is used in a text)</td>
<td>30</td>
<td>20</td>
<td>1.50</td>
</tr>
<tr>
<td>Word Maps</td>
<td>30</td>
<td>12</td>
<td>2.50</td>
</tr>
</tbody>
</table>
Table 2 presents the reading strategies of the 30 E-Learning students and the frequency of errors as well as the weighted mean of each reading strategy. As shown in the above table, contextual analysis got the highest frequency of error and the lowest weighted mean. This shows that students’ weakness is in determining the words used in the texts provided in the class. The second reading strategy that got the highest frequency of error is synonyms and antonyms. The third reading strategy that got the highest frequency of error is concept definition maps.

6. Data Gathering Procedures
The data gathering procedures as shown in Figure 1, there were 30 Grade 7 E-Learning students and the results of their E-Learning modules for reading were the input. Scores for each module were tabulated for each learning competency for reading. Frequency of errors and computation of the weighted mean for module activities were tallied to identify what competency needs more improvement for mastery. There are seven competencies and under each competency there are also sub-competencies. The main competencies were then identified to check the number of items under these competencies for frequency of errors. The frequency of errors and the weighted mean for the seven main competencies were then categorized to determine the module exercises that could affect the scores of the E-Learning Grade 7 students. The data were then analyzed and interpreted.

7. Statistical Treatment of Data
The statistical treatment of data utilized in the research paper is frequency and weighted mean. Frequency is used for determining the number of errors committed in each competency. The weighted mean was used to identify the exercises where students got higher score which then provided the strategies used to answer the exercises in the module.

8. Summary
This research paper was able to identify the learning competencies that need to be improved and reading strategies that enhance the reading ability of the E-Learning Grade 7 students of Marikina Science High School. The following learning competencies for reading need to be improved and students need to attain competence so that upgrading of reading ability will be achieved: (1) use structural, lexical, and contextual devices in deriving the meaning of unknown words, ambiguous and information-dense texts; (2) conduct a covert dialogue with the writer as a basis for formulating and modifying hypotheses; and (3) Get information from the different parts of a book, current information from newspapers and data from general references in the library and use varied text types to develop extensive reading skills.
For the reading strategies used in the modules that facilitated the mastery of the learning competencies in reading, the following data were gathered: (1) word maps; (2) morphemic analysis; and (3) concept definition maps.

9. Conclusions
Based on the data presented in the tables, identifying the meaning of the words is one of the competencies that need to be improved. It showed from the results that students find it difficult to determine meaning of the words in a reading. The reading strategies employed in the modules for E-Learners exhibited that contextual analysis (context clues) is one of the strategies the students that teachers should focus on. The skill of identifying the clues given in a reading text is the weakest skill in reading as proven by the results of the module exercises. The strategy that helped students understand the texts is the word map where they will identify unfamiliar words and guess its meaning without any clue. The E-Learning students have also a good skill in morphemic analysis. In a nutshell, E-Learning students have difficulty in context clues and synonyms and antonyms as reading strategies.

Recommendations:
Based on the conclusions, the researchers recommend that there should be emphasis on vocabulary exercises for the E-Learning Grade 7 students. This should be coupled with the reading strategies utilized in the modules that brought good results in their reading exercises. These exercises are recommended to be used by the students. Crafting other reading strategies similar with the reading strategies employed in the reading modules is advisable to attain the adeptness of learning competencies for reading.

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The Effects of Makerspace Experience on Group Collaboration and Self-Efficacy: A Pilot Study

Sue-Jen Chen

Abstract

Makerspaces are environments that offer tools and opportunities for hands-on learning and creation. Makers are individuals engaging in procedural/tactical tasks to invent or customize products by applying higher order cognitive and other skills. This research is grounded on cognitive- and social-constructivist learning theories to investigate the effects of makerspace experience on promoting group collaboration, self-efficacy as well as students’ perceptions of their learning process and product. The presentation will report the process and results of the pilot study.

Keywords: Makerspace, Perception, Teamwork, Collaboration, Self-efficacy

1. Introduction

Makerspaces are environments that offer tools and opportunities for hands-on learning and creation (NMC Horizon Report, 2016). The alternative term for makerspace is "fab lab," (fabrication laboratory) originated at MIT’s Center for Bits of and Atoms in MIT Media Lab by Professor Neil Gershenfeld. The idea behind Fab Labs is “Give ordinary people the right tools, and they will design and build the most extraordinary things.” (FabLabDC).

The recent maker movement in education has redefined the roles of teachers, the methods and format of teaching and learning, and revolutionized the design of and the contents provided in learning environments (makerspaces) such as classrooms, learning labs, and learning resource centers. This movement is gaining attention and growing in popularity internationally. Fab Foundation was formed to facilitate and support the growth of the international fab lab network. More and more K-16 schools, public libraries, and private learning institutions are remodelling their learning spaces, providing materials and resources, revising the curriculum and adapting teaching methods/strategies and learning activities to be part of this movement.

Makers, also known as problem solvers, creators, and/or hackers and tinkers, engage in procedural/tactical tasks to design and/or customize products and materials to better serve their intentions. The act of making can be defined as an inquiry-driven social activity (Canino-Fluit, 2014) that enables students to develop 21-century skills (Partnership for 21st Century Skills, 2004). During the process of planning and making/creating, in addition to
subject specific knowledge (e.g., math, science, visual arts, engineering), students are required to apply a variety of cognitive skills such as creative and critical thinking, analytical and problem-solving skills, as well as communication and collaboration skills in order to actively work together with others to complete the project. Through the process of making, the essential 21st century skills for the following four critical areas for development can be fostered:

- Collaboration and teamwork
- Creativity and imagination
- Critical thinking
- Problem solving

The concept of “maker movement” is derived from Piaget’s constructivism and Seymour Papert’s constructionism theories. The movement advocates “learning by doing” and “invent to learn.” The purpose of “making” is to solve a problem or to accomplish a goal (Martinez & Stager, 2014).

Most research on maker movement focuses on redesigning/rearranging the learning spaces and the contents (hardware, software or materials) inside the spaces. Research investigating effective pedagogies for enhancing learning in makerspaces is very limited (Bowler, 2014).

Self-efficacy refers to one's belief in his/her ability to accomplish a task or succeed in a specific situation. One's sense of self-efficacy can influence his/her choice of action, approaches, or effort to carry out a task. The role of self-efficacy in motivation and performance has been increasingly researched since Bandura's (1977a) original publications. As people engage in tasks, they acquire information about how well they are doing. This information influences their self-efficacy for continued learning and performance. Thus, self-efficacy can be used to help predict motivation and performance. Research showed interventions such as models, goal setting, and feedback, can be employed to affect self-efficacy (Schunk, 1995). This study will assess students’ self-efficacy after the makerspace tasks. The information may be used to understand students’ performance as well as to design the interventions for promoting motivation and learning.

Given the great majority of the students had no prior experience with a makerspace and this pilot study was the first time they used the resources in a makerspace to intentionally create something to solve a problem. The purpose of the pilot study is to explore students’ attitude and perception of their makerspace experiences, small group collaborative problem-solving, and self-efficacy. To be more specific, the research questions are:

1. What are students’ attitude and feeling about their learning experiences in makerspace?
2. What are students’ perceptions of group process such as collaborative learning, creating, and problem-solving in the makerspace?
3. What are students’ perceptions of their self-efficacy after the makerspace experience?

2. Methodology
2.1 Sample
25 undergraduate preservice teachers enrolled in an introductory technology course taught at a state university in the southeastern U.S. participated in the study. The demographic results are as follows: Gender: 4 – male, 14 - female; status: 14 – traditional students, 4 - non-traditional students; rank: 4 – sophomore, 12 – junior, 2 – teaching licensure.

2.2 Procedure
It took 7 classes (75-minutes each) from September 8 to October 4, 2016 to complete the entire makerspace unit for the pilot study. Below are the steps:
1. Required the students to complete the assigned reading and videos about makerspace. The reading help students build foundation knowledge about makerspaces. The videos present good examples of the process of making and the products of intentional creation.
2. Required the students to online sign up for a project group. Each group consisted of 3 members.
3. As a class, visited the makerspace located in the Curriculum Materials Center (CMC) on campus. All members in the same group were sitting together at the same table to listen to the orientation provided by the director of CMC. During the orientation, students were introduced to the equipment, tools, and resources available for them to use as well as the policies of using CMC.
4. After the orientation, students were asked to work as a group to use the available resources in CMC to create something to solve a problem or to serve a specific purpose. The intention of the field trip was to get familiar with the makerspace environment and the available resources.
5. During the next class, each group showcased their creation, reflected and discussed their learning and creating experiences in CMC.
6. Announced the multimedia group project which consisted of two components: a fab lab project and a multimedia instructional video teaching the audience how to create what they created. The video should be uploaded to YouTube to disseminate and share the information.
7. Explained to the class the following conceptual framework for guiding the process of creating the makerspace project:
   - Identify a problem
   - Brainstorm possible solutions
   - Select the solution
   - Develop project plan
   - Create product
   - Test/evaluate
   - Revise
   - Implement
   - Share the creation
8. Completed instructing the knowledge of videography and scripting, skills of video editing, and steps of uploading videos to YouTube.
9. Arranged an opportunity for students to showcase their makerspace creations and multimedia instructional videos in the atrium of the education building.
10. Required the students to complete the makerspace post-production or learning reflection survey.

2.3 Data collection and instruments
An online Makerspace Reflection Survey was administered in early November 2016 to solicit students’ perceptions of their experiences with makerspace creation via group collaboration and of their self-efficacy. The survey was composed of four components: Three items in part A were to collect student demographic information (gender, status, academic rank); part B consisted of 8 rating items using a three-point Likert scale (3=Agree, 2=Neither Agree nor Disagree, 1=Disagree) and three open-ended narrative items dealt with student attitude, opinion, and feeling about makerspace experiences; and Part C were ten four-point scale rating items to assess student self-efficacy after completing the makerspace project. The items in Parts A and B were developed by the author. The General Self-Efficacy Scale (GSE) was adopted from the work of Ralf Schwarzer & Matthias Jerusalem (1995).

2.4 Data analysis
18 of 25 participants’ responses are valid for analysis. Descriptive analysis was used to analyze the students attitude and self-efficacy Surveys. Content analysis was applied to evaluate students written responses to the three open-ended narrative questions. The unit of analysis was defined as a complete written response to each question by each individual student. The following procedure was used to organize and analyze the responses:
1. Gather all responses to the same question.
2. Identify key thoughts or incidents expressed in each response.
3. Code each key incident in terms of relevancy to the content of the question.
4. Group the incidents that are coherent, consistent, or regularly recurring.
5. Establish the patterns of incidents.
6. Sort the patterns into categories.
7. Label the categories which must be mutually exclusive.

3. Results and discussion
The results and discussion are presented according to the three research questions.

Research Question 1: What are students’ attitudes and feelings about their learning experiences in Makerspace?

<table>
<thead>
<tr>
<th>No.</th>
<th>Item Statement</th>
<th>A (%)</th>
<th>N (%)</th>
<th>D (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Members of my group worked together to solve problems.</td>
<td>72.22</td>
<td>16.67</td>
<td>11.11</td>
</tr>
<tr>
<td>2</td>
<td>Members of my group respect each other.</td>
<td>77.78</td>
<td>16.67</td>
<td>5.55</td>
</tr>
<tr>
<td>3</td>
<td>My group consistently engaged in learning tasks and assignments.</td>
<td>72.22</td>
<td>16.67</td>
<td>11.11</td>
</tr>
<tr>
<td>4</td>
<td>Through completing the makerspace project, I have learned to work collaboratively.</td>
<td>77.78</td>
<td>16.67</td>
<td>11.11</td>
</tr>
<tr>
<td>5</td>
<td>I think group communication contributed to the quality of team project.</td>
<td>100</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>6</td>
<td>I wish I had been taught how to work as a member of a team.</td>
<td>100</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>7</td>
<td>I felt that participating in makerspace group project was valuable to me as a prospective educator.</td>
<td>88.89</td>
<td>11.11</td>
<td>0</td>
</tr>
<tr>
<td>8</td>
<td>Overall, my experience of makerspace creation was very positive.</td>
<td>77.78</td>
<td>22.22</td>
<td>0</td>
</tr>
</tbody>
</table>

*Total response N=18
Table 1 reports descriptive analysis results of survey rating items on students’ attitude, opinion, and feeling about their makerspace experiences. Examining the frequency and percentage of ratings for each survey item, all students agreed group communication contributed to the quality of team project (Q5) and they wish they had been taught how to work as a member of a team (Q6). 13 of 18 (72.22%) agreed the members of their groups worked together to solve problems (Q1) while 5 (27.78%) rated neutral or disagree. The same response pattern showed the item: My group consistently engaged in learning tasks and assignments (Q3). The survey results also revealed that the great majority of students (88.89%) agreed participating in makerspace group project was valuable to them as future teachers (Q7); they learned to work collaboratively through completing the makerspace project (Q4); their overall experience of makerspace creation was very positive (Q8). 14 (77.78%) of students agreed members of their groups respect each other.

These results clearly indicate that makerspace provides valuable and positive learning experiences and the opportunity to learn collaboration and teamwork as well as problem-solving, the essential 21st century skills. The results also suggest the need of providing training on building knowledge and skills about effective teamwork, group process, group roles, group communication, and collaboration prior the start of the makerspace activities.

Research Question 2: What are students' perceptions of group processes such as collaborative learning, creating, and problem-solving in the Makerspace?

In order to respond to the reflection questions, students have to critically examine their products and analyze the process of learning and creation. This exercise helps them develop analytical and critical thinking as well as problem solving skills, the essential 21st century skills.

Tables 2 to 4 provide examples of student narrative responses to the three open-ended learning reflection questions. The examples for each question are classified by the themes. It was observed, students’ responses to the narrative questions well-align with their responses to the attitude survey, but the description presents more in-depth and detailed information which provides insight of a problem and help explain the cause-effect of an incidence.

From the content analysis of students’ reflection on their makerspace experiences, three themes emerged: teamwork, learning, and perspective (see table 2). For the reflection question regarding how to improving the product when given a second chance, four themes emerge: content/Subject matter, teamwork, product improvement, and unspecific (see table 3). For the question asking suggestions for modifying the makerspace assignment and/or
activities, four themes emerged: content, instruction/direction, group composition, and time (see table 2).

The narrative examples described by the students echo the rating results of the attitude survey (see table 1) and explains the reason for the rating. Based on the quantitative and qualitative data results, makerspace assignment and activities should continue to be included in the course, but with modifications on assignment specifications and activities such as providing teamwork training and exercise before the project, more detailed or clearer instruction about the assignment requirements and direction to guide the activities, allots more lab time for completing the project and maybe using different grouping strategy.

**Table 2. Reflection on Makerspace Learning Experience**

<table>
<thead>
<tr>
<th>Theme</th>
<th>Examples of Positive Experiences</th>
<th>Examples of Negative Experiences</th>
</tr>
</thead>
</table>
| Teamwork    | • I'm extremely proud of my partners… By working in a team we were able to use the strengths of each person… I have a renewed faith in collaborative learning.  
  • My team worked really well together and I enjoyed it. Teamwork helped solve all of our issues because we all had many different ideas.  
  • I loved my coproduct makers, we delegated everything to try and divide the work evenly.  
  • This project helped build leadership skills and creativity skills.  
  • Teamwork helped solve all of our issues because we all had many different ideas. | • Working in a group is good and bad…  
  • Our group especially had problems when it came to meeting, agreeing on a product, and dividing up the work everyone would contribute.  
  • We were a very disorganized group but pulled it together in the end. |
<table>
<thead>
<tr>
<th>Learning</th>
<th>Perspective</th>
</tr>
</thead>
<tbody>
<tr>
<td>• I had new view on creating something for teaching a class.</td>
<td>• My perspective of teaching and learning has also been altered.</td>
</tr>
<tr>
<td>• …helped me learn a new way to teach through steps and video</td>
<td>We found a way to create a history lesson/diversity lesson and make it fun for children.</td>
</tr>
<tr>
<td>• I learned how to cooperate well with another and plan things around both of our busy schedules</td>
<td></td>
</tr>
<tr>
<td>• This project allowed me to research and find out about…</td>
<td></td>
</tr>
<tr>
<td>• I also learned a lot about how to display a product using technology and social media.</td>
<td></td>
</tr>
<tr>
<td>• I learned a lot about my computer and how much it could actually do.”</td>
<td></td>
</tr>
<tr>
<td>Theme</td>
<td>Example</td>
</tr>
<tr>
<td>-------------------------------</td>
<td>-------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Content/Subject matter</td>
<td>• … Make the concept a little bit easier to understand&lt;br&gt;• …Would take more time to think about what product to create.&lt;br&gt;• Some of the fractions we chose might be hard to mentally add together … I would pick&lt;br&gt;• Fractions that were a little simpler to add mentally.</td>
</tr>
<tr>
<td>Teamwork</td>
<td>• Better communication with the group.</td>
</tr>
<tr>
<td>Product improvement</td>
<td>• Make the product more durable&lt;br&gt;• Made one out of other recycled material that children would have an easy time working with&lt;br&gt;• I would have created something harder than the frog.&lt;br&gt;• Could have made the sound affect a little better if we would have played with it more&lt;br&gt;• More detailed game that can be implemented &amp; played as a main trait of the product to&lt;br&gt;• Create more interest, retention and higher degree of marketability”&lt;br&gt;• More craft supplies to actually show how it could be the children designing it and not just the teacher</td>
</tr>
<tr>
<td>Unspecific /no need for improvement</td>
<td>• Focus on making the project better for children.&lt;br&gt;• I cannot think of what I would have done differently but I am open to suggestions&lt;br&gt;• Absolutely nothing</td>
</tr>
</tbody>
</table>
Table 4. Suggestions for modifying the makerspace activities

<table>
<thead>
<tr>
<th>Theme</th>
<th>Example</th>
</tr>
</thead>
</table>
| Content                    | • No need to change  
• Great project and helped me use a resource I don't use often enough. I would make no changes!  
• This was a fun and great assignment.  
• Seen [show] products that were made in passed classes. |
| Instruction/direction       | • Make the directions a bit clearer  
• More detailed instructions and make this a more interactive project in the classroom. |
| Group composition           | • A smaller group of having just pairs (2 students), rather than 3 or more.                                                          |
| Time                       | • More time for the project  
• Give the assignment at the beginning of the semester and have it due towards the end. |

Research question 3: what are students' perceptions of their self-efficacy after the makerspace experiences?

Table 5. Result of Students’ Self-efficacy Survey

<table>
<thead>
<tr>
<th>No.</th>
<th>Item Statement</th>
<th>Not at all true</th>
<th>Hardly true</th>
<th>Moderately true</th>
<th>Exactly true</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>I can always manage to solve difficult problems if I try hard enough.</td>
<td>0% (0)</td>
<td>0% (0)</td>
<td>44.44% (8)</td>
<td>55.56% (10)</td>
</tr>
<tr>
<td>2</td>
<td>If someone opposes me, I can find the means and ways to get what I want.</td>
<td>11.11% (2)</td>
<td>33.33% (6)</td>
<td>44.44% (8)</td>
<td>11.11% (2)</td>
</tr>
<tr>
<td>3</td>
<td>It is easy for me to stick to my aims and accomplish my goals.</td>
<td>0% (0)</td>
<td>0% (0)</td>
<td>50% (9)</td>
<td>50% (9)</td>
</tr>
<tr>
<td>4</td>
<td>I am confident that I could deal efficiently with unexpected events.</td>
<td>0% (0)</td>
<td>5.56% (1)</td>
<td>55.56% (10)</td>
<td>38.89% (7)</td>
</tr>
<tr>
<td>5</td>
<td>Thanks to my resourcefulness, I know how to handle unforeseen situations.</td>
<td>0% (0)</td>
<td>5.56% (1)</td>
<td>66.67% (12)</td>
<td>27.78% (5)</td>
</tr>
<tr>
<td>6</td>
<td>I can solve most problems if I invest the necessary effort.</td>
<td>0% (0)</td>
<td>5.56% (1)</td>
<td>33.33% (6)</td>
<td>61.11% (11)</td>
</tr>
<tr>
<td>7</td>
<td>I can remain calm when facing difficulties because I can rely on my coping abilities.</td>
<td>0% (0)</td>
<td>5.56% (1)</td>
<td>61.11% (11)</td>
<td>33.33% (6)</td>
</tr>
<tr>
<td>8</td>
<td>When I am confronted with a problem, I can usually find several solutions.</td>
<td>0% (0)</td>
<td>5.56% (1)</td>
<td>55.56% (10)</td>
<td>38.89% (7)</td>
</tr>
<tr>
<td>9</td>
<td>If I am in trouble, I can usually think of a solution.</td>
<td>0% (0)</td>
<td>5.56% (1)</td>
<td>50% (9)</td>
<td>44.44% (8)</td>
</tr>
<tr>
<td>10</td>
<td>I can usually handle whatever comes my way.</td>
<td>0% (0)</td>
<td>0% (0)</td>
<td>72.22% (13)</td>
<td>27.78% (5)</td>
</tr>
</tbody>
</table>

*Total response N=18
Table 5 shows descriptive analysis results of students’ responses to the self-efficacy survey items. The survey results reveal that overall, the students in this class have a high sense of self-efficacy. 95 percent or more of the class members rated all items, except question # 2, exactly or moderately true. Students indicated the question statement in item 2 is confusing; they were not sure what the question asked for. That may explain why 8 of 18 students rated the items hardly or not at all true. High agreement with an item reflects high sense of self-efficacy or high assurance in their capabilities. According to Weibell (2011), people with “high assurance in their capabilities” tend to approach difficult tasks as challenges to be mastered, set challenging goals and maintain strong commitment to them, attribute failure to insufficient effort or deficient knowledge and skills which are acquirable, and approach threatening situations with assurance that they can exercise control over them. They may perceive affective arousal as an energizing facilitator of performance.

According to the survey results, the great majority of students in this class is confident in their capabilities in setting goals and will make effort to approach and accomplish the goals. Learning motivation should not be an area of instructional concern. Rather, the revision of the makerspace learning should focus on providing teamwork training, detailing or clarifying directions for project/assignment, allowing more time to complete the creation, as suggested in reflection questions 2 and 3.

4. Conclusion

With the growing popularity of makerspace culture globally, more and more learning or resources centers are innovating or converting the space to be fab labs. At the same time, increasing number of teachers are adopting the makerspace “learning by doing” culture by incorporating inventing, making, or creating into assignments or class activities. As mentioned earlier in this paper, makerspace can help foster the four critical areas of 21st century skills: collaboration and teamwork, creativity and imagination, critical thinking, and problem solving. Effective, meaningful, or intentional creation goes beyond simply put the students in an environment equipped with tools and materials. Due to the newness of the maker movement, instructional design model or strategies for fostering these skills has yet to be formulated. This study piloted the following conceptual framework for guiding the learning and making process in a makerspace to find out students’ attitude and perception on their learning process and product. The study results yielded some insight to refine the instructional design of the materials and activities for makerspace collaborative creation.

More studies in the same line should be encouraged to maximize the effects of makerspace. Identify a problem -> brainstorm possible solutions -> select the solution -> develop project plan -> create product -> test/evaluate -> revise -> implement -> share the creation

References


Fab lab (n.d.). Retrieved Jan. 10, 2017, from the Fab lab

Wiki: https://en.wikipedia.org/wiki/Fab_lab


Student Well-Being and Involvement: Technology use in Kindergarten

Monika Tavernier

Abstract

The growing understanding of what young children’s minds can master lead to an increasing range of skills they are supposed to learn at young age. In Hong Kong, kindergarten children learn to read, write, count, add, subtract, tell the time, play an instrument, etc. Technology helped to support this development through the provision of a wide range of app gamified learning programs that help learn and reinforce reading, writing, arithmetic skills. Although, these learning games may lead to measurable gains in children’s skills, they do not promote healthy technology usage habits nor do they help develop the whole child.

This study introduced a group of four to five years old children to one open-ended, content creation application (SeeSaw). The provided tasks and children’s activities catered towards the development of transferable, generic skills and focused on ensuring children’s well-being and involvement and therefore their healthy development. The findings indicate that content creation apps have the potential to instil purposeful, personally meaningful engagement with technology while facilitating children’s well-being and involvement.

Keywords: Mobile devices, mobile learning, early childhood education, content creation

1. Introduction

Technology plays an important part in the lives of many, if not most, people in the developed world. Mobile technologies have become cultural tools, because members of the society use them in their everyday lives (Fox, Diezman, & Grieshaber, 2011; Edwards, 2013) to communicate with one another using talk, text and voice messages, emails and images, collaborate, and create. There is even a so called texting language, which is another indicator that mobile technologies used for communication purposes are cultural tools. Due to the omnipresence of these devices, today’s young children are exposed to the new communication practices from early on. Mobile technology owners may allow the children access to the devices and join the conversations (‘say hi to daddy!’ or ‘Let’s take a photo and send it to grandma!’).

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The other side of young children’s technology engagement includes two categories: using technology for entertainment and for learning (Chiong & Shuler, 2010). Both may seem appropriate in the individual situation, but may not lead to the development of healthy technology usage habits. However, as caretakers and teachers, the children’s well-being, including their health, should be one of our main concerns. The slow integration of technology in early childhood education may be a sign that early childhood teachers are concerned and try to protect their young students (Lindahl & Folkesson, 2012a, 2012b). However, since children have access to technology in their out-of-school life, this may not be the right approach to instil protect the children in the long term. The literature has identified a number of developmental and health threats linked to technology overuse. Therefore, it is necessary to provide children access to technology and teach and model healthy technology usage habits.

2. Literature Review
Currently, young children’s exposure to technology in early childhood settings is either very limited to very basic (Edwards-Graves & Langley, 2009). Their in class technology experiences differ a lot from what they do at home (Zevenbergen, 2007; O’Mara & Laidlaw, 2011). Although there are examples of beneficial technology integration in ECE, computer assisted learning has not become a common sight in early childhood education (ECE). The research literature provides rich evidence of advantages, disadvantages and concerns, which may help understand the phenomenon. Some concerns could be alleviated through the development of mobile technologies, however a number of concerns remain. The following sections introduce seven on these concerns.

2.1. Children’s technology user makes them obese (Spritzer, 2007)
Desktop technologies were location dependent and could only be operated using the keyboard and mouse. So, in the pre-mobile devices period this concern was very evident. If children engaged with the computer, they sat on a chairs and moved their fingers only (Lang, 2003). However, with the advancements of technology and the introduction of mobile devices and playstation fitness games, this thread is less evident. People can now mow around while using technology and even engage in exercises through technology (e.g. digital tennis).

2.2. Screen time damages the eyes.
It was found that an extended exposure to digital screens time causes computer vision syndrome (Yan, Hu, Chen, & Lu, 2008). This leads to headaches, dry and tired eyes. Also, too much exposure to the harmful violet light from screen may increase a child’s risk to develop macular degeneration later in life (http://www.allaboutvision.com/parents/children-computer-vision-syndrome.htm, 2015). So, it is recommended to keep the exposure to screen with violet light to a minimum and follow the advice to keep a distance to the screen and interrupt one’s activity regularly, look further away and rest the eyes.
2.3. **Computer Games make aggressive (Spritzer, 2007).**
It was long debated that a certain type of computer games causes aggression and violence in the player. Griffiths’ (2000) and Sakamoto’s (2000) did not find evidence for this concern. However, it is possible that competitive games or war games affect the mood of a child, especially, if they lose in a game.

2.4. **Children’s early engagement with technology makes them stupid/uncreative (Spritzer, 2007; Neuß, 2002).**
Computer assisted learning and the use of instructive and manipulative applications were related to measurable learning in the areas of language development (Yelland & Gilbert, 2012) and mathematics (Clements, 2002). Therefore, this claim cannot be supported. However, Falloon (2013b) found that the learning from instructive and manipulative learning programs may be short-lived, because they may not stimulate higher order thinking. Neuß’s (2002) perceived risk that the illustrations, sounds and animations of children games and electronic books may hinder young children’s development of creativity has not been investigated enough to come to a conclusion. It appears that this unreasonable, because picture book include a lot of pictures, too, and during read aloud activities the reader may also add additional sounds and read the story in an entertaining manner.

2.5. **Technology promotes social disengagement (Lindahl & Folkesson, 2012a, 2012b).**
While it is true that any time spent in front of a screen is time that children do not spend facing their peers and toys (Nie et al., 2005), it cannot be confirmed that children’s engagement with technology leads to a social disengagement. In fact a number of studies found that children collaborated often while using technology (Beschorner et al., 2013; Hutchison et al., 2012). This may be related to the activities and programs they engaged in and the teacher’s pedagogy practices (e.g. task design, learning environment and teacher’s actions). These findings stress again the importance of the careful preparation and evaluation of children’s technology use.

2.6. **Children prefer using the technology to regular activities (Lindahl & Folkesson, 2012a, 2012b).**
It is undeniable that the introduction of a new toy such as a tablet or new application is very attractive at first. At the beginning children will be very interested to explore the new toy and prefer ‘playing’ with it over traditional toys. However, these initial high levels of interest in a newly introduced technology wear off quickly (Lipinksiki, Nida, Shade & Watson, 1986), if the technology activities are not given a special treatment.

2.7. **Playing computer games may lead to later addiction (Buermann, 2003).**
There are a number of games that provide their players experiences, such as emotions and feelings of belonging and motivation, that are similar to those in the real world. The games challenge the user and engage them in intensive problem solving and collaborations with others players. Such games pull their players into another world and it may be difficult to stop playing the game. The provided levels of perceived autonomy, relatedness and competence contribute to the player’s motivation to play the games. Thus, these games may lead to addictive playing behavior. Therefore, it is necessary that teachers and caretakers choose the programs for young children wisely and monitor their behavior (http://www.apa.org/helpcenter/digital-guidelines.aspx, 20016).

All of these concerns are important and need to be address appropriately. It appears that the main concerns about children’s technology engagement surround the domain of health concerns and their learning. However, well-being and involvement are two components that affect the children’s health and learning, too, and have not received much attention when it comes to their technology use.

Well-being relates to emotional-intelligence and good mental health (Laevens, 1994 & 1997), while involvement describes the extent to which children operate to their full capabilities and considers how focused, engaged and interested a child is in an activity. Laevers (2005 as cited in Woods, 2016) explained:

Children with a high level of involvement are highly concentrated and absorbed by the activity. They show interest, motivation and even fascination. That is why they tend to be persevere. (...) When there is involvement we know children are operating at the very limits of their capabilities. Because of all these qualities involvement is the condition that brings about deep level learning. (p. 10)

The Leuven scales of well-being and involvement (Laevers, 2005, see Table 1 and 2) provide a solid tool to monitor and evaluate both (Marsh et al, 2005; Parmar, 2014; DfE, 2012). Although, the Department for education (DfE, 2012), recommend the use of the scales there is little evidence that it is being used for young children’s engagement with technology. Based on these observations, this article proposes to combine 1) a teacher’s careful preparation of technology enhanced learning activities, 2) health recommendations that reduce the health threats technology may pose, and 3) use both scales to assess children’s well-being and involvement while they use technology, instead of prioritizing the planned learning outcomes. This is based on the understanding that learning will be brought about if children’s levels of well-being and involvement are high (Laevers, 2005 as cited in Woods, 2016).

3. Methods
This article is based on six months of action research and data collection. A group of eight four to five years old children were introduced to iPads and one creation app, SeeSaw, that allows the users to create digital artifacts using photos, drawings, text, audio and video. The app itself did not provide any gamely elements and no entertainment, if the users to do create
artifacts of view others artifacts. The use of iPads and this kind of apps were deemed most effective to reduce the negative health and developmental impact technology may have on young children.

tables such as iPads a location independent, so children are not forced to remain in one location while they create digital artifacts. The screen brightness could easily be adjusted, further, due to the non-entertaining character of the app, the children felt little internal incentive to engage with the iPad and app longer than it took them to create their artifacts (no more than fifteen minutes each time). Since the app does not provide content, engage them in competitive behavior, or provoke strong feelings the risks of aggressive behavior streaming for this kind of technology use seem minor. This also impacts the risk of social disengagement that may be caused by extensive technology use. Firstly, the children had a clear objective in mind when they used the iPad and once they achieved it they moved on to other learning activities of their choice and joined their friends. Further, they had a tendency to wait for one another and support one another during their iPad activities. These observations lead to the assumption that this kind of app and applied pedagogy practices may not contribute to the development of addictive technology habits.

3.1. Sampling

The sample was a purposive involving one group of children attending an international kindergartens that follows with international baccalaureate primary years program. The sample group includes eight children ranging from four to five years. All twenty children were invited to join the study, however, only the parents of eight children provided the full consent for their children to participate. The sample represents children that have a middle class socioeconomic background that allows them to attend a private, non-subsidized international kindergartens in Hong Kong. These children are not technology savvy, but are likely to be exposed to mobile devices in the out-of-school and in-school environment. However, their independent and purposeful engagement with these devices may vary widely.

3.2. Study Design

Over the course of six month a routine developed that was followed by the teacher and the participating researcher. One a weekly basis the children would have one teacher initiated iPad activities that followed a similar repertoire:

1. children were gathered in a circle around the teaching adult
2. The adult would present the activity
3. The adult would demonstrate the activity, involving the children in the description of the sequence of action and purpose of each action
4. The children would receive an iPad (one iPad for two children) and engage in the activity
5. The adult monitors and supports the children’s activities.
At all times an open-ended task framed the children’s iPad activity (e.g. take a photo of the environment and find shapes), and a selection of functions (photo, video, audio, drawing) were suggested to inspire the children’s artifact creation. However, the children decided how they made use of the functions and developed the content of their artifacts by themselves. The children also chose where they wanted to work (e.g. on the carpet, bench, or Table), with whom they wanted to partner up, and when they were finished.

3.3. Data Collection
The data set included the children’s digital artifacts, videos and transcripts, and the researcher’s notes (activity plans and reflections), teacher’s and children’s feedback. On a weekly basis the researcher joined the class to either observe a teacher lead an activity or lead an activity herself. Each activity lasted about minutes, including the non-screen time (e.g. activity introduction and demonstration) and actual screen time. The activities were video recorded from the moment the teacher started the activity until the last student finished it. By the time of writing this article eleven iPad activities were conducted, producing 107 digital artifacts and about 300 minutes of video data. The scoring of the children’s well-being and involvement included focused on the time pairs of children received an iPad to engage in the suggested activities. Therefore, the scoring started as soon as they were handed the iPad and stopped when they returned the iPad. All together, the children engaged in ten teacher and researcher design learning activities (see appendix 3).

3.4. Data Analysis
The data analysis used the Leuven scales of well-being and involvement (see appendix 1 and 2) to organize video data in 2 minute sections to gain an understanding of the individual child’s well-being and involvement throughout an activity. The video data also provided information about the possible causes for changes in the scores. The causes for a change in their well-being and involvement were organized according to emerging themes (see Table 1).

Table 1. Extract of Data of Well-Being of one individual child

<table>
<thead>
<tr>
<th>Task</th>
<th>Change 1</th>
<th>Change 2</th>
<th>Change 3</th>
<th>Change 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Focused on using the app.</td>
<td>Posing for photo.</td>
<td></td>
<td>Jumps while listening back.</td>
</tr>
<tr>
<td>2</td>
<td>TA calls Anton to photograph</td>
<td>Takes iPad.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
4. Findings
The scoring and analysis of the children’s actions and the observable well-being and involvement and the review of the children’s digital artifacts revealed that although well-being, involvement and the artifacts are related, each tells a different story. The emerging themes encompassed the following causes for a change in children’s well-being and involvement.

Table 2. Causes of changes in Well-Being and Involvement

<table>
<thead>
<tr>
<th>Well-being</th>
<th>Involvement</th>
</tr>
</thead>
<tbody>
<tr>
<td>Technology Competence</td>
<td>Technology Skills</td>
</tr>
<tr>
<td>Liking of Task</td>
<td>Access to the iPad</td>
</tr>
<tr>
<td>Task Comprehension</td>
<td>Liking of Task</td>
</tr>
<tr>
<td>Task Achievement</td>
<td>Task related knowledge</td>
</tr>
<tr>
<td>Partner Choice</td>
<td>Quality of teamwork</td>
</tr>
<tr>
<td>Task Autonomy</td>
<td>Level of freedom</td>
</tr>
<tr>
<td>attention span</td>
<td>Completion of own share of task</td>
</tr>
<tr>
<td>personal health</td>
<td>Task duration</td>
</tr>
</tbody>
</table>

In the following we will look at the individual elements: well-being, involvement, and causes of change to either. Table 3 and 4 show the mean scores of all children, per activity, per every two minutes. The score 0 indicates that all children completed the activity.

4.1. Well-Being
The average of the children’s well-being averages around three (see Table 3), which means that the children often display “a neutral posture. Facial expressions and posture show little or no emotion. There are no signs indicating sadness or pleasure, comfort or discomfort.” (Leavers, 2005). There is a tendency that the well-being decreases over the course of an activity. Most of the time the children’s well-being is on the higher side during the beginning of an activity with the children showing signs of satisfactions (e.g. smiling, approaching the activity enthusiastically). As an activity progresses this changes and the well-being decreases. The main observable causes for that are that either gets bored after waiting for his turn for some time and watching his partner work with the iPad. This is especially the case, if the iPad user excludes his partner from the iPad his activity. The other scenario shows the first iPad user having completed his activity, not engaging in his partner’s iPad activity and wait to leave and start another non-iPad activity.

Table 3. Overview of means of children’s well-being per 2 minutes per activity

<table>
<thead>
<tr>
<th>iPad Time</th>
<th>Well-Being Scores per Activity</th>
<th>Means</th>
</tr>
</thead>
<tbody>
<tr>
<td>Minutes</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>2</td>
<td>3.875</td>
<td>3,125</td>
</tr>
<tr>
<td>4</td>
<td>3.875</td>
<td>3,375</td>
</tr>
<tr>
<td>6</td>
<td>3,125</td>
<td>2.5</td>
</tr>
<tr>
<td>8</td>
<td>4</td>
<td>1.75</td>
</tr>
<tr>
<td>10</td>
<td>1.25</td>
<td>0.625</td>
</tr>
<tr>
<td>12</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>14</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>16</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>18</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>20</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

So, the causes for this decrease could be found in the domains a lack of relatedness between the pairs (less effective teamwork), a lack of competencies (unsureness how to use the app functions) or unsureness about the task). Figure 1 shows the observable behavior showed children move away from another (image 1), not letting the partner watch what they are doing (image 2) or removing the partner’s hands from the screen (image 3) make faces (image 1), making sounds of annoyance or clearly verbalizing that they want to work alone, and looking seemingly aimlessly around (image 4).
Figure 1. Well-being below a score of 3
An increase of well-being could be related to children’s displayed pleasure of working with their partner (image 5), positive feelings about their digital creation (image 6 & 8), positive interactions with their partner (image 7), and having access (or a turn) to use the iPad. The well-being of the children could be positively influenced through providing support such as modeling the task activities, monitoring turn taking, and giving feedback.

Figure 2. Well-being above a score of 3
Looking at the individual child, it could be seen that they were often very absorbed in their activity and concentrated on their activities. The lack of the smiles, and happy or cheerful outcries may be due to nature of the activities. The activities required the children to plan, do, and review their actions during the creation process. These processes require them to concentrate and think critically, rather than engage in spontaneous, play like actions.

4.2. Involvement
The analysis of the involvement scores are mostly above three. During the first ten minutes of nearly all activities the average involvement score is four. This means that the children engaged in “continuous activity with intense moment and they seem at all time involved. They are not easily distracted.” (Laevers, 2005).
The children displayed high levels of involvement while they had a turn with the iPad and if their partner had a turn. Often the non-iPad partner watched the iPad user closely before having their own turn. They also commented their partner’s work, supported them verbally or through gestures with the operational issues with the app and ensured that they addressed the teacher design task (e.g. include a voice recording). So, they prepared their own iPad activities by watching and supporting their partner. However, their partner (the first iPad user) was often less involved and more ready to leave the activity to do something else.

**Table 4.** Overview of means of children’s involvement per 2 minutes per activity

<table>
<thead>
<tr>
<th>iPad Time</th>
<th>Involvement Scores per Activity</th>
<th>Means</th>
</tr>
</thead>
<tbody>
<tr>
<td>Minutes</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>6</td>
<td>5</td>
<td>3.75</td>
</tr>
<tr>
<td>8</td>
<td>3.75</td>
<td>1.875</td>
</tr>
<tr>
<td>10</td>
<td>2.5</td>
<td>0</td>
</tr>
<tr>
<td>12</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>14</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>16</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>18</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>20</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

**Figure 3.** Involvement above a level of 3

Image 9 to 11 show the different forms of involvement. Image 9 shows how the girl has the iPad and is the main iPad user, but her partner watched her actions closely and steps in to
show her something, when she needs help (where to find her name) and enable her to continue with her activity. Image 10 shows a pair that is unsure about what to do. Instead of just sitting and waiting for help or engaging in unrelated activities, the pair looks around to find out what they should do. They are highly involved and try to solve their problem. Image 12 shows another pair that works together. While one has the iPad, the other is actively involved in the partner’s actions and reacts with smiles and comments. Image 12 shows the level of involvement. The child is completely absorbed in the creation of his artifact. In this case he is moving the iPad around to get the best possible photo of a toy.

5. Discussion
Well-being and involvement affect each other, but their observable levels can differ. For instance, a child may be highly involved in the creation of a digital artifact (see images 1 to 3) and at the same time experience low levels of well-being. In the case of the girl seen in image 1 to 3, she expresses low levels of well-being, because she feels her partners disturb her work flow. Similarly her partner experience low levels of well-being, because she makes them wait extensively and excludes them for her iPad activity. Generally, it appears that after eight minutes the dynamics change. While the well-being decreases visibly, the children’s involvement decreases at a slower rate. The decreased well-being becomes evident in the children’s unsettledness. They are moving around, showing boredom and less energy in their activities. However, they still continue their activities, show persistency and concentration to create artifacts that satisfy their own expectations. Additionally, children use the time after completing their work to look at their peers digital artifacts. So, although they are not involved in the creation process, they are still involved in the activity itself.

Another reason for the decreasing score is grounded in the calculation of the means. All children’s scores were considered, even those of children that had finished their activity at that moment already and received ‘0’ as a score. So, the decrease of the scores is not an indicator of overall low levels of well-being and involvement, but an indicator that says that more and more children completed their activities and returned the iPad to the adult. Considering these findings, it becomes evident that the children’s active, personal, and hands-on iPad activities last between four and ten minutes. This time was spent on focused activities that had the children engage in critical thinking skills such as deciding what they wanted to create and share, how they would use the available functions. Then they would have to realize their ideas, review the artifacts and decide, if they ‘are happy’ with them or redo the elements they are not satisfied with.

The findings of this study powerfully illustrate how mobile technologies such as tablets and content creation applications can address a more holistic child development approach using technology than older desktop technologies and learning programmes with pre-determined learning outcomes. Using the scales of well-being and involvement was effective an effective tool to monitor and evaluate children’s engagement with tablets and content creation apps.
and their effects on the children’s behavior, well-being and involvement in the learning activities. The health concerns mentioned in the literature review could be addressed adequately. The children’s activities were short, purposeful, stimulated their creative and critical thinking, did not promote prolonged use such as games, allowed them to move around, share, communicate, collaborate and take turns in a spontaneous way (similarly to sharing or taking turns with a toy). However, using this kind of application cannot guarantee that children stay on task during the activities and achieve the teacher planned learning outcomes.

6. Conclusion
Children’s engagement with technologies comes along with a number of benefits, such as the personalization of learning, and risks (e.g. computer vision syndrome). In the past the focus of research where either the technology related learning outcomes and the health impacts that technology overuse may pose. While there were a number of recommendations made to address these health risks, the children’s well-being and involvement was not yet the center of attention when it came to young children’s technology use. However, both are the basis for learning to occur. So, considering both young children’s technology related learning activities was necessary.

This study found that using well-being and involvement as a way to evaluate the health risks that tablets and content creation apps may pose to young children, lead to an understanding that both are means to effectively address the previously described health hazards. It was also found that the children’s learning was focused on generic skills. The teacher’s tasks were only framing the children’s activities and they had to develop an understanding what means of communication (photo, drawing, or audio) works for their purposes. On top of that they developed transferable technology operation skills. Both may contribute to the development of technology literacy skills. These skills describe the use of online tools and applications to collaborate, share, create, inform and enrich.

7. Limitations
The study was a small scale study and conducted in one kindergarten only. The findings are indicative and need further investigations and application in other settings to test their transferability across different educational learning environments and cultures.

References:


**Appendices**

**Appendix 1: Leuven Scales of Well-being**

**Table 1. Leuven Scale of Well-Being**

<table>
<thead>
<tr>
<th>Level</th>
<th>Well-being</th>
<th>Signals</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Extremely low</td>
<td>The child clearly shows signs of discomfort such as crying or screaming. They may look dejected, sad, frightened or angry. The child does not respond to the environment avoids contact and is withdrawn. The child may behave aggressively, hurting him/herself or others.</td>
</tr>
<tr>
<td>2</td>
<td>Low</td>
<td>The posture, facial expression and actions indicate that the child does not feel at ease. However, the signals are less explicit than under level 1 or the sense of discomfort is not expressed the whole time.</td>
</tr>
<tr>
<td>3</td>
<td>Moderate</td>
<td>The child has a neutral posture. Facial expression and posture show little or no emotion. There are no signs indicating sadness or pleasure, comfort or discomfort</td>
</tr>
<tr>
<td>4</td>
<td>High</td>
<td>The child shows obvious signs of satisfaction (as listed under level 5). However, these signals are not constantly present with the same intensity</td>
</tr>
<tr>
<td>5</td>
<td>Extremely high</td>
<td>The child looks happy and cheerful, smiles, cries out with pleasure. They may be lively and full of energy. Actions can be spontaneous and expressive. The child may talk to him/herself, play with sounds, hum, or sing. The child appears relaxed and does not show any signs of stress or tension. He/she is open and accessible to the environment. The child expresses self-confidence and self-assurance.</td>
</tr>
</tbody>
</table>

Appendix 2: Leuven Scales of Involvement

Table 2. Leuven Scale of Involvement

<table>
<thead>
<tr>
<th>Level</th>
<th>Involvement</th>
<th>Signals</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Extremely low</td>
<td>Activity is simple, repetitive and passive. The child seems absent and displays no energy. They may stare into space or look around to see what others are doing.</td>
</tr>
<tr>
<td>2</td>
<td>Low</td>
<td>Frequently interrupted activity. The child will be engaged in the activity for some of the time they are observed, but there will be moments of non-activity when they will stare into space, or be distracted by what is going on around them.</td>
</tr>
<tr>
<td>3</td>
<td>Moderate</td>
<td>Mainly continuous activity. The child is busy with the activity but at a fairly routine level and there are few signs of real involvement. They make some progress with what they are doing but don’t show much energy and concentration and can be easily distracted.</td>
</tr>
<tr>
<td>4</td>
<td>High</td>
<td>Continuous activity with intense moments. The child’s activity has intense moments and at all times they seem involved. They are not easily distracted.</td>
</tr>
<tr>
<td>5</td>
<td>Extremely high</td>
<td>The child shows continuous and intense activity revealing the greatest involvement. They are concentrated, creative, energetic and persistent throughout nearly all the observed period.</td>
</tr>
</tbody>
</table>


Appendix 3: Framing Task for iPad activities

The following tasked framed their activities:

1. Take a photo of your partner and use the voice recording function to introduce your partner and tell us something about him/her.
2. Take a photo of an artifact of today’s small group learning activity. Add a voice recording that tells us what it is, how you made it and what you made it for.
3. Take a photo of a toy of your choice. Trace around it. Add a voice recording that tell use why you chose this toy.
4. Take a photo of small objects. Choose a number. Use the drawing function to circle the same amount of objects as the number you chose.
5. Look at the two posted images. Use the comment function to share what you see and what it makes you think of.

6. Look at your peer’s work, use the heart (like function) to show which works you like. You may add a voice recording to add a comment or ask questions about their work. When you are done, look at and listen to the teacher’s post. Share your answer to the task using the comment function.

7. Choose a 2D shape construction photo. Take a photo of it. You may add drawing features. Add a voice recording to tell use what you think it is. Then create your own 2D shape construction. Take a photo and tell us what you created.

8. Take a photo of your environment. Find the shapes in our environment and draw them. You may add a voice recording to tell us what shapes you found.

9. Use the Numicon Jigsaw to create different combinations of ten. Take a photo of your findings. You may add a drawing and a voice recording to tell us about your findings.
Guiding Mobile Learning Pedagogy Practices for Tablet use and Creation applications in ECE

Monika Tavernier

Abstract
The decades of research that documented the use of technology use in education repeatedly indicated that there is a need for new pedagogy practices that address the changing dynamics of teaching and learning with technology. The rapidly growing influence that technology has in our lives leads to a need to continue integrating technologies into educational settings to teach the next generations how and what for to use them. This should extend the use of programs that gamified learning. Such have their valid spot in education and instill the use of lower-order thinking due to their strong ties to the behaviorist learning learning theories. Educators may need less sophisticated pedagogy practices to effectively use then when using content creation apps. However, the future is about innovation and the creation of contents, so this type of technology exposure should be present in educational settings, too. Creation applications facilitate higher-order thinking. The use of a range of creation tools and a wide spectrum range of possible learning activities, require more complex pedagogy practices. Here, we present evidence-based practice insights and contribute to the emerging literature of future mobile learning pedagogy.

Keywords: ICT, mobile learning, technology, early childhood education, knowledge building

1. Introduction
Technology found its way into education a long time and there is plethora of studies about computer assisted learning (Siraj-Blatchford & Siraj-Blatchford, 2006; Kelly & Schorger, 2001) and Web 2.0 learning activities (Chu & Kennedy, 2011; Chu, Chow, & Tse, 2011; Notari, Reynolds, Chu, & Honegger, 2016). The calls to integrate technology go all the way down to early childhood education (Chiong & Shuler, 2010; Marsh et al, 2005; Edwards-Groves & Langman, 2010). However, the integration of technology in early childhood education (ECE) has been difficult (Edwards, 2013, Parette, Quesenberry, & Blum, 2010; Li, 2006). Teachers’ pedagogical beliefs, a lack of positive experiences of technology use in early childhood settings (Ertmer, 2005), and health concerns (Spritzer, 2015) are part of the reasons. Despite these reasons, a range of technology devices found their way into education

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Technology use in education is so popular that the development and sales of educational software and programs is an ever growing market (Goodwin, & Highfield; 2012). Behavior shaping programs that gamify the learning of pre-determined content (such as arithmetics and phonetics) are particularly popular (Goodwin, 2012), even though it was found that the related learning effect may only be short-term (Falloon, 2013b). Often, these activities are a form of content consuming programs embedded in instructive, manipulative or combined instructive-manipulative activities designs.

Slowly, researchers (Falloon, 2013; Couse & Chen, 2010) and teachers (Goodwin, 2012) start to understand the educational potential of content creation applications. Creation apps, also called constructive apps (Goodwin & Highfield, 2012), are open-ended programs that allow the user to develop digital multimedia content using photo, video, drawings, voice recordings and text. The introduction of such open-ended programs, require more planning and pedagogical framing, because the app itself does not pre-determine an activity purpose, outcome or sequence.

Using such application relates closer to the way technology is used out of the school environment. Mobile technologies such as mobile phones and tablets turned into a form of cultural tools (Wohlwend, 2010; Edwards, 2013; Wolfe & Flewitt, 2010) that shaped the ways we communicate, collaborate, work, and create. Using content creation apps allows children to use mobile technologies to communicate, collaborate and create. However, as with all cultural tools children need some form of modeling and learning that allows them to develop the skills to use them effectively. So, developing new pedagogy practices that fill this gap is a timely thing to do.

This article is part of an ongoing research that implements iPads and one content creation app in one early childhood setting to improve young children’s reflective self-learning abilities. This work proposes the use of guided interactions (Plowman & Stephen, 2007) and self-determination theory (Deci & Ryan, 2000) as a basis for the development of mobile learning pedagogy for tablets and content creation application.

1.1. Theoretical Framework

The theoretical framework (see figure 1) illustrates that the teacher’s actions, task design, and the learning environment constitute the cornerstones of the pedagogy practices proposed in this study. These practices are shaped by Plowman and Stephen’s (2007) work about teacher’s actions and interactions with the children and technology, and Ryan and Deci’s self-determination theory (2000), a motivation theory. This theory affects on the one hand the teacher’s development of learning activities and on the other hand the children’s actual motivation during the creation process of the digital artifacts.

Guided interactions encompasses all interactions between teacher, child and technology (Plowman & Stephen, 2007) and can be classified into direct and indirect interactions, both of
which enable teachers to facilitate the purposeful use of technology. This teacher’s actions during class activities include demonstrations, instructions, modeling, prompting, feedback, monitoring and managing (Plowman & Stephen, 2007). All of these actions affect how children use the digital creation tools embedded in the app.

Ryan ad Deci’s (2000) self-determination theory affects the development of pedagogy practices that consider the children’s perspective in terms of their perceived task autonomy, competence, and relatedness, and the final outcome, the artifacts. According to this theory, a person’s motivation to engage in an activity is high, if they experience high levels of perceived autonomy, competence and relatedness (see Table 1). Therefore, the proposed pedagogy practices are grounded within self-determination theory (Ryan and Deci, 2000) and informed by guided interactions (Plowman & Stephen, 2007).

Table 1. Self-Determination Determiners

<table>
<thead>
<tr>
<th>Determiners</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Autonomy</td>
<td>Autonomy described the ability to control the course of the activity</td>
</tr>
<tr>
<td>Competence</td>
<td>Competence described the ability to effectively manage the challenges of the activity.</td>
</tr>
<tr>
<td>Relatedness</td>
<td>Relatedness described the ability to relate to social contact during the activity</td>
</tr>
</tbody>
</table>

Figure 1. Theoretical Framework
Adapted from Ryan and Deci (2000)

2. Literature Review
From Naismith, Lonsdale, Vavoula, and Sharples’ (2004) summary of mobile learning activities we know that technology can cater for six different kinds of learning (see Table 2). However, their work was published before the release of the iPad and other mobile touch screen operated devices. So, their work needs to be extended and further developed to include newly emerged forms of mobile learning. Kearney, Schuck, Burden, and Aubusson (2012) suggest that mobile learning pedagogy is built on authenticity, collaboration, and personalization.

Table 2. Learning Theories for Technology Use in Education

<table>
<thead>
<tr>
<th>Learning Theory</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Behaviorist</td>
<td>Activities that promote learning as a change in observable actions</td>
</tr>
<tr>
<td>Constructivist</td>
<td>Activities in which learning actively construct new ideas or concepts based on both their previous and current knowledge.</td>
</tr>
<tr>
<td>Situated</td>
<td>Activities that promote learning within an authentic context and culture.</td>
</tr>
<tr>
<td>Collaborative</td>
<td>Activities that promote learning through social interaction.</td>
</tr>
<tr>
<td>Informal and lifelong</td>
<td>Activities that support learning outside a dedicated learning environment and formal curriculum</td>
</tr>
<tr>
<td>Learning and teaching support</td>
<td>Activities that assist in the coordination of learners and resources for learning activities.</td>
</tr>
</tbody>
</table>

Adapted from Naismith et al. (2004; p. 18)
While all these works provide important insights into mobile learning, they appear too complex and theoretical for the average teacher. Evidence-based practices are more effective to make change happen in the early years field (Buysse & Wesley, 2006). Marder and Fraser (2012) suggest that evidence-based practice may be instructional strategies, intervention, or teaching programs that have resulted repeatedly positive outcomes when experimentally tested. Due to the repeated implementation of these practices they come along with a range of practical information that teachers may be better able to adapt for their own teaching environments that theories. Therefore, this research introduces evidence-based practices for mobile learning activities in early childhood education.
2.1. Guided Interactions

Proximal Guided Interactions (see Table 3) provide a framework that classifies the interactions between a teacher and the students during an activity that facilitates the use of technology devices. Based on real observation in classrooms Plowman and Stephen developed an overview of interactions that enhance children’s engagement and learning using technology. They suggest that using a range of communication means such as oral, physical actions, gestures, touch, and face expressions will enhance children’s learning, and the lack of them will impact their technology related learning experiences negatively (Plowman & Stephen, 2005). Include practices such as demonstrating how to use the technology, as well as scaffolding practices such as explaining, modelling, prompting and giving feedback in mobile learning pedagogy practices for young children appears to be a promising approach.

Table 3. Proximal Guided Interactions

<table>
<thead>
<tr>
<th>Form of guided interaction</th>
<th>Example</th>
<th>Mode</th>
<th>Learning</th>
</tr>
</thead>
<tbody>
<tr>
<td>demonstrating</td>
<td>How to use a tool such as the paintbrush or an eraser</td>
<td>Physical action, oral</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Placing a hand over a child’s hand as their move the cursor or click on an icon</td>
<td>Touch</td>
<td></td>
</tr>
<tr>
<td></td>
<td>How to frame a picture in viewfinder</td>
<td>Touch, oral</td>
<td></td>
</tr>
<tr>
<td></td>
<td>How to plug in electronic keyboard</td>
<td>Physical action, oral</td>
<td>operational</td>
</tr>
<tr>
<td></td>
<td>Turning over pages of a story as children listen on audio tape</td>
<td>Physical action</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Waving hand in front of Eye Toy</td>
<td></td>
<td></td>
</tr>
<tr>
<td>enjoying</td>
<td>Sharing pleasure in features such as animation</td>
<td>Oral, laughter</td>
<td>Learning disposition</td>
</tr>
<tr>
<td></td>
<td>Moving to the music on a CD</td>
<td></td>
<td>Knowledge of the world, learning</td>
</tr>
<tr>
<td>Role</td>
<td>Description</td>
<td>Action</td>
<td>Disposition</td>
</tr>
<tr>
<td>------------</td>
<td>------------------------------------------------------------------------------</td>
<td>----------------</td>
<td>------------------------------</td>
</tr>
<tr>
<td>explaining</td>
<td>Explaining what is on the slides for the computer microscope</td>
<td>Oral</td>
<td>Knowledge of the world</td>
</tr>
<tr>
<td>instructing</td>
<td>Reading dialogue box on screen; Tell child how to use digital camera; Tell child to push the button on a tape player</td>
<td>Oral, gesture oral</td>
<td>operational</td>
</tr>
<tr>
<td>managing</td>
<td>Intervening in turn-taking</td>
<td>Oral, facial expression</td>
<td>Learning disposition</td>
</tr>
<tr>
<td>modelling</td>
<td>Putting on headphones to check sound level; Using a play phone to order a taxi</td>
<td>Physical action, oral</td>
<td>Operational; Knowledge of the world</td>
</tr>
<tr>
<td>monitoring</td>
<td>Moving child to appropriate level of difficulty</td>
<td>Gesture, oral</td>
<td>Learning disposition, operational</td>
</tr>
<tr>
<td>prompting</td>
<td>Suggesting a child tries something new; Helping with typing in names</td>
<td>Oral</td>
<td>Learning disposition</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Oral, physical action</td>
<td>operational</td>
</tr>
<tr>
<td>Providing feedback</td>
<td>Giving encouragement for efforts; Smiling as child types name; Saying ‘That’s beautiful’ when child shows picture on camera</td>
<td>Oral, facial expression oral</td>
<td>Learning disposition</td>
</tr>
<tr>
<td>supporting</td>
<td>Staying close to child using video camera for safety and emotional support</td>
<td>Physical presence</td>
<td>Learning disposition, operational</td>
</tr>
</tbody>
</table>

Source: Plowman and Stephen, 2007 (p. 15)
3. Methods
The presented part of the ongoing research aims to share the applied pedagogy practices and activities. Its objectives are to motivate other teachers to explore and effectively use mobile devices and content creation applications to enhance or transform young children’s learning and learning with technology experiences.

3.1. Sampling
The sample was a purposive involving one group of children attending an international kindergartens that follows with international baccalaureate primary years program. The sample group includes eight children ranging from four to five years. All twenty children were invited to join the study, however, only the parents of eight children provided the full consent for their children to participate. The sample represents children that have a middle class socioeconomic background that allows them to attend a private, non-subsidized international kindergarten in Hong Kong. These children are not technology savvy, but are likely to be exposed to mobile devices in the out-of-school and in-school environment. However, their independent and purposeful engagement with these devices may vary widely.

3.2. Study Design
The qualitative data collected in the first six months of this 18 months long data collection period, included twelve videos of about 26 minutes each. The videos were taken during planned observations. Each activity followed a similar repertoire:
• Children were gathered in a circle around the teaching adult
• The adult would present the activity
• The adult would demonstrate the activity, involving the children in the description of the sequence of action and purpose of each action
• The children would receive an iPad (one iPad for two children) and engage in the activity
• The adult monitors and supports the children’s activities.
At all times a guiding topic was provided (e.g. take a photo of the environment and find shapes) to frame the children’s activities. Further, a selection of functions (photo, video, audio, drawing) was suggested to inspire the children’s artifact creation. However, the children decided how they made use of the functions and developed the content of their artifacts by themselves.

Some activities were conducted by the teacher and some by the researcher. Although they tried to adapt the same approach, they actions and interactions with the children varied. While the teacher was focused on supporting the children in achieving the planned activity outcomes through demonstration and repeated modeling, the researcher focused on keeping her influence on the children’s work as small as possible. As a result she used demonstration only at the beginning of each activity and refrained from repeated demonstration or modeling.
3.3 Data Collection

The qualitative data was collected over a period twelve activities teacher-led activities that took were conducted during the first six months of a bigger study. The data included video observation records, interviews, artifacts, and documents (evaluation records, transcripts, lesson plans, activity reflections). To evaluate the activities and identify the best pedagogy practices the video data and artifacts (children’s digital artifacts and adult’s activity plans and activity reflections) were deemed most suitable (see figure 2).

The data collection framework illustrates that the teacher’s actions and interactions during an activity affect the children’s actions and interactions and therefore their digital artifacts creations. The teacher’s activity planning and reflection (artifacts) also impact the children’s digital artifact creations, because they frame the current and future activities. So, they too, affect the children’s well-being, involvement and motivation. As a result, the children’s actions, interactions and artifacts are indicators of their well-being, involvement, and motivation and in the digital artifacts. Therefore, they were analyzed to determine the best ‘mobile learning pedagogy practices with content creation apps’ and lead to the development of evidence-based pedagogy practices.
3.4. Data Analysis

The effectiveness of the pedagogy practices was assessed considering the children’s observable behavior (evidence based on video recordings), in particular their well-being and involvement (evidence based on video recordings), their motivation to participate in the teacher-designed activities, children’s feedback after activities, and their digital artifacts. The findings from all three sets of data will be triangulated to evaluate and understand the effect of the pedagogy practices.
The Leuven Scales of well-being and involvement (Leavers, 2005) will be used to analyse the children’s observable well-being and involvement. The findings were reported in another article and conference presentation (Student well-being and involvement: Technology use in Kindergarten).

The children’s motivation was evaluated using statements of post-experimental intrinsic motivation inventory (IMI; Ryan & Deci, 2000). Due to the children’s short attention span and the richness of the collected data, the statements were used to analyse the children’s behavior captured on the video. The children’s verbal interactions with their peers and the teacher (including comments and questions about the tasks) were used as indicators for the perceived autonomy, competence, and relatedness. For instance, children’s questions about the operation of the app and task understanding were related to their perceived competence (see Table 4). The analysis of the children’s artifacts served as a way to re-evaluate the video observations (well-being and involvement) and to compare the children’s feedback with the views of the adult leading the activity. In addition to this procedure, the children were asked to rate three statements after four individual activities. Three smiley faces indicated their level of agreement and provided feedback (see figure 3). The children used these smiles or a verbal comment such as ‘a lot’, ‘very much’, or ‘a little’ to rate the following statements:

- I think the activity was fun to do. (Relatedness)
- I think I did pretty well at this activity. (Competence)
- I tried really hard to do well during the activity. (Competence)

Statement 1 was deemed to related to relatedness, because the children’s perceived fun depended on their experienced team work as well as on their competence and interest in the activity. Statement 2 and 3 were related to competence. Children were deemed to think more positive about their achievement, if they needed little extra help and could cope with the task independently. The children’s feedback was valuable, but not reliable enough to stand along. Therefore, the gained insights from the feedback was triangulated with the findings from the video data and artifacts. For instance, the quality of speech, speech content and visual content were deemed indicators of the children’s motivation. So if a child recorded “I do not know what to draw”, it was taken as an indicator for low feeling of competence and low motivation.

Figure 3. Rating Scale
The video data included ten videos of 20 to 30 minutes each. They captured all iPad activities from the moment the teacher introduced an activity until the last child finished the activity and returned the iPad, a total of 305 minutes. A total of 80 artifacts were evaluated.

Table 4. Adapted Post-Experimental Intrinsic Motivation Inventory Statements

<table>
<thead>
<tr>
<th>Determiners</th>
<th>IMI</th>
<th>Indicator</th>
</tr>
</thead>
<tbody>
<tr>
<td>Autonomy</td>
<td>I feel like I cannot decide by myself how I want to use the app.</td>
<td>- Child asks for guidance (how to do it, what to do next)</td>
</tr>
<tr>
<td></td>
<td>I feel I am free to express my ideas and thoughts within the app activities.</td>
<td>- Child work independently and realizes the task requirement in her own way</td>
</tr>
<tr>
<td></td>
<td>I feel I can decide for myself how to do things with the app.</td>
<td></td>
</tr>
<tr>
<td>Competence</td>
<td>Often, I am not sure how to use the app functions.</td>
<td>- Child requires extra help to operate the app or device</td>
</tr>
<tr>
<td></td>
<td>I often feel, I am not very good at using the app.</td>
<td>- Child requires extra support to complete the tasks</td>
</tr>
<tr>
<td></td>
<td>I feel that I am learning interesting new skills in the iPad group.</td>
<td></td>
</tr>
<tr>
<td>Relatedness</td>
<td>I get along with the children in the iPad group.</td>
<td>- Child is interested in other’s activities</td>
</tr>
<tr>
<td></td>
<td>I think the people in the iPad group care about me.</td>
<td>- Child also wants to have a turn</td>
</tr>
<tr>
<td></td>
<td>I feel close to the people in the iPad group.</td>
<td>- Child is eager to participate</td>
</tr>
</tbody>
</table>

Adapted from Ryan and Deci (2000)

4. Findings

Although the data analysis has not been completed yet, the preliminary findings indicate that a good balance of guided interactions and activity designs that considered the three elements of the self-determination theory (autonomy, competence, and relatedness) are a solid foundation to design and conduct learning activities in kindergarten that make use of tablets and content creation app.

The task design was often framing an activity. They provided the children a theme and an expected digital outcome. The children were given the autonomy to decide how they wanted to use the embedded app functions such as photo taking, drawing, and voice recording, to express their understandings, share their views and knowledge.
Artifacts, and richer descriptions of the findings will follow later.

References


Development of students’ research skills through digital storytelling with mobile devices

Natalia Churchill¹ and Edwina Lam²

Abstract
Developing online research skills is essential for 21st century learners. They are important because they incorporate skills such as problem solving, critical thinking and collaboration among others. Our school-based project required students to examine authentic problems in their daily lives that enticed them to develop multiple solutions by creating new products or services or innovating on existing products or services. This innovation process involves online research supported by real-life data collection. One of the main foci of the project is digital storytelling, which required students to plan, develop and present their design thinking process through the use of digital stories with mobile devices. We found out that digital storytelling contributed to the development of students' online research skills, as the outcome demonstrated that online research skills and digital storytelling supported the development of students’ critical thinking skills, and the ability to solve problems independently and collaboratively. Critical thinking skills in the context of this project are examined as the ability of the students to search for information, assess its validity and reliability, and use the information to construct new meanings.

Keywords: online research skills, digital storytelling, mobile technology

1. Introduction
Contemporary research demonstrates that schools across the world create opportunities for the integration of information and communication technology into mainstream curriculum (Vincent, 2006; Jewitt, 2008; Robinson, 2010; Yang & Wu, 2012; Sweeney-Burt, 2014). The context of our project is an international school in Hong Kong. The school management understands the importance of technology integration by the teachers in day-to-day lessons, and the teachers are given opportunities to engage their students in meaningful projects with technology. Representing through multimodal texts and research skills are considered as important components of the school curriculum, thus acknowledging the need for the students to develop relevant 21st century skills. These skills are: independent learning, digital skills, thinking skills, communication skills, teamwork, knowledge managements and ethics (Bates, 2015). Furthermore, in order to cultivate these skills in today’s students it is important to understand how the school curriculum can address them and what practices are needed to be established. Trilling and Fadel (2009) suggested that effective project learning

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might be a suitable context for the development of the 21st century skills. They claimed that it should have the following key elements:

- Project outcomes tied to curriculum and learning goals;
- Driving questions and problems lead students to the central concepts or principles of the topic or subject area;
- Learners’ investigations and research involve enquiry and knowledge building;
- Learners are responsible for designing and managing much of their learning; and
- Projects are based on authentic real-world problems and questions that students care about (p. 109).

An attempt has been made to integrate these key elements into our school’s curriculum. One of the non-core subjects in the school is Research Skills. This subject was identified as suitable for project work that would allow the students to investigate a real-life problem and conduct a research in order to provide solutions.

2. Research skills project

Primary 5 Research Skills lessons are designed to help the students develop collaboration skills and critical thinking skills for conducting independent online research. Critical thinking skills in the context of the school project on innovation are examined as the ability of the students to identify the information they need, search for it online, evaluate its validity and reliability, and use this information to address a given authentic problem.

The students were required to work collaboratively in small groups to examine authentic problems in their daily lives that enticed them to develop multiple solutions by creating new products or services or innovating on existing products or services. This innovation process involved online research supported by real-life data collection. The students were given a task to identify ways to improve a product or a service in their school. For example, projects requiring improving a product were among others: revamping classroom furniture, beautifying the school’s recess areas, innovating a paper recycling machine, modifying the school’s outdoor sun umbrellas into rain-water collectors. Projects requiring improving a service were among others: planning recess recreational activities, improving lunch distribution at the school canteen, and managing unfair play during ball games. The project that we are going to discuss in this paper is called “The Amazing Collecto-Umbrella” and it was created by a small group of 10 years-old students.

The students were given two weeks to brainstorm what they would like to research. For this project, the students got the inspiration during a Science lesson at school when they learnt about water conservation. During the Research Skills lesson, they walked around the school with the iPads and took pictures of different places at school which potentially could be used for their project. Whenever it was necessary, they stopped and conducted an online search on the different ways to use rainwater. Eventually, they came up with the idea to water the school vegetable patch using rainwater they would collect. They came up with a design of their product, which was a combination of an umbrella turned upside down, a drain in the middle of the umbrella, a pipe inserted in an outdoor table and a plastic barrel placed under
the table that would serve as a rainwater collector. The rough sketch of their product design (hand-drawn and later photographed with the use of an iPad) can be seen in Figure 1 below.

![Image of Amazing Collecto-Umbrella design](image)

**Figure 1:** The Amazing Collecto-Umbrella design

Consequently, the students showed their design to the class. They emailed the photograph of the design and conducted a survey using Google forms to find out whether the potential consumers of their product (school children) would appreciate their idea and whether they had any feedback, which would allow the innovators to improve their design. Having their survey in iPad allowed the students to approach their schoolmates in different areas of the school and have immediate access to the survey results. The innovation process involved online research supported by real-life data collection.

3. **Digital storytelling as a suitable context**

Students created digital stories in iMovie to present their research findings and product design. Digital storytelling with iMovie was identified as a suitable context for the research skills project because “… pupils need to be taught now which tools are effective and how to use them responsibly” (e-Safetysupport, 2013). Representing with multimedia may be possible through digital storytelling, which, in turn, becomes a 21st century skills tool to help students increase or develop digital literacy skills. ‘Digital literacy’ in the context of this school project is defined as a set of skills that enable an individual to use technologies to work with information (Churchill, 2016). Jewitt (2008) highlighted that all modes contribute to the construction of meanings in some way and “no one mode stands alone in the process of making meanings; rather, each plays a discrete role in the whole” (p. 247). Hoban (2013) suggested that “digital explanations” are advantageous for teaching and learning the nature of science. He further compared digital explanations to slide shows and recommended the use of digital storytelling as beneficial to student engagement and understanding of the material. The final product of digital storytelling is a digital story. Reading such stories includes interrogating modalities:
particular ways in which the information is to be encoded for presentation to human beings (Churchill, 2016). It means that “through the use and creation of multimodal texts, students have opportunities to use linguistic, visual and audio modes in order to experience, conceptualize, analyze and apply meaning” (Wilder, 2010). Digital storytelling is an activity in which students’ online research skills get deployed. It’s a tool and a context that requires working with media.

4. Affordances of mobile technologies

Mobile devices are becoming increasingly predominant in everyday use. Community of researchers around the world recognize the importance of mobile technologies in classroom settings (Attewell, 2005; Traxel, 2009; Hutchison & Reinking, 2011). Mobility includes not only the ability of students to conveniently hold mobile devices like iPads, but it allows searching for the information on-the-go. In such way, the students are empowered to conduct online research whenever the need arises. This is different from the use of laptops, which are bulkier and thus limit the physical mobility. In addition, taking photographs with laptop cameras might not be convenient.

In addition, conducting research on a desktop computer, albeit relevant to the given project, may not necessarily support students’ critical thinking that is otherwise evident when students come across a real-life problem. For example, in the project discussed in this paper, the students carried their iPads around the school when brainstorming on the various places that might be suitable for their product design. On one instance, they considered innovating a school turtle pond. The use of iPads provided an affordance of conducting immediate online research of similar problems (if any) in other schools or institutions. On another instance, the students came across an outdoor table with an in-built sun umbrella. This immediately instigated an online search for the relevant information with the use of iPads. As a result, upon searching for types of umbrellas and rainwater, they collected sufficient background information and images, and identified the topic of their research and

The affordances of mobile technologies for teaching and learning have been seen in the literature. For example, in a study conducted on the use of personal digital assistants (PDAs) – a mobile technology that proceeded iPads and smartphones – the researchers (Churchill & Churchill, 2008) identified the following five educational affordances of this mobile technology:

1. Multimedia-access tool
2. Connectivity tool
3. Capture tool
4. Representational tool
5. Analytical tool

In light of the development of contemporary mobile technologies, it is possible to claim that the second affordance – connectivity tool – was extended to include the Internet connectivity.

These are the affordances of mobile technology for the development of research skills through digital storytelling that we observed in the innovation project discussed in this paper.
5. Conclusion
The students used critical thinking skills to work with information they found online. They collected information relevant to their research, evaluated its validity and reliability and used the information for their project. Furthermore, digital storytelling contributed to the development of students’ research skills as it underlined problem-solving, collaboration and involved critical thinking – the 21st century skills – while authentic problem-solving involved research and multiple solutions. It was concluded that developing of digital stories contributed to the development of research skills, while mobile technologies – the use of iPads – supported on-the-go information and ability to search for, save and retrieve information as well as reuse it in a given authentic problem-solving context.

References


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