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CONTENTS

Empathic Technologies and Virtual, Contextual and Mobile Learning in VR/AR/MR Environments

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Abstract

Students' motivation and interest as well interaction between students and teachers in e-Learning and Mobile Learning environments can be improved through the use of affective technologies and empathic systems.This paper introduces Emphatic concepts, an emphatic platform and an Emphatic Forum approach. It contextualizes this initiative within the Emphatic Products, a EU/ITEA2 research project, and proposes future developments in terms of unique features such as moving to, adapting to, even defining a whole new interaction paradigm in Virtual Reality (VR), Augmented Reality (AR) and Mixed Reality (MR) immersive environments.

Keywords: Affective technology; Empathic system; Forum; Virtual reality; Augmented reality; Mixed reality; Immersive environment

1. Introduction

1.1. Emotions, Empathy and Affective Technologies

It is known that emotions remain primarily in the limbic system of the brain as explained by Picard (1997). Emotions are instinctive responses to external stimuli that are not planned ahead or formed according to logical processes. Conventionally, emotions have been considered as the reverse of reasonable and rational action. For that reason, they were perceived as being in conflict with a rational approach. However, the reality is that human reactions and responses are formed by a combination of both emotional and rational processes.

Empathy is the ability to understand the emotions of others in an adequate way, and to experience similar feelings ourselves, as described Nguyen and Masthoff (2009), by allowing us to make increased interactions in social contexts and increasing trust and collaboration as positive behaviors. among others. It is also the skill to assign our own emotions and feelings to an object, such as a work of art (Dictionary.com, 2014). Thus, the human capacity to relate with others, or to create emotional attachments to objects, presents a great opportunity for the improvement of information technology (IT) and information systems (IS). Since emotions determine and structure our perceptions, direct our attention and prepare us for action as stated by Paiva, Leite and Ribeiro (2014), there is an increasing active presence of our affective dimension in our actions and decisions; it is discussed how emotional

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information systems can take us to a different and more powerful level. Many researchers, among them Prendinger, Dohi, Wang, Mayer and Ishizuka (2004), defend that systems interacting emotionally with users, by recognizing emotions for instance, could make those systems easier to use and increase productivity.

The main purpose of affective technology is to contribute to the increase of coherence, consistency, predictability and credibility of a human computer interaction, thus resulting in computers and technologies capable of recognizing human emotions, interacting with them and conveying positive emotions. On the other hand, empathic systems are communication and information platforms, as well as software, whose aim is to provide an empathic, affective component to interactions.

As technology becomes more present and constant in our daily lives, the applications of affective technologies and empathic systems are increasing and being introduced in new contexts and areas of expertise. Affective technologies and empathic systems can have great benefits in Education (both in form of e-Learning and Mobile Learning). Whilst traditional teaching eases the lecturer's role in terms of immediately adjusting himself or herself to student needs, with constant feedback, distance learning, does not make it possible for teachers and students to have physical interactions and know the needs and skills of each other as states Wang, Chignell and Ishizuka (2006). As a result, education technologists and other researchers have focused on the mentioned constraint, focusing on empathic systems and the way how they can improve learner's interest and motivation.

More than ten years ago, mobile learning had to do with using laptop computers. Five years ago, mobile learning referred to the use of smartphones and tablets. One of the current challenges for AR technology is to implement effective technology on mobile platforms as discussed by Rattanarungrot, White and Newbury (2014). We envision that in five years' time VR/AR devices, namely those associated with smartphones, will be widely used in distance and even face to face (AR and MR) learning. In this context, augmented reality can be defined as a concept "for displaying digital contents overlaid on top of real world scenes that can enhance remarkably a user's learning experiences" (Rattanarungrot et al., 2014) by using advanced computer vision and tracking techniques to recognize and make use of markers, images or 3D objects in real environment as suggested by Carmigniani et al. (2011).

Guy (2010) anticipated the use of VR stating that "What is missing currently is a fully mobile VR system". With Samsung Gear VR and Google Cardboard system, among others, affordable mobile VR systems that can be used for learning are no longer missing.

In July 2015, Ambient Insight Mobile Learning Market Report, Atkins (2015) stated that "Smartphone-enabled virtual reality education apps are an entirely new type of Mobile Learning".

1.2. The 'Emphatic Products' project

The Empathic Products project was held under the ITEA2 umbrella and consisted of a consortium of a diversity of companies, big ones and SMB, commercial and academic. These companies came from

several European countries with different empathic technologies that integrated to increase their knowledge through viable prototypes. Those working prototypes were divided into four main domains: Wellness; Immersive Communication; Public Environments; Education and Gaming. Development had to take into account the ability to use empathy, that is, to detect or influence users' emotional states. Empathic information could be acquired through sensors (heart rate, facial expression, motion, brain activity) or extracted from users' inputs (text, voice, interactions). Depending on the product, users could confirm or not the emotional states that were detected or extracted.

As was seen in the Empathic Products project, empathy comes in many ways and different contexts. Being its aim to make human interaction more effective while using technology to access information or communicate with others, it is therefore no surprise that many of the implemented use cases evoke VR/AR systems. When words like "immersive" are applied to systems consisting of flat panels, some with touch input, when 3D environments are used to manage information and recognize who is also interested in a certain topic, VR/AR/MR comes naturally as the next frontier to explore. That is what this paper intends to do based on, for the time being, laboratory settings with two VR systems, Oculus Rift SDK2 and Google Cardboard viewer. The software development is based in Unity3D technologies which is the main development platform for these systems and allows, with technology from Microsoft, also to simulate AR/MR experiences for Hololens.

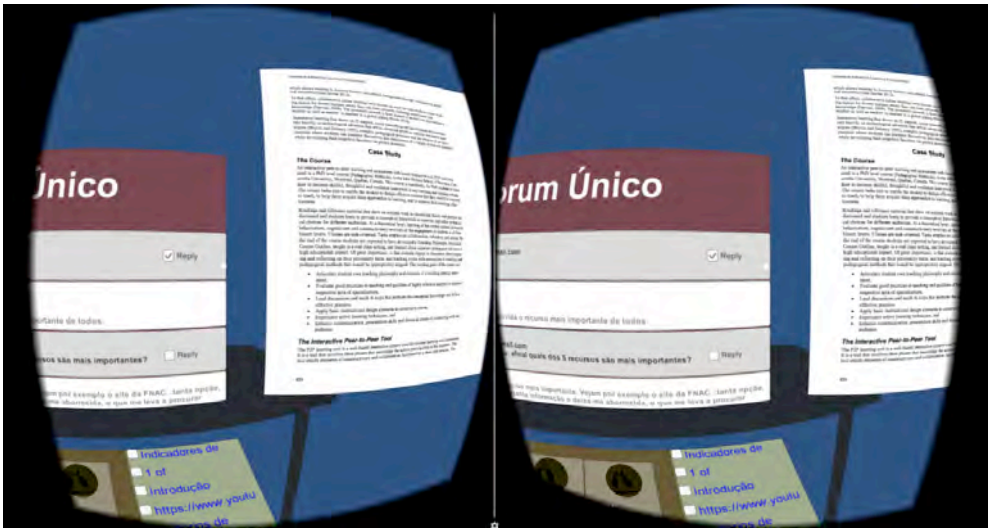

Figure 1. Using Unity3D tools to target devices like Oculus Rift and Google Cardboard

The initial conceptual environment will still be the one present in Umniverse. Nevertheless, being the Umniverse client written in Javascript, it will be rewritten from scratch in Unity C#. For the backend, it has been decided to invest in a new 100% cloud solution using Google's Appengine Java PaaS (Platform as a Service). Still less rich than the previous Umniverse technologies, this move prepares us for the foreseeable future and leads us to rethink the whole concept, thus facilitating new approaches allowed by new interaction frameworks. Being Unity a tool with a wide support to develop to the most

recent VR, AR and MR platforms as shown in Fig. 1 (Oculus Rift and Google Cardboard), it still enables to target a wide variety of other systems from desktop (i.e. Windows, Linux, MacOS), to mobile operating systems (i.e. iOS, Android, Tizen, Windows) not leaving out gaming consoles (i.e. PlayStation, Xbox) nor TV (i.e. Apple TV, Android TV, WebOS, Tizen). The web browser, the only client platform of Umniverse, won't be neglected with two HTML5 clients, one of them using a WebGL based version exported from Unity.
As the previous R&D frontend-backend 3D environment was called Umniverse, the present one is, for the time being, called TAT as meaning the intersection of our Tapalife, Apluk and Tappnet R&D projects.

1.3. Adding a 3D Immersive environment

One of the main research hurdles of the previous tested, Umniverse, was to be able to distinguish how easy and natural the use of an Empathic Forum was while at the same moment the user was subjected to a learning curve through the Umniverse environment itself. Using a 3D environment in a 2D monitor and using as an input a mouse, cleary 2D, and keyboard was nothing but natural. VR/AR/MR has thus the potential to allow users to navigate and experience a 3D world the way human beings have evolved in doing so, with their senses and hand movements interacting in a 3D space.
The Empathic Forum Umniverse experience and its undealt potential is still so strong that in TAT every communication is based around “virtual apps” as if each one was a forum. Thus, any “virtual app” allows communication among the app users taking advantage of the same Empathic Forum features that were previously implemented and tested. This implementation is even technically improved for, being cloud based, one has to prepare for situations where there are MOOC (Massive Online Open Course) with thousands of students and communities with up to millions of members/friends/followers.

2. Literature Review

In general, affective computing studies how computers can recognize, model and respond to human emotions and how these emotions can be expressed in a such remote environment as an interface / computer interaction as explained by Picard (1997).
We can differentiate two crucial dimensions of affective computing. One has to do with using technologies capable of capturing the intricate variety of human emotional responses. The other is an affective response to the collected data that has been captured through the mentioned technologies. Humans use body language and facial expression as a mean of expressing emotions and as a result, computers need to decide on the right emotional responses in order not to have negative reactions from users (Picard, 2003). Picard (2002, 2009) referred the use of affective technologies in medicine. This technology can undoubtedly play a role while a treatment is conducted, thus improving the well-being of the patient. Besides the use of these technologies in medicine. Other authors (Prendinger et

al., 2004) have identified five possible uses for empathic technologies: i) tracking and measurement; ii) reflection and interaction; iii) selection of specific approaches; iv) building of social relationships; and v) building of predictive models. All the above referring to the affective states of agents or avatars.

Bickmore (2003) introduced a theory to describe long-term social relationships between computers and computer artifacts and users. This would allow users to build relationships and also provide them with support during a negative emotional state, for example, in the context of a health treatment (Bickmore, 2003).

Empathic systems have increased importance within e-Learning and Virtual Learning Environments (VLE). Kort, Reilly and Picard (2001) developed a four-quadrant model describing interrelations between learning and emotion and suggested a computerized "learning companion" to answer according to the affective states of the user. In this model students would start in a quadrant and evolve to other quadrants, consequently helping the students regain interest and enthusiasm.

Akbiyik (2010) used this model to study the effect of introducing Information and Communication Technology (ICT) in the classroom. They concluded that in order to be more efficient, systems should consider a myriad of variables (Akbiyik, 2010).

Shen, Wang and Shen (2009) not only concluded that it is possible to improve the results of students by providing an emotionally aware learning environment, but also provided a list of key aspects that will need to be researched and addressed in the future (Shen et al., 2009): i) more varied technologies to capture emotions; ii) affective learning systems will need to cope with entire courses and not with singled out materials; iii) the mentioned systems will need to cope with teaching and group learning; and iv) e-learning models will adjust teaching strategies to affective states.

Rubens, Kaplan and Okamoto (2014) introduce and develop the concept of Web 3.0 and e-learning environments. This includes a component of 3D environments. In what immersive 3D environments is concerned, Tang, Biocca, and Lim (2004) explain and debate the differences of Virtual Reality versus Augmented Reality and respective advantages/inconvenients. Being focused in social interaction, it becomes particularly interesting for our education/communication project. Focused explicitly on education, Ly, Saadé, and Morin (2015) show that there are many advantages on using immersive environments, whatever learning theories one supports (constructivism, cognitivism), namely to visualize and contact with what a human can hardly see in real life.

Mujber, Szecsi, and Hashmi (2004) present Virtual reality (VR) as a "rapidly developing computer interface that strives to immerse the user completely within an experimental simulation, thereby greatly enhancing the overall impact and providing a much more intuitive link between the computer and the human participants". In fact, the primary concept behind VR is that of illusion. Therefore, this type of technology allows illusion to gain form, by letting its users enter through the computer screen into a three-dimensional (3D) world. The user can move around and interact with the presented worlds as if they were real (Mujber et al., 2004). In an educational context, VR can offer learners an audio-

visual dimension that presents more contextual and linguistic information than a standard textbook can provide (Yang, & Liao, 2014).

One can say that virtual reality and augmented reality complement each other, since virtual reality creates the environment that will be used in the augmented reality.

Blascovich et al. (2002) defines a virtual reality environment (VRE) as "synthetic sensory information that leads to perceptions of environments and their contents as if they were not synthetic".

Augmented Reality, especially in its Mixed Reality version, includes the fusion of any digital information within real world sceneries (we can say that the information co-exists with real objects), that means that this technology is able to enhance one's immediate surroundings with electronic data or information, in a multiplicity of media formats that include not only visual/graphic media but also text, audio, video and haptic overlays (FitzGerald et al., 2012).

Klopfer (2008) indicated that the concept AR should not be defined in a restricted way. This concept could be applied to any technology that combines real and virtual information in a significant manner.

Augmented Reality (AR) is a variation of Virtual Reality (VR). VR technologies completely immerse a user inside an artificial context. While immersed in this context, the user cannot see the real world (Azuma, 1997). In contrast, AR allows the user to see the real world and allows the user to interact with the virtual environment using real objects. Azuma (1997) provides a frequently accepted definition of AR as a technology which merges real and virtual descriptions, it is interactive in real time, and records the virtual imagery with the real world. Hence, AR enhances reality, rather than completely replacing it (Azuma, 1997).

Dunleavy and Dede (2014) identify two forms of AR presently accessible to educators: location-aware and vision-based. The first presents digital media (text, graphics, audio, video, 3D models) to learners as they move through a physical area with a GPS-enabled smartphone or similar mobile device, this allows to enhance the physical environment with narrative, navigation, and/or academic information relevant to the location (Dunleavy & Dede, 2014). The second introduces digital media to learners after they point the camera in their mobile device at an object (for example with QR code technology, 2D target) (Dunleavy & Dede, 2014).

AR, as well as the more sophisticated MR, has persuasive qualities and characteristics for educational purposes; its potential and affordance can be further developed when an AR system is designed by connecting multiple types of technologies (Wu, Lee, Chang, & Liang, 2013). Wu, Lee, Chang and Liang (2013) state that AR could facilitate learning content in 3D perspectives, ubiquitous, collaborative and situated learning, learners' senses of presence, immediacy, and immersion, visualizing the invisible, and bridging formal and informal learning.

One of the advantages of AR/MR is that it is useful for supporting ubiquitous learning in real environments. Frequently ubiquitous learning engages the use of mobile devices, such as smartphones. By using the location or other context data of the user, the system can supply some learning content

and present the information onto the real context thereby creating a stronger relation between the digital content and the real environment (Santos et al., 2016).

3. Empathic Forums New VR/AR/MR Prototype

Any forum can be considered empathic. Every post generates a reaction from other forum readers, eventually leading to a reply. A forum tool was selected for the first steps in entering the new visualization and interaction paradigm present in 3D immersive environments.

For that purpose, the Umniverse platform (2011a, 2011b) has been selected. This is a research and development environment with applications in learning (distance and mobile learning) among others, with a forum available. In TAT, or Umniverse 2.0, original Umniverse's forum's advanced features were not removed but, as was previously stated but important to underline, were made available for each and every app that is available on the platform. This way, every app becomes a forum where users can use the same empathic signaling to their posts as they did in Umniverse. The presentation of the posts and its management can now free themselves from a 2D screen, although with a 3D representation, and take advantage of the much wider “space” available in an almost real 3D immersive environment. Those features included being able to reply to multiple posts with a single post and to indicate that a post covered more than one topic at once, being these not only textual topics but, as described in previous work [31], full objects such as documents and videos. Mostly important, the empathic tagging will be kept, in its automatic and manual modes, as well as all the search and learning analytics capabilities over empathic information.

Finally, let us underline that Umniverse, even if still on R&D grounds, was way more mature than it is now the TAT environment. TAT is a platform just now experimenting with the new VR/AR/MR potential. Sharing this early prototype with our empathic forum technologies, now in an 3D immersive environment, signals a future commitment to having a realistic set for teachers and students to collaborate where sensory information must go hand in hand with emotions and affections.

Fig. 2 and Fig. 3 illustrate the radical user interface changes that immersive environments imply.

Figure 2. A view of managing forum posts on the Umniverse platform

Figure 3. A simulated MR view of managing forum posts on the prototype of the 3D immersive platform

4. Conclusions

Having eliminated the particular learning curve from the Umniverse environment, it is still to be seen what will be the learning curve of users to the new VR/AR/MR platform. If 3D immersive environments are here to stay, in a few years that will no longer be a cause for concern for its main aim will certainly be attained as to let the user interact in a most natural way.

Having not yet collected any data from the user experience to put it through a framework such as UTAUT, the first VR/AR/MR prototypes with the equivalent to the Empathic Forum setup provided the following early indications:

- VR/AR/MR is indeed the natural next step to the classic 3D virtual screen based environments;

- Tagging messages with emotions continues to be powerful and, having now more realistic avatar that the ones in Umniverse, and transposing the written emotions to avatar expressions and body language becomes natural and almost urgent;

- TAT apps appear to be a more powerful concept than objects in Umniverse for they have an intrinsic representation, in this case both in 2D and 3D, associated with them. Instead of being an afterthought, apps design is at the forefront of their creation, together with attributes and behaviour which were the basis for the object classes; the AR/MR simulator seems to have even more practical use cases than VR has, namely for mixing distance learning moments with eventual face to face classes or work group sessions.

- The concept of having nine avatars at once was easier to grasp in Umniverse coarse environment than in the more realistic TAT one. Users are only now becoming at ease with these new worlds and cumbersome technology still gets in the way.

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Mobilizing the Troops: A Review of the Contested Terrain of App-Enabled Learning

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Abstract

This paper presents a thematic review of app-enabled learning in the context of recent developments in mobile technology and M-Learning. In reference to "mobilizing the troops," we present three metaphors that reflect the issues that teachers, school leaders and systems have grappled with in recent years. Drawing on findings from a range of case studies and literature reviews, we examine the present time as an opportunity to explore more pedagogically-informed uses of mobile devices and uses, and suggest "app smashing" as an approach that moves the learner beyond the underlying limitations of constraining the learning to individual apps. The paper highlights several contexts where this use has been achieved and identifies the implications for educators across all educational contexts moving forward.

Keywords: apps, mobile learning, tablets, iPads, Android, iOS

1. Introduction

Mobile devices have become ubiquitous in many educational contexts. Some early critics have drawn comparisons with the affordances of laptop and desktop computers and present findings that mobile devices are more suited to passive consumption of content rather than genuine constructivist learning (see, for example, Ebert, 2011). Others such as Zittrain (2009) point to the specific limitations of apps as more akin to "appliances" than applications. However, the current range of learning opportunities that many mobile devices now afford perhaps stands in contrast to these earlier concerns. Most mobile devices can be distinguished from other forms of computing with their generally smaller screen sizes, touch interfaces and more lightweight operating systems. Nonetheless, their uses now encompass many of those that were previously the domain of desktops and laptops, such as typical office productivity, full-scale audio recording and video editing, file management and cloud storage, advanced gaming and language translation. These uses speak to the veracity of earlier predictions such as Austin Blaauw, Mahlke, Mudge, Chakrabarti, & Wolf (2004) who believed that the capability of mobile devices would, in a few short years, become akin to the "supercomputers" of his day.

In 2013, global sales forecast data pointed to the increasing use of mobile devices in almost every context – in both developing and developed countries around the world. In particular, the sales figures for mobile devices showed exponential growth; while at the same time, sales of desktop and laptop computers show limited growth in the short-to-mid term and decline in the long term. The projections

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for the immediate years ahead suggested that mobile devices are, for many users, supplanting traditional desktop devices and drawing further users away from relying on laptop devices.

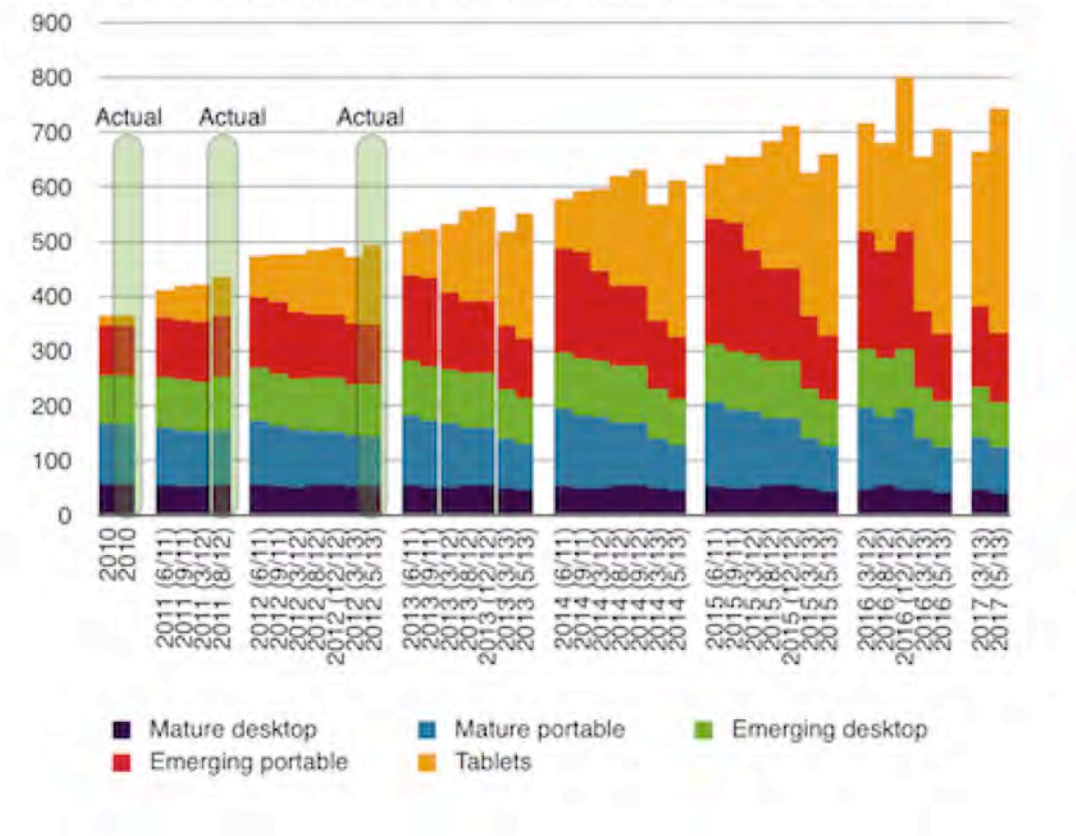

Figure 1. IDC's Changing forecast: PC & tablet sales by segment 2010-2017
(IDC, 2013)

More recently, mobile device categories such as the *2-in-1* (also referred to as "detachable tablets") – that is, tablets that plug in or wirelessly attach to keyboards and trackpads and are thus used as traditional laptops – further suggest a move towards the use of mobile devices as full-featured computers (IDC, 2015). The growth of this new device category has led to IDC revise their current projections, with analysts now suggesting that desktop PCs will continue to decline, and that some categories of non-detachable tablets – most notably, standard iPads and non-detachable Android tablets – will show slowed growth. Analysts further note that "detachable tablets are expected to grow quickly" (np) and that, overall, the trend towards use of mobile devices over traditional computers will continue.

When exploring data such as IDC's sales shown in Figure 1, it is important to examine the recent development of mobile devices to the point where they are now able to supplant other forms of computing. For example, modern tablet devices are relatively recent, being easily traced back to the launch of Apple's iPad in 2010. Since that time, other tablet hardware running different versions of Android and Windows mobile operating systems have been developed. With each new device and operating system release, the capabilities of these devices have evolved considerably. All three device

categories – iOS, Android and Windows - now represent whole *device ecosystems*, which Tilson, Sorens and Lyytinen (2012) regard as "highly complex technology… accompanied by mobile operating systems (OS), large communities of developers, diverse content providers, and increasingly complex networks, jointly forming digital infrastructures" (p. 1324).

Two of the most notable examples of the 2-in-1 device category include Microsoft's *Surface Pro Tablet* – with a full-featured Windows operating system – and Apple's *iPad Pro*, with a 12.9-inch screen that Apple argues "lets you be more creative and productive" (Apple, np). These devices are further supported by office productivity suites like *Microsoft Office*, *Google Docs & Sheets*, and *iWork* now available on Android and iOS, thereby supplanting the need for a traditional desktop or laptop computer and, to an extent, redefining the capabilities of tablet devices. Google currently supports two mobile device ecosystems that include Android phones and tablets, and *Chromebooks*, which are closer in form to standard laptops but run lightweight operating systems that interface with Google's Cloud-based applications. It is competition between these platforms and their associated ecosystems with increased demands and pressures from consumers, that means the affordances on all mobile devices are likely to expand in the years ahead. These circumstances suggest that educators should exercise a degree of caution when seeking to apply and build on some of the lessons in mobile device deployment and use.

2. Sending the Troops "Over the Top" Before They're Ready?

In many learning contexts, Mobile Learning (or M-Learning) has been an important marker in the vision of future technologies for several years. In their *Horizon Report*, Johnson, Levine, Smith, & Smythe (2009) noted the potential of mobiles being especially linked to "the ability to run *third-party applications*, [which] represents a fundamental change in the way we regard mobiles and opens the door to myriad uses for education, entertainment, productivity, and social interaction" (p. 8, our emphasis). Since this time, a relatively large number of educational jurisdictions have been exploring the use of mobile devices - especially tablets – in the classroom. This exploration has taken different forms, such as the use of trial school- and system-based deployments, devices from home that are brought to the school (Bring Your Own Device, or BYOD), and mandated minimum specifications (Bring Your Own Designated Device, or BYODD). While technology programs that involve scaled deployments and use of technology devices are not new, the advent of mobile hardware that is lightweight and portable – with superior battery life – has promoted further thinking about technology use. However, amongst the early examples of schools and systems that have deployed and used mobile devices for learning, we find evidence of concerns about the limitations of these devices that reflect a number of problems inherent in the early adoption of the technology.

Examining the evolution of tablet devices and their ecosystems, Zittrain (2009) viewed mobile devices as far more similar to "appliances" than real computing tools, and suggested that the learning that can occur through the use of mobile devices was vastly inferior to learning that can occur with full-

featured desktop devices. Central to the author's argument is the notion of *generativity*, which he defines as "a system's capacity to produce unanticipated change through unfiltered contributions from broad and varied audiences" (p. 70). Zittrain draws attention to the wide-scale use of early mobile applications (or apps), many of which were only designed to work in specific and anticipated ways that stand in contrast to a traditional computer that can be programmed to work in unanticipated ways. Zittrain presents five principles of generativity that serve as conditions by which it is achieved through the use of any computing device:

(1) How extensively a system or technology leverages a set of possible tasks;

(2) How well it can be adapted to a range of tasks;

(3) How easily new contributions can master it;

(4) How accessible it is to those ready and able to build on it; and

(5) How transferable any changes are to others – including (and perhaps especially) non-experts (p. 71).

While the notion of generativity and underlying principles are treated in a largely theoretical fashion in Zittrain's (2009) book, similar concerns about the limitations of mobile devices for generativity are echoed in earlier studies of their deployment, adoption and use in different educational contexts. For example, in a study of high school and primary students' preferences for device use where both iPods and iPads were deployed in addition to laptops and desktops, Crichton, Pegler and White (2012) found that students only preferred tablets "for a variety of commonplace tasks," while preferring laptops for "for searching the Internet, creating media, and checking email." This study further noted the scepticism of many high school students and teachers who "appeared to struggle to find educational uses for the devices" (p. 23). Culén and Gasparini (2011) have observed similar reticence among both high school and tertiary students in using the iPad as "a platform for work purposes" (p. 200). In a study comparing the use of iPads to a computer lab, Khaddage and Zeidan (2012) argued that most teachers and school leaders showed clear signs of being unprepared to make full use of tablet devices, implementing lessons that were still tied to computer lab tools.

These weaknesses echoed in the research reflect concerns among educators that mobile devices may not be viable alternatives to traditional computers. However, such concerns are often shaped, in part, by the educator's understanding of affordances, the existing curricula and pedagogical approaches. Another important factor is the extent to which students are allowed – and even encouraged – to use mobile devices for their learning. For example, data from the *Project Tomorrow report* suggests that in spite of growth in the number of students with mobile devices, their use has been widely discouraged:

> In one year's time, the percentage of middle school students with tablets jumped to 52 percent, a doubling over the 2011 percentage. Despite this proliferation of mobile devices in the hands of students, schools are still reluctant to allow usage of such personal devices. Amongst high school students with smartphones, only approximately half say they can use their device at school (36 percent of 9th graders and 42 percent of 12th graders). Only 9 percent of all students say they can use their personal tablets at school… If you have a mobile device, you are probably not allowed to use it at school (Project Tomorrow, 2012, pp. 4–5).

While more recent findings suggest some rethinking of attitudes (Johnson, Adams Becker, Estrada, & Freeman, 2015; Walling, 2014), there is a need for further evidence of major attitudinal change across all educational contexts.

3. Equipping the Troops with an AAA: Atomized Arsenal of Apps

As a fairly recent term, "*Atomization*" refers to the ways that computational functions are separated into multiple, smaller apps of software traditionally represented by legacy software suites. Examples of this include numerous Cloud- and Web 2.0 applications available online, most of which have seen considerable movement away from traditional computer uses such as word processing in productivity suites like *Microsoft Office*. Atomization is particularly applicable to mobile devices, where device's mobile nature, the touch- and gesture-based interfaces, cellular Internet connectivity and other features like accelerometers and cameras inform the development of the apps, hundreds of which may be installed on any one device. The fact that the apps are very low-cost (or free) along with generally being easy to use are key factors in educators being able to explore and implement them in teaching and learning. In other words, the "atomized" nature of these apps informs the flexibility with which they may be integrated into current and future learning designs.

As the issues that have emerged in recent research suggest, clearly identifying the benefit of mobile devices remains a challenge in many educational contexts. Pilgrim, Bledsoe and Reily (2012) point out that "although schools and universities are investing in technologies such as the iPad tablet, educators are struggling to keep pace with the speed of technological development and demand" (p. 16). In recent findings, however, evidence speaks to the use of mobile devices to support constructivist learning, especially where closer attention is paid to the learning environments in which the devices are used. For example, Foote's (2012) study of deployment in one high school found that the process of deployment itself cultivated "an exploratory climate on campus—as teachers, students, and administrators learn at the same time how to use the iPad and what it will mean for their teaching" (p. 18). Likewise, Shuler, Hutchins and La Shell (2010) found that tablet use aligned particularly well with Cooperative Learning as an instructional method, where the use of devices facilitated productive collaborative learning and "where students are engaged in higher level thinking activities such as

problem solving and discussion of complex ideas" (p. 11). In a study by Rossing, Miller, Cecil and Stamper (2012), both teachers and students reported that they believed the device aided problem solving, connection of ideas and improved participation and interaction.

Central to the use of mobile devices and Atomization is the proliferation of apps – numbering in the hundreds of thousands – now available to users. While some of these have been developed specifically for educational use, others have been appropriated for their educational relevance. By contrast to many the training and instructional manuals that often underpin the use of traditional desktop applications, teachers and learners usually learn how to use apps through experimentation, play or trial and error. The sheer number of apps available therefore presents challenges to teachers and school leaders seeking to support the successful implementation of mobile devices in any school context. These challenges are further apparent in open Bring-Your-Own-Device (BYOD) environments, where educators must ensure that the affordances of an app on one platform are available on others. Findings in the literature show that schools have responded differently to the challenges presented by the sheer number of available apps, for example, by involving teams of teachers in exploration and experimentation, and engaging school leaders align app use with curricula objectives. Some schools choose to mandate a set of "core apps" for common purposes across the school curriculum; others leave the decisions about which apps to use in the learning process up to individual teachers and learners.

However, there are a number of issues that still need to be addressed when grappling with the very large number of apps available for each device platform as noted in recent findings. For example, Bos and Lee's (2013) review of several thousand mathematical apps on iOS found that "most are simple flashcard, numeric procedures of mobile textbooks… and do not support sense-making… active learning, or integrated visual models" (p. 3655). Other critiques of educational apps highlight limitations that echo Zittrain's (2009) concerns about *generativity*. For example, in her review of general educational iOS apps that involved the scoring of apps on several criteria such as *grade relevance*, *content area*, *curriculum standards* and *customer ratings*, Watlington (2011) found that a majority of apps were "useless for educational purposes", with at-times limited guidance available for determining which ones were of use (p. 3112). The review also found that some subjects such as English and Mathematics were far better resourced than others such as Music, Art and Science. The difficulty of deciphering which apps to use is reflected in a more recent review by Cherner, Dix and Lee (2014) who strongly advocate "cleaning up that mess" and argue for the development of a framework across all device platforms for classifying educational apps (p. 1). By contrast with iOS, there is a paucity of studies that specifically focus on the use of Android or Windows Mobile apps in education. However, White and Turner (2011) note the potential of the Android as a more open platform for coding and app development, thereby fostering skills in design and computational thinking.

In spite of the need to make sense of the apparent deluge of apps available, recent research clearly highlights the learning benefits of apps in several areas. In particular, these findings are strongly linked to situated uses of the device in carefully planned learning environments. They also suggest that the highly portable and ease-of-use attributes of mobile devices are important factors that hold considerable potential for future learning designs. However, realising this potential requires careful planning, as Foote summarises in her study of the iPad as a 1-1 device:

> Will the iPad's portability, ability to be personalized, and functionality impact its effectiveness in a school setting? In answering this question, so much depends on the purposes for which it is intended, the pedagogy accompanying its use, training afforded to teachers, the methods for implementing the new technology, and the tech support provided (p. 15).

Drawing attention to the portability of mobile devices and their software from one environment to the next, Melhuish and Falloon (2010) argued that the device could potentially be "invisible within the learning experience" (p. 6) Similar arguments about device portability and the ease of using apps are echoed in Whitehouse's (2011) discussion of *blurred learning* as a seamless technology-enabled learning environment with learners "often working synchronously across distance and at the same time working face-to-face with a group" (p. 145). Chandler and Redman's (2013) study of tablet use in teacher professional learning draws attention to the use of the mobile devices to support connected, collaborative ways of professional learning, through activities that include note-making, content sharing and mind mapping. They argue that the iPad is "a tool that can support social, collaborative and exploratory communication experiences" (p. 61).

Literacy is a key area in the literature where situated learning experiences with mobile devices have been more closely examined. Meaurant (2010) studied the use of iPad apps for English as a Foreign Language (EFL) studies, finding that the availability of English language apps and the portability of iPads are especially useful for typical EFL classroom settings, where students "often alternate between whole-class activities and diverse individual, paired and small group tasks" (p. 228). Hutchison, Beschorner and Schmidt-Crawford (2012) have explored literacy apps among native speakers, drawing attention to the educational value of digital, interactive books. The use of apps that support both composing, and responding to, these texts helped to facilitate what they and others regard as *new literacies*:

> Digital texts can require different skills, strategies and dispositions, collectively referred to as new literacies to read and navigate them. Thus it is important that teachers understand these differences and integrate digital technology into the curriculum to provide students with opportunities to learn these new literacies (p. 16).

With the growing collections of increasingly interactive and multimodal eBooks and other e-texts, educators should continue to explore tablet devices as tools for enhancing literacy experiences and

engaging reluctant readers. However, as Lankshear and Knobel (2007) have argued, literacy should arguably be an act of *doing*. While the concerns of Zittrain and other early critics suggested that mobile devices could not be used for advanced creativity – or *generativity* beyond the design of the original software developers – more recent findings suggest a need to rethink these positions. In her study of iPads as part of a 1-1 program, Foote (2012) draws attention to its creative affordances, finding that "it has spurred creativity… because of the [still] camera, video camera, and the apps that can be used for creative storytelling and video production" (p. 16).

Reid and Ostashewski (2011) studied the use iPad apps for digital storytelling in upper elementary classrooms, finding that students demonstrated higher conceptual understanding and creativity using these apps when compared with traditional approaches. The study also reports that students were able to integrate the use of other apps such as *Speak It!* to build audio material to incorporate into their projects, noting that their confidence and abilities to work independently improved, and that students of all abilities "found success with the iPads in a number of ways." Teachers in the study also felt supported by the ease of using apps for digital storytelling. Pilgrim, Bledsoe and Reily (2012) have also examined the relationship the increased number of ways to demonstrate literacy through creativity apps, they note that there are several high-quality apps that encourage learners to show and explain their learning:

> *ShowMe*, *Educreations* Interactive Whiteboard, and *ScreenChomp* are free downloads that record pen strokes and audio simultaneously. Then the user can post the recording online for others to access. These features can be used in any content area but are especially helpful in recording math problems with audio instructions. Students can also record their own audio or video clips to demonstrate understanding (p. 19).

4. "Smashing" the Arsenal for More Pedagogical Firepower

Perhaps the most encouraging findings on app-based learning to date are those showing evidence of being pedagogically informed, often in association with non-transmissionist pedagogies such as inquiry-, problem- and challenge-based forms of learning. Evidence suggests models such as Design Thinking (Beetham & Sharpe, 2013) may play a role in ensuring that mobile devices are actively used to generate new ideas and support constructivist learning with higher order thinking. However, research also suggests that educators need to employ a Design Thinking approach when sequencing the use of apps – sometimes referred to as "app smashing" (Young, 2014). By app smashing, the teacher or learner moves beyond the limitations of an individual app and sees the learning design as employing different apps at different stages as needed. Significantly, it is possible to argue that this approach holds considerable potential for addressing concerns about generativity, though it requires both careful planning and creativity. Brenner and Hauser (2015) consider the importance of learner

metacognition, choice and autonomy when "smashing apps," suggesting that the process and learning outcomes of app smashing have the potential to "grant students the freedom, through a plethora of choices, to create exactly the type of product they can envision" (p. 337).

Hutchison, Beschorner and Schmidt (2012) have investigated the technology and literacy skills required in transformation of data across a range of representational forms associated with different apps. In their study, upper-elementary students used a range of iPad apps to visualize, order, interpret and represent meaning when responding to and composing written texts. During the visualization stage, where students used *Doodle Buddy* to illustrate and annotate their ideas prior to writing narratives, and then used *Popplet* to "represent the main events in the [learning] sequence, connecting them with time-order words" (p. 18). To enhance their retelling of the narratives, students also sequenced and annotated their illustrations in *Strip Designer*, while *Sundry Notes* was used to explain cause and effect in the narrative by inserting students' audio comments on an instructional-level text to explain their understanding. As one child noted, using apps like *Popplet* "helped with comprehension, because we picked out main ideas and when we had to put them in order."(pp. 19-20).

In another case study of iPad apps in an upper-elementary Social Sciences classroom, Berson, Berson and McGlinn-Manfra (2012) highlight the potential of the iPad as "a conduit for fostering classroom community building as well as promoting social studies learning goals" (p. 88). In a series of activities, the class used the app *My Haiti: Valdo, a Child's Story* to generate empathy for victims and survivors of the 2010 Haiti earthquake. Students then linked this empathy activity to a range of apps for different purposes and modalities with a view to expanding their understanding of the issues and actively researching answers as part of the learner inquiry process. The process described in the case study reflects the use of a apps that support a range interfaces, modalities and literacies, while not specifying a clear sequence. Such learning is often a feature of many project- and inquiry-based learning models (Buck Institute for Education, 2014; New Tech Network, 2012).

As these examples demonstrate, sequencing the learning process through the meaningful use of apps – and the approach of "app smashing" - has the potential to support twenty-first century pedagogies and extend the range of digital skills and new media literacies. When combined with the low technical barriers to using apps and the portability and growing affordances of tablet devices, there is potential for creating highly immersive and collaborative learning environments with "invisible" technology and a clear focus on authentic, situated, learner-led inquiry.

5. Conclusion

This paper has examined the challenges and opportunities inherent in the journey towards effective use of apps and mobile devices in teaching and learning. Prior to these highly personal, mobile devices, the focus on technology in education institutions has arguably been on expensive and relatively fixed technology infrastructure necessary to enable unified ways of learning within the institution – such as

the computer lab or those at the back of designated classrooms. Such learning environments were, to a fair extent, centrally administrated by school leaders and IT personnel who at times have been removed from teaching and learning. This older paradigm has been successfully challenged for its limitations, weaknesses and cost-ineffectiveness (see, for example, Cuban, 2001). By contrast, the development and wide scale adoption of mobile devices represents a marked departure from these earlier infrastructure-led designs. Educators and learners alike continue to wrestle with understanding and meaningfully using a growing number of tools, platforms and ecosystems, newer paradigms such as Cloud Computing now point to "device agnosticism" and "convergence" as the new normal (Garner, Zoller, Trotter, & Anderson, 2005; Prince, 2011). At the same time, we have the emergence of what Rideout, Saphir, Tsang, & Bozdech (2013) refer to as the "app gap," in which lower-income children (ages 0-8) have more than 50% less experience using mobile devices than higher-income children in the same age group" (p. 10).

In drawing conclusions about their students' use of a wide range of apps, Hutchison, Beschorner and Schmidt (2012) maintain that "teachers should select appropriate activity types and assessment strategies before making a final selection about which technology tool will be most useful" (p. 21). By designing the learning task as, in a way, independent to the technology, the teacher is arguably better equipped to carefully and purposefully select apps as cognitive steppingstones within the learning task, resulting in tasks that more consistently challenge students to develop a wide range of digital skills. As Berson, Berson and McGlinn (2012) note, through the use carefully selected and sequenced apps, students "learn a new form of literacy as they move between apps and engage in both personalized and collaborative learning experiences" (p. 89). At the same time, by carefully framing the learning process with key stages and sequences, both students and teachers can more easily substitute apps. Such substitution may be necessary, for example, in cross-platform environments where different apps exist on different platforms, or in circumstances when new apps are released to replace older ones.

While some schools offer choice very broadly by encouraging students to bring in any device through BYOD, other schools implement whole-of-school technology programs that see the deployment and use of one main device. Regardless of the direction that is taken, the diversity of software platforms and apps now represents choice on a "micro" level at a "macro" scale. Students are, more than at any time in the past, able to determine which technology tools will be suitable for each stage of the learning process. With recourse to the case studies discussed, this paper has shown that choice can operate in a number of ways. At the same time, many schools maintain large infrastructure-led solutions where specific hardware and software are mandated, representing environments where it remains very difficult to capitalise on the benefits of personalised mobile devices. Nonetheless, it is important to remember that the education community has an important voice in technological change. Just as Dewey argued that the makers of the tools should not dictate how they are to be used, educators and learners have a responsibility to challenge technology giants and software developers to

meet their needs in a changing world. By visualizing learning processes and exploring apps as cognitive steppingstones, teachers and learners are more able to recognize what they need from technology and work pragmatically and openly to address these needs.

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Moving Toward a Mobile Learning Landscape: Presenting a Mlearning Integration Framework

Helen Crompton[5]

Abstract

Mobile devices transcend the educational affordances provided by conventional tethered electronic and traditional learning. However, empirical findings show that educators are not integrating technology effectively into the curriculum. In this study, a thematic synthesis methodology was used to develop and present a framework for thinking about the integration of mobile devices in teaching and learning. The mobile learning (mlearning) integration framework is comprised of four main parts: beliefs, resources, methods, and purpose. These four areas are elucidated to reveal the many sub-components that determine how technology is integrated. An ecological framework is then presented to demonstrate how the individual parts of the initial framework operate through a complex, interconnected network of systems involving personal and environmental factors.

Keywords: mlearning, integration, pedagogy, framework, model.

1. Introduction

Mobile learning (mlearning) represents untethered access to knowledge and educational resources via devices, such as mobile phones and tablets (Eisele-Dyrli, 2011; YeonJeong, 2011). These devices transcend the educational affordances provided by conventional tethered electronic learning and traditional learning (Crompton, 2013). However, empirical findings show that educators are not integrating technology effectively into the curriculum (Kurt, Kuzu, Dursun, Güllepınar & Gültekin, 2013). Teachers who do use technology, primarily use it for low-level tasks, such as drill and practice programs or a free time activity (Chen, Gallagher-Mackay, & Kidder, 2014; Hsu, 2012, 2013).

The purpose of this study was to explore theories and empirical evidence of educator technology integration to develop and present a framework for thinking about the integration of mobile devices in teaching and learning. This study begins with a brief overview of mlearning. This is followed by a review of existing frameworks focused on mlearning and then on technology integration in general. The mlearning integration framework is then presented with each section unpacked to delineate the mlearning considerations for each of the areas. Next, an ecological framework highlights how the integration of technology is influenced by social and physical factors in systems in which the educator is situated. The conclusion provides a summary of the findings.

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2. Background

2.1. Mlearning

Mlearning is "learning across multiple contexts, through social and content interactions, using personal electronic devices" (Crompton 2013a, p. 4). This definition includes the underpinning constructs of mlearning, which are pedagogies, context, social interactions and technological devices (Crompton). Pedagogies can be extended as learning can take place across multiple environmental contexts and subject area contexts. The user can work with others locally and globally and there is a wide variety of content available via Internet connectivity. The technological devices are the tools that can be utilized to take advantage of these additional affordances.

There is strong empirical evidence to show that educators are effectively integrating mobile devices in learning (e.g., Bressler, 2015; Song & Kim, 2015; Tangney, Bray, & Oldham, 2015; Wishart, Ekanayake, & Fernandes, 2015). National and international standards of best practices (viz., ISTE, 1998, 2007, 2016; U.S. Department of Education) state that technologies should be integrated into the curriculum by educators. Mobile devices offer more opportunities for learning than tethered technologies (Crompton, 2013b). This learning is personalized, contextualized and not restricted by temporal or spatial constraints. Nonetheless, knowing how to integrate these devices into learning is a wicked problem (Mishra & Koehler, 2007).

2.2. Integration Frameworks

Early mlearning frameworks have emerged. MIT developed the *MIT Mobile Framework for educational institutions* which was to support those thinking of incorporating mobile applications in higher education (Yu, 2009). Casany et al. (2012) developed Moodbile: A framework to integrate m-learning applications within learning management systems. These are both valuable frameworks, but they are focused on integrating technology into other technology systems and do not focus on educators integrating technology into the curriculum. Park (2011) developed the pedagogical framework for mobile learning, which was developed to categorize the examples of mlearning in the context of distance education. The focus of this framework was studying the distance of the learner to the teacher as mediated by the mobile device.

Koole (2009), Uden (2007), and Zurita and Nussbaum (2007) used activity theory as a framework for analysing people's practices and developmental processes while considering individual and social influences in the use of mlearning. Koole designed the Framework for the Rational Analysis of Mobile Education (FRAME) connecting to Vygotsky's work on mediation and the zone of proximal development. Uden developed a framework for designing mobile applications for mlearning and

Zurita and Nussbaum developed a framework for analysing the tasks, needs and outcomes for designing mlearning activities. For an educator, these frameworks provide little to no support as they consider how they should go about integrating mlearning into the curriculum.

For general technology integration, two frameworks often used by educators to incorporate technology into the curriculum are the Technological, Pedagogical, and Content knowledge (TPACK) framework (Mishra & Koehler, 2006) and the Substitution, Augmentation, Modification and Redefinition (SAMR) framework (Puentedura, 2009). While these frameworks are for the incorporation of all digital technologies and not specifically for mobile devices, they do provide a valuable contribution as a starting point for educators.

2.2.1. TPACK

The TPACK framework is based on Shulman's (1986) model that highlighted the connection between pedagogy and content with a two circle Venn diagram. Mishra and Koehler (2006) added technology to highlight that there were three areas of knowledge that a teacher should have; these are technology, pedagogy, and content knowledge (see Figure 1). The overarching message is that when the three areas are working together, effective technology integration is achieved. In other words, pedagogy should be an instructional approach proven effective in having students understand that particular content. The technology should work well with the pedagogy and the content in facilitating that learning.

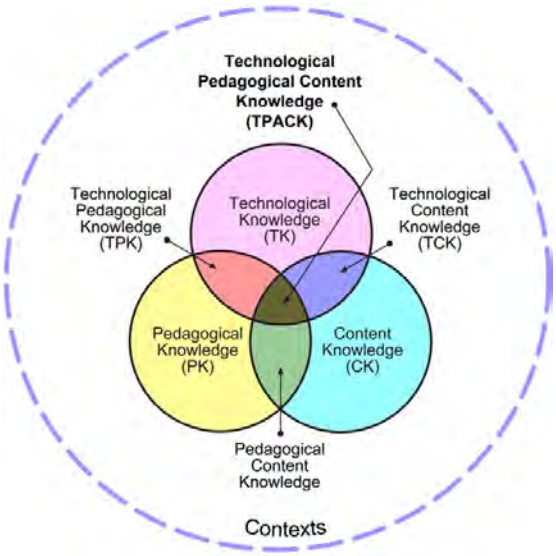

Figure 1. Mishra and Koehler's (2006) TPACK framework

2.2.2. SAMR

The SAMR model can be used to assist educators in thinking about technology integration, but it takes a different approach than the TPACK framework. The SAMR model is used to categorize four different ways technology can be used for teaching and learning: See Figure 2. The substitution category describes the use of technology for a task where a non-digital technology would work. For example, if Google Earth was used to locate a country, technology is substituted for what a paper map could do and has no added benefit. In the augmentation category, technology has some functional improvement. For example, if Google Earth rulers were used to measure the distance between two places. This has functional improvement beyond using a paper map. These bottom two categories of the SAMR model are titled *enhancement* as that is how the use of technology supports learning.

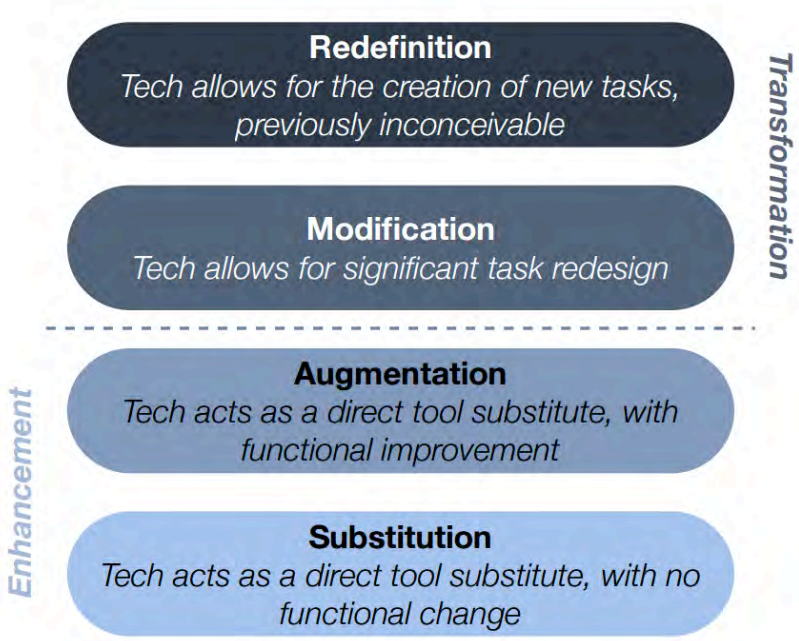

Figure 2. Puentedura's (2009) SAMR model.

The third category is modification. This describes activities where the technology allows for a significant task redesign. An example of this would be using Google Earth layers, such as panoramio and 360 cities to research locations. The top category of the SAMR model is redefinition. This category describes tasks that could not be conducted without technology, such as creating a narrated Google Earth guided tour and sharing this online. Many mlearning activities fit with the redefinition level, as tasks that are impossible with tethered technologies or non-technologies. For example, students could be out on a field trip and getting assistance from experts around the globe as they attempt to identify plant species from particular environments. The student could come across wildlife

that the class cannot identify and use a social website (e.g. iSpot; Woods, McLeod, & Ansine, 2015) to upload a photograph of the animal and connect to other experts around the world who would identify the creature while they are still on the field trip. These top two categories of SAMR are jointly named transformation as they take advantage of those affordances that only technology can provide.

2.3. Research Purpose

The purpose of this study was to design a framework for thinking about the integration of mobile devices in teaching and learning. The three research questions guiding this study to the final development of a mlearning integration framework are:

1. What is the scholarly understanding of technology integration in education and what frameworks have already been developed?

2. What makes learning with mobile devices different than learning with tethered technologies?

3. What does an educator need to think about as they integrate technology into the curriculum?

3. Methods

A thematic synthesis (Thomas, Harden, & Newmark, 2012) was adopted to answer the three research questions and to construct the mlearning integration framework. Thematic synthesis can be employed to bring together research from different types (Thomas & Harden, 2008) and is particularly suitable for analysing multidisciplinary datasets, offering people across the paradigm a way to share a common understanding of their endeavours (Boyatzis, 1998). This is particularly important for an mlearning study as it involves reviewing quantitative, qualitative, and mixed methods studies from educational technology/ICT, computer science, human computer interaction, instructional design, media studies and many other areas.

Broadly speaking, the thematic synthesis involved the application of thematic codes to, and across studies using an inductive and deductive process. Studies were identified using an electronic search of databases including ERIC, EBSCOHOST, ProQuest, Elseview Direct, JSTOR, Sage Journal Online and also a manual search was conducted on Google. Search terms such as “mlearning”, “frameworks’, and “technology integration” were used. Thomas et. al.’s (2012) three stage process was then employed for the thematic synthesis.

The first stage involved the identification of themes across the studies gathered, translating the findings of the studies into a common metric. The codes at this stage were fairly descriptive remaining similar to the text contained in the primary studies. NVivo was used in this qualitative thematic coding process to assist in the line-by-line systematic approach of reviewing the studies and as an electronic

record for further analysis in the following stages. The second stage of the process involved the organization of thematic codes into descriptive themes. In this stage, the aim was "to develop and articulate relationships between the themes and associate conceptually similar themes with one another" (Thomas et. al., p.196). The final stage of the thematic synthesis was to generate analytical themes. This took the synthesis beyond the content of the primary studies to offer new conceptualizations and explanations.

4. Findings and Discussion

In this section, the findings of the thematic synthesis are presented as a new mlearning integration framework. The framework is presented in Figure 3 and is comprised of four main categorized parts. While these four part are listed separately, it is important to note that they are highly interconnected.

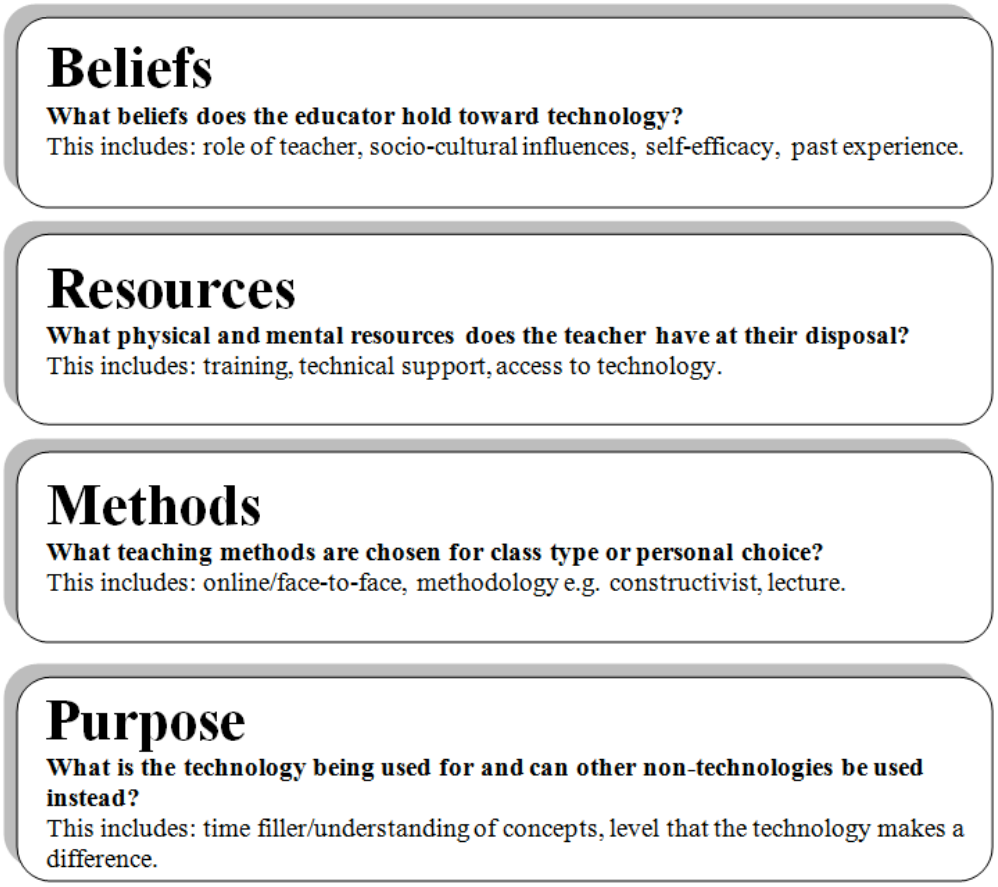

Figure 3. mlearning integration framework.

4.1. Beliefs

While the use of technology has increased in education, pedagogical practice has gone through very little change (Murphy, Iyer, & Warriem, 2015). Having students learn with mobile devices can cause a conflict with the beliefs of educators. Empirical evidence has cascaded down to educators to inform them that learning should be student-centered, and students should be taught to be active thinkers and

seekers of information and not hand-fed. Educators understand and want to move in this direction, however, they also feel that the educator should have overall control of learning. This is often built on what Lortie (1975) describes as the apprenticeship of observation. Educators have each experienced school for many years as a learner and believe that this has taught them how to teach. They have developed ideas about the teacher's role, they have formed beliefs about what works and acquired a repertoire of strategies and scripts for teaching.

Traxler (2010) described this problem as the dichotomy between what educators profess to value for student learning, such as agency, control, choice, and access to knowledge and loss of teacher control of standardization, quality, and consistency. As educators prepare to use mobile devices in teaching and learning, they should recognize that mlearning will disrupt many beliefs they have held about teaching and learning. Educational institutions will shift from a "we teach" approach to an "I learning" environment (Herro, Kiger, & Owens, 2013).

Educators need to be cognizant of their beliefs on the value of mobile devices for learning. Mixed advice is often given about the value of technology in education. Research findings show that those who value technology in their classrooms are more likely to use it and obtain better outcomes (Buquoi, McClure, Kotrlik, Machtmes, & Bunch, 2013; Lui, 2011). This is a self-fulfilling prophecy. Educators who do not see the value in integrating technology into their classrooms will probably not spend a great deal of thought on that integration and use it for low level tasks or free time. Empirical evidence shows that these beliefs about the value of technology are also effected by subject area, with some subjects deemed as better fitting than others (Howard, Chan, & Caputi, 2015a). Educators need to be aware that technological pedagogical strategies that work for one subject may not be transferable to another subject; just as not all pedagogies work for every subject or every student.

Beliefs on the value of technology are often derived from national (Caronia & Caron, 2004) and local (Roblyer & Doering, 2010) social cultural influences. There has been an unprecedented switch in the perceived value of mobile devices in education causing great belief dissonance with educators as mobile devices have gone from ban to embrace in educational circles. Many young educators who attended school during the ban era are struggling now as they incorporated technology. They have to disrupt those memories of past teachings by educators who served them so well, to understand that what we now know about learning has changed and mobile devices have affordances that should be exploited for educational purposes.

The final beliefs addressed in this section are those of an educator's self-efficacy. Self-efficacy are personal beliefs about one's ability to succeed in specific situations or to accomplish a task (Bandura, 1997). For example, an educator may belief that they are not adequately prepared to teach using mobile technologies (Crompton, Olszewski, & Bielefeldt, 2016) and have concerns about being able to keep up-to-date with the changing technologies (Harris, Mishra, & Koehler, 2009). Educators should

not ignore these beliefs, but seek out resources and professional networks to help them gain knowledge and skills.

4.2. Resources

From the literature there are three main resources needed by educators to effectively integrate mlearning. Educators need training, access to mobile technologies and technical support. Educators need training in how to effectively integrate mlearning into the curriculum. It should not be assumed that an educator who uses a device for personal use should know how to use it for teaching and learning. "Understanding effective use of technology is a prerequisite to any realization of positive educational outcomes resulting from [mobile technology] resources" (Bebell & O'Dwyer, 2010, p. 7).

Training should include: a basic understanding of how to operate the device; the affordances of the devices for learning and how pedagogies have now been extended to take advantage of these benefits; and a framework, such as this framework, to recognize the interconnectedness of beliefs, resources, methods, and purpose on mlearning integration. Furthermore, empirical evidence showns that one off training does not suffice and training needs to be continued on a regular basis (Crompton et al., 2016).

The availability and access to technology and Internet connectivity is a barrier to mlearning integration. Studies reviewing restrictions on technology show predictable negative outcomes (e.g., Redmann & Kotrlik, 2008). However, many institutions are creating a lack of access unintentionally. For example, computer carts are designed so they can hold many devices on one cart and be moved from place to place. Nonetheless, for security concerns, these carts are often bolted to walls or tethered in some way to make them static to one place. This is often in a classroom with the only group to have instant access to the devices are those using that classroom. Internet connectivity is another essential. If educators are continually finding that the devices are not able to connect to the Internet, valuable time is wasted and educators will finally stop trying. Obviously, educators need devices for integration to be possible. These devices need to be in good working order and newer technologies, such as tablets and smart phones are needed to take advantage of the more modern affordances (Ryan, 2014).

Technical support is another resource necessary for successful mlearning integration. In a review of the research, Hew and Brush (2007) identified the lack of technical support as one of the major barriers to integrating technologies. This need for technical support has most likely increased due to a greater number of mobile technologies now available. The people on location in technical support would activate and configure the devices initially, then provide ongoing support for problem shooting, repairs and upgrades.

4.3. Methods

The methods are the ways that a class can be taught. For this section, a dichotomy is described of imposed and selected methods. For the educator, there are structures often imposed by the institution, such as how the class is offered (e.g. face-to-face, online, blended, synchronous, asynchronous etc). There are also the choices made by the instructor depending on their beliefs, knowledge and training of how students learn. These latter choices may not be a choice for some educators, but imposed by the educational institution with textbook or course adoption that specifies a method. As for mentioned, these methods make a difference to the ways in which mlearning is integrated. Educators need to consider the format of the class and the restrictions on using particular technologies in those arrangements.

Educational institutions that offer online instruction often have "technology savvy staff" and more technology support than institutions that teach face-to-face (McNeal, 2015). There are various technologies that can be used in online synchronous and asynchronous courses, such as simulations and video lectures that can be viewed on mobile devices (McNeal). Nonetheless, field trips to ponds with temperature probes on mobile devices are probably no appropriate in an online asynchronous learning environment, but excellent in face-to-face classes connected to that content.

An educator's philosophy and preferred learning methodology has a direct influence on the integration of mlearning (Hancock, Knezek, & Christensen, 2003). If an educator prefers to be the giver of information in a didactic, lecture type approach, this educator will find it more difficult to integrate mobile devices. This is because the learner has been enabled in the learning process with a device that gives them direct access to the knowledge. Those with constructivist ideals and methodologies want the learner to be active and will find it easier to integrate technology [especially mlearning] into the curriculum (Sang, Valcke, van Braak, & Tondeur, 2010).

Zhao, Pugh, Sheldon, and Byers (2002) postulated that these methodological beliefs and values can also be discipline oriented. In a study conducted by Howard, Chan, Mozejko, and Caputi (2015b), professional and instructional uses of technology were examined across three core subject areas: English, Mathematics, and Science. Trends confirmed a difference in technology related practices across the disciplines. Howard et al. (2015b) posited that further research was needed to better understand teacher beliefs and how these make a difference across subject areas. In this framework, the interconnectedness between mlearning integration, beliefs, methodology, and subject are addressed.

4.4. Purpose

Educators must consider the intended purpose for integrating mlearning for it to have the best possible value. It is the purpose that defines the quality of the integration. Ottenbreit-Leftwich, Glazewski,

Newby, and Ertmer (2010) found that the purpose for using technology was typically aimed at engaging and motivating students, improving comprehension and higher-order thinking skills (e.g. visualization and manipulating data) and in anticipation of skills students needed for future work and learning.

In the TPACK framework, Mishra and Koehler (2006) do not identify which of the teacher knowledge areas (content, technology, or pedagogy) should be the primary focus. With a standards-based curriculum, educators are forced to look at the content they are to teach as the main focus of learning. Therefore, the purpose of a lesson would be for students to learn a particular concept e.g. multiply two digit numbers. As the educator integrates technology, they should think about what technologies can be used to support in the teaching and learning of those concepts.

> Particular technologies have their own propensities, potentials, affordances, and constraints that make them more suitable for certain tasks than others. Using email to communicate, for example, affords (makes possible and supports) asynchronous communication and easy storage of exchanges. Email does not afford synchronous communication in the way that a phone call, a face-to-face conversation, or instant messaging does. Nor does email afford the conveyance of subtleties of tone, intent, or mood possible with face-to-face communication. (Koehler & Mishra, 2009 p. 61)

In addition to thinking about the technological affordances provided to learning a particular content area, the SAMR model (Puentedura, 2009) also has the educator thinking about the pedagogical approach that will make the best use of that technology. In other words, is technology being used where non-technologies could work just as well to get the students to understand the concepts, or is it used to modify or redefine learning. For mlearning, are the mobile devices being integrated where tethered technologies would do the same job, or is it enabling the learner to better understand by using affordances such as the portability of the tool? The purpose for integrating technology should have educators thinking about what technology is the most effective in supporting learning a particular standard in a content area and pedagogically, how to fully exploit the affordances of that device.

4.5. Framework

The beliefs, resources, methods, and purpose are the four main parts that make up the mlearning integration framework. Each part encompasses multiple sub-parts which are interacting, interrelated, and/or interdependent elements that need to be considered for an educator to effectively integrate technology. In the prior descriptions, it is evident that they are all highly interconnected. For example, an educator's epistemological *beliefs* will make a difference to the *method* that they choose and *resources* available for training can change the *purpose* to which the educator uses technology. How an educator integrates technology is affected and modified by *systems*. In Figure 4, a nested social

ecological model is presented to show how the mlearning integration framework is influenced by personal and environmental factors.

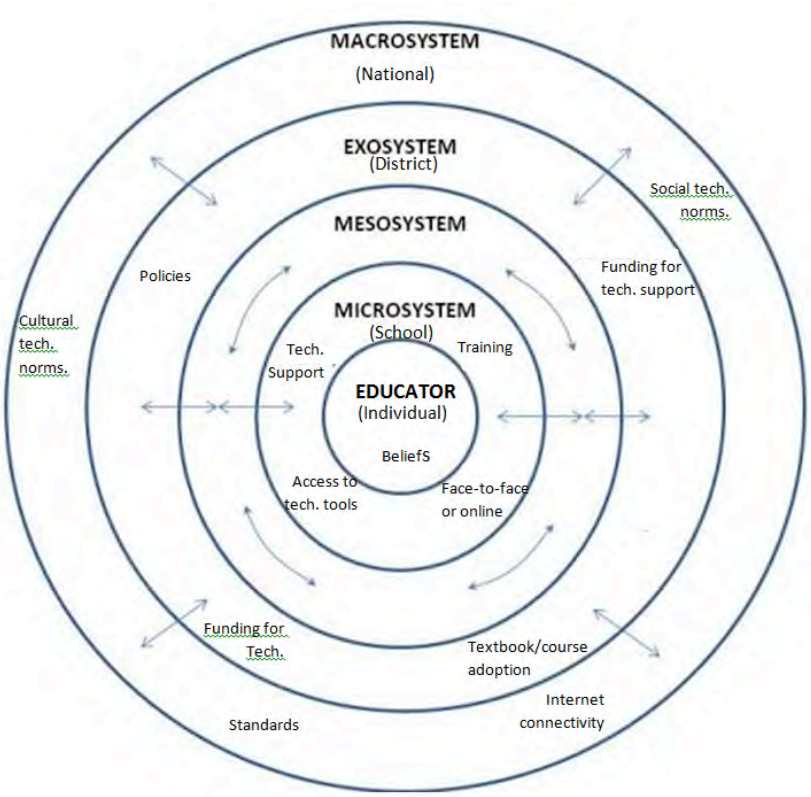

Figure 4. Mlearning integration ecological framework

Figure 4 is based on Bronfenbrenner's (1979) Ecological Framework for Human Development that shows how the development of the child (centre circle) is mediated by various systems. Bronfenbrenner posited that to understand human development, the entire ecological system needs to be taken into account. This ecological framework has the educator in the centre, with the concentric circles representing the different systems determining how that educator integrates technology. This includes social ecology of how individuals interact as well as environmental factors including physical environment which includes resources, such as technologies available.

Working outward, the educator is in the centre of the circles. The educator is using their beliefs to make decisions on technology integration. The microsystem is the layer closes to the educator and contains the structures with which the educator has direct contact. The educators' technology integration is influenced by the immediate surroundings, such as a school and the resources and social interactions in that school. The mesosystem shows the connection between and across the structures of the [educators] system (Berk, 2000). In other words, the various arrows show how all the parts are interconnected. The exosystem is the school district. In this system, funding for technologies and

technology support staff are often determined as well as textbook and course adoptions. In the outer ring, the macrosystem shows how the integration of technologies are mediated by the social, religious, and cultural norms of that nation, as well as standards and internet connectivity.

5. Conclusions

The purpose of this study was to design a framework for thinking about the integration of mobile devices in teaching and learning. Using Thomas et al.'s (2012) method of thematic synthesis, a framework was constructed of four parts: beliefs, resources, methods and purpose. The findings show that educators need to be cognizant about their beliefs on the value of technology in teaching and learning and how those beliefs are moulded by social and cultural influences. In addition, educators need to respond to beliefs of low self-efficacy with plans to seek training to improve skills, knowledge and confidence. Three types of resources were identified as essential for effective technology integration, these are: training, access to mobile technologies and technical support.

Methods was the third category identified in the framework. For structures, such as the format of the class (online, face-to-face), educators need to consider which types of technology (hardware and software) are effective in those environments. There are also the methodologies selected by the educator which are constructed from philosophies and preference. The purpose is the final part of the framework. The methods selected will directly connect with the purpose of the technology in class. For example, if the educator uses a didactic, lecture only approach, mobile devices will be of little to no use if the teacher wants to control the flow of information.

The social and environmental factors described in the mlearning integration framework are presented in a mlearning integration ecological framework. The latter framework diagrammatically highlights how mlearning integration is influenced by environmental factors from various systems connected to the educator. This study is valuable for researchers, educators, school leaders, technology personnel, and policy makers in understanding the complex interconnected system that is involved when educators integrate mlearning into teaching and learning.

6. Limitations and Future Studies

One limitation of the thematic approach used in this study is that even though a selective approach has been used, findings could arguably reflect the author's original perspectives and priorities. However, this limitation was minimized in this study as the frameworks under review included clear inclusive terms and methods, so the author was not able to use a bias analysis on the inclusion or exclusion of those findings. Going forward, it would be beneficial for researchers to study the framework in various educational contexts to see if there is anything omitted from the mlearning integration framework that needs to be added. The ecological framework also identifies interactions that could be studied further

to add to the scholarly knowledge. For example, there is a paucity of empirical evidence on pedagogical approach and mobile learning integration, future study would be useful in this area.

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Enhancing A Mobile and Personalized Learning Platform Through Facial Analytics and Interactive Quizzes

Mimansha Gupta[6]*, Vincent Tam*[7] *and Edmund Y. Lam*[8]

Abstract

Learning analytics techniques to capture learners' real-time responses can be computationally intensive for mobile devices. Yet with the diversity of many online educational videos such as the Ted Talks, YouTube or other open educational resources, the mobile learning platform intrinsically presents an opportunity for learners and instructors to analyze the pace and quality of learning. In a previous work, the PErsonalized Teaching And Learning (PETAL) platform was developed to monitor the learner's progress in viewing educational videos through a carefully designed facial analytics technique to detect learners' attention levels and their proximity to the screen of the mobile device. The PETAL application will alert a learner if (s)he is not paying attention while viewing an educational video. In this work, we propose to further improve the original PETAL by using online and interactive quizzes to more precisely evaluate the learner's level of understanding while viewing the educational videos. The interactive quizzes can be flexibly added by an instructor by modifying a simple configuration file. When a learner gives an incorrect answer to a particular quiz question, (s)he will be requested to revise a specific section of the concerned video. All the data about the learner's progress is uploaded and stored securely on a password-protected cloud platform to guarantee data privacy for future analyzes. There were some initial and positive students' feedback collected from an empirical evaluation of the enhanced PETAL system. Clearly, the enhanced PETAL platform provides many promising directions for future extensions.

Keywords: learning analytics; personalized learning; mobile devices; web cameras; web application.

1. Introduction

Learning is widely being recognised as a product of interaction. These days, educators are spending more and more efforts into designing their learning methodologies and course content to maximize the value of these interactions. Learning analytics has proven to be an attractive field for research aimed to better understand the process of learning and its environments through measurement, collection and analysis of learner's data and context. There are several techniques that have been deployed in the area of learning analysis that require to estimate the learner's real-time responses to course material or live presentations. However, these are too computationally intensive, and therefore, infeasible for execution on any mobile device (Dinh, Lee, Niyato & Wang, 2011) with limited computational power and storage. These days, with extensive use of mobile devices to watch videos for self-study by a large number of learners, efficient learning analytics methods (Chatti, Dyckhoff, Schroeder & Thüs, 2012;

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Monroy, Rangel, Bell & Whitaker, 2015; Zhou, Han, Yang & Cheng, 2014) can be deployed for preliminary analysis to provide instant feedback to the learner as well make use of web services to do further analysis on the data that has been captured. This could not only deeper understanding of self-study to the learner but also provide thorough reports to course instructors to review overall performance of the whole class and assess quality of study material made by the instructor. This will likely bring in many new pedagogical impacts to the various aspects of teaching, learning, assessments and evaluations of students anytime and anywhere. Consider an example scenario of real-life applications where a primary school teacher in Sciences may ask a group of Grade 5 students to view a video of what was taught in class which introduces some basic concepts of the human respiratory system. While watching the video for self-study, after a sub-topic is completed, each individual student will need to answer a simple quiz consisting of multiple-choice questions on his/her mobile device on which the efficient learning analytics algorithm will quickly generate an initial feedback report to each learner. The quiz questions and timing can be customized by the teacher to help strengthen concepts learnt by the students. After the quizzes have been attempted by all students, the teacher can still receive a more detailed students' progress report sent by the cloud server, reviewing that most of the class has some difficulty in understanding the functionality of lungs for which (s)he may revise the relevant concept in the next lesson. With the portability of mobile devices, learners can review their study material in a way that allows interaction between him/her and the teacher and even other peers.

Besides learning analytics, mobile and sensing technologies have seen a large increase in usage with more and more functionalities being added to them. The usage of mobile devices, smartphones and tablets proliferates in all walks of life. Children of all ages find themselves attracted to these devices and in most households, spend a large amount of time with them. Given the frequent use of technology, especially in the classroom, we find an ever pressing problem: e-Learning (Cantoni, Cellario & Porta, 2004) rarely ever tailors itself to each individual child and gives no indication of the quality of self-study, thereby making it difficult to determine each individual's true grasping or understanding of the taught material. However, at the same time, we find that Computational Intelligence (Jang, 1993), specifically the facial feature detection and recognition techniques (Hennessey, Noureddin & Lawrence, 2006; Ioannou, Caridakis, Karpouzis, & Kollias, 2007), is advancing very rapidly. To tackle these problems and suggest improvements to learners and instructors to improve their self-study, we hereby propose a possible solution to the challenging problem of catering to an individual learner's needs.

To respond to the above problem of evaluating a learner's real-time responses and indicate accurate progress in self-study done through watching educational videos, we tend to look at large eLearning systems with high computational power. However, these fail when the learner is in a remote

environment, outside of traditional classrooms. Therefore, in this paper, we explore the applications of the Android programming libraries and the Open Source Computer Vision (OpenCV) software (The OpenCV Development Team, 2014) to develop the PErsonalized Teaching And Learning (PETAL) e-Learning platform (Liu, Tam, Tse, Lam & Tam, 2014) that detects learners' levels of attentiveness and the proximity of their eyes to mobile devices and alert learners when they identified to be distracted, zoning-out, sleeping or too close to the display of the device playing the streaming video clips for personalized learning or self-study through the PETAL e-Learning platform.

Basically, PETAL integrates front-facing cameras to act as image sensors, which are present on a majority of tablets and smartphones currently in the market. Using a simple, yet efficient tracking algorithm the PETAL application continuously monitors and analyzes learners' responses to the video being streamed directly to the app by capturing facial orientation and eye movements thereby providing a truly personalized learning experience to nurture the academic development of learners while protecting their eyesight. It tracks the learner's responses using the front camera present on most of the smart mobile devices by capturing video at 30 frames per second in response to the educational video that the learner is watching as a means of self-learning. PETAL has several applications in the field of learning analytics and also e-Learning as it provides access to learner in his/her self-study environment and opens doors to facilitate interaction between instructors, other peers and further processing of this data using cloud technology. The application has several functionalities such as calibration of learner's position in front of the device, allowing a user to select a video to watch from the videos present locally in the user's device and playing the video in a custom media player. The application will alert the user if he/she is too close to the screen, distracted or sleepy which watching the video and also replays the part which the user may have missed.

The purpose of this work is to extend this functionality and add new features to make the mobile learning application more holistic and facilitate interactions between an instructor and the students.
It has been observed that leaners while watching educational videos often get distracted or do not pay attention and do not go back to the point in the video that they missed. The current version of Petal addresses this issue. However, there has been no interaction between the instructor and the learner. To make sure a learner has understood the concept and has gained the ability to apply it, it is necessary to have some checkpoints or quizzes. Feedback collected from students in February 2016 showed a positive trend with most of them in favour of using PETAL as a mode of self-study outside the classroom. They agreed that the app would provide an excellent way to track their attention levels and test their knowledge. The app introduces a mode for teachers where teachers can set quiz questions and view performance of the class.

This paper is organized as follows. Section 2 reviews the preliminary background and related work on facial feature detection techniques and relevant details about the platform. Section 3 discusses the system design and features of the enhanced PETAL platform. Specific issues about the prototype and its implementation as well as evaluation results are covered in Section 4. Section 5 summarizes the work and sheds light on future work and plans.

2. Preliminaries

This section considers some preliminary work that will facilitate our subsequent discussion. It firstly reviews some previous work on visual computing and natural interaction analysis for e-learning systems. Later, we will consider an earlier work utilizing facial recognition techniques to analyze the learners' head orientations and attention spans in viewing course materials such as the lecture notes on desktop computers. Here, it is worth noting that the facial recognition algorithm employed by PETAL platform is targeted to run both efficiently and effectively on mobile devices such as Android tablets, thus a more challenging task with the very limited computational resources and web cameras of relatively lower resolutions available on the tablet PCs. However, through the mobile applications of our PETAL system, the learners' responses can now be quickly analyzed anytime and anywhere. In addition, the real-time images captured for any individual learner can also be simultaneously sent to the cloud server of our PETAL system to run more sophisticated image processing algorithms for a thorough analysis of the learner's responses.

2.1 Natural Interaction Analysis for e-learning Systems

In (Cantoni, Cellario & Porta, 2004), *Cantoni et. al.* gives a precise overview on the future e-learning systems, from both technology- and user-centric perspectives. Especially, the visual component of the e-learning experience is emphasized as a significant feature for effective content development and delivery. Besides, the adoption of new interaction paradigms based on advanced multi-dimensional interfaces (including *1D/2D/3D/nD* interaction metaphors) and perceptive interfaces (that are capable of acquiring explicit and implicit information about learners and their environment to allow the e-learning systems to "see", "hear", etc.) is presented as a promising direction towards more natural and effective learning experiences.

2.2 A Facial Recognition Method for Analysis of Learners' Responses

Conventionally, many e-learning systems utilize user feedback or profiles, and also try to collect such information based on questionnaires, thus likely resulting in incomplete answers or deliberately misleading input. In (Asteriadis, Tzouveli, Karpouzis & Kollias, 2008), *Asteriadis et. al.* present a specific facial recognition method for the analysis of learners' responses in order to compile feedbacks related to the behavioural states of the learners (e.g. their levels of interests) in the context of reading

an electronic document. This is achieved using a non-intrusive scheme through employing a simple web camera installed on a desktop/notebook computer to detect and track the head, eye and hand movements (Hennessey, Noureddin & Lawrence, 2006) and provides an estimation of the level of interest and engagement of each individual learner with the use of a neuro-fuzzy network (Jang, 1993). Experiments show that the proposed e-learning system can detect reading- and attention-related user states very effectively in a testing environment where children's reading performance is tracked.

3. System Features of Enhanced PETAL Platform

Figure 1 shows the design diagram of the activity sequence involved for the enhanced PETAL platform on Android devices. A thorough understanding of the Android life-cycle of activities, fragments, dialog fragments, and the *OpenCV* face detection methods enable us to execute timely notifications and quizzes in the PETAL system. The camera preview screen is hidden from the user while maintaining the communication between face detection data and the video player. When the camera detects an emotion, an emotion variable is set to a specific integer value to be shared with the video player. This mechanism allows us to track and analyze students' responses to educational videos, therefore enabling the PETAL system to pause the video and alert the user as necessary.

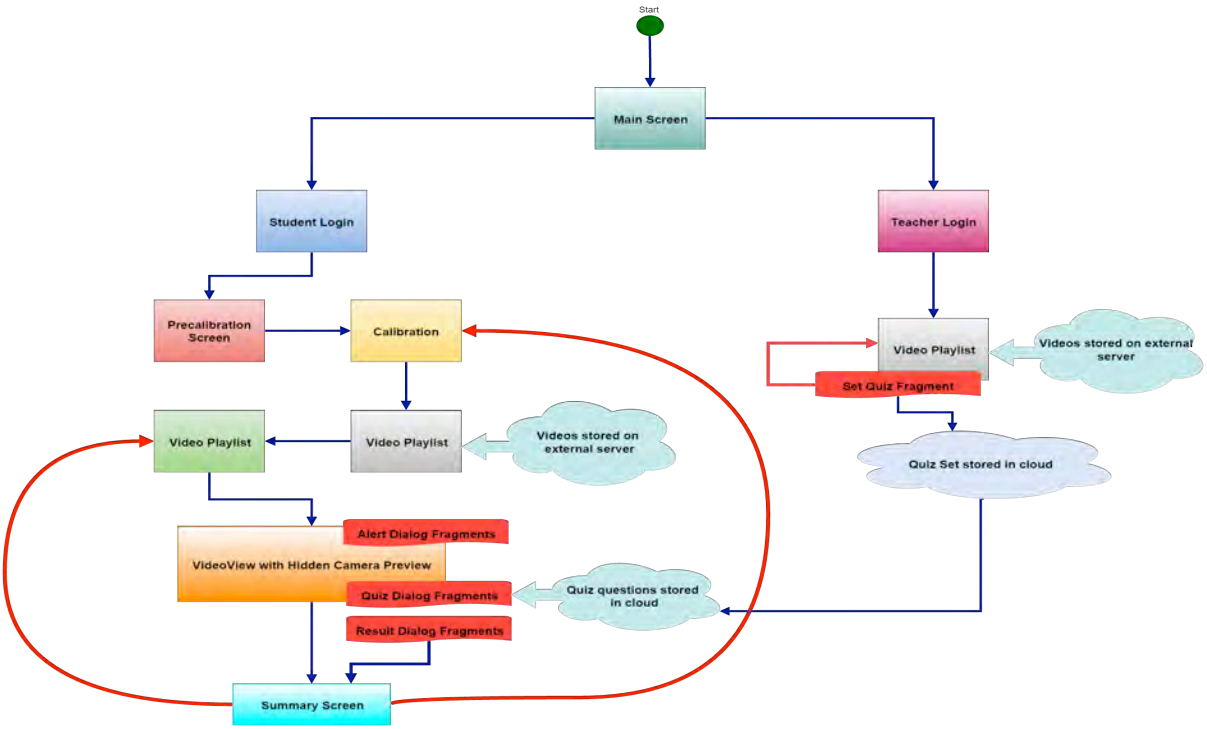

Figure 1. System Diagram showing the Activity Sequence of the PETAL e-Learning Android App

The application tracks the user's eye movements and records times the user was distracted/zoning out/sleepy as well as parts of the video the user chose to replay and indicates these times to the user at the end of the video. If any quizzes have been set to be played during the course of the video, the

video is paused, the quizzes are displayed. Once the student answers all questions, result of the quiz is displayed along with suggestions as to which topics the student needs to revise more to truly personalize the student's self-study session and actively interact with the student/user.

To facilitate interactions between learners and instructors, the android application has a Teacher mode. Here, the teacher can set quiz questions and correct answers for educational videos, the exact timestamp they are supposed to appear at as well as the topic each question is related to. These quizzes are stored on a secure database in the cloud and appear to a student only at the timestamp specified when watching the video.

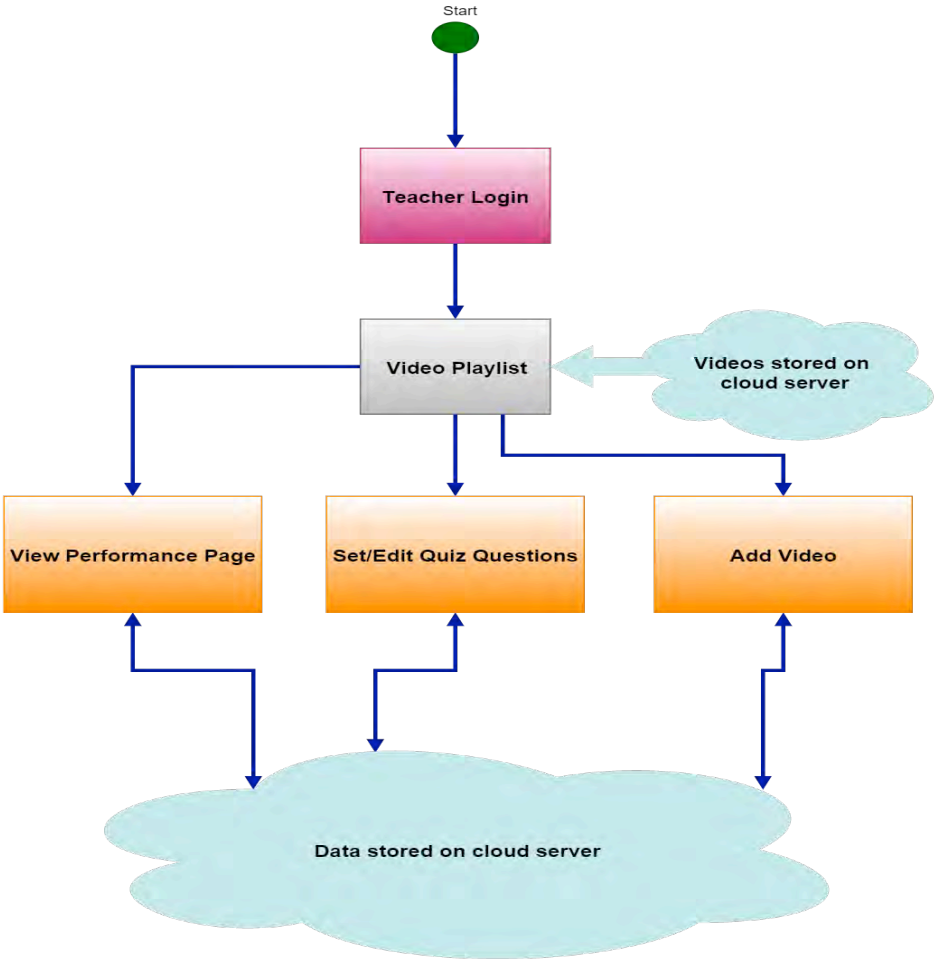

Figure 2. System Diagram showing the Action Sequence of the PETAL supporting Web Application

The teacher can also log into a web application to set questions and view performance of the learners in the quizzes, with the identity of learners hidden, in the form of graphs to identify trends in class performance, identify topics where students were found to be struggling the most to make improvements in teaching material. New videos can also be added through the web application and quiz questions can be added/edited. The web application acts as a management or support application for the teacher to manage and view data well. Figure 2 displays the action sequence diagram of the key supporting web application of PETAL platform.

4. An Empirical Evaluation of Prototype Implementation

To demonstrate the feasibility of the proposed e-learning platform, a prototype of the PETAL Android application was carefully developed on the latest Android system (Version 6.0.1) with the *OpenCV* library (Version 2.4.9) and thoroughly tested. Figure 3 gives the different diagrams showing the pupil detection and its use to determine the learners' distraction in various scenarios with a previous implementation of our PETAL system. There were some initial and positive students' feedbacks collected on our initial prototype and reported by a voluntary student group in HKU. For detail, refer to (Sabih, 2013). Figure 4 shows the two diagrams of calibration and pupil detection of our enhanced PETAL platform to estimate the level of attentiveness and the proximity of the concerned learner to an Android tablet while viewing an educational video with the enhanced version of the PETAL platform.

In a recent empirical evaluation, a small group of 15 Engineering students mostly in their second or third year of studies in the University of Hong Kong were asked to try out the enhanced PETAL system integrated with the interactive quiz function and then responded to a simple questionnaire consisted of 8 questions. These questions were targeted to collect the students' feedback mainly on the effectiveness of the enhanced PETAL system in facilitating their mobile or online learning. Out of the 15 respondents, 9 students (i.e. *60%*) were satisfied with the user interface and features of the enhanced PETAL application. Besides, 11 (around *73%*) out of the 15 students agreed that the enhanced PETAL system is easy-to-use and also effective for self-learning through watching the educational videos. A more detailed evaluation and analysis possibly on a larger number of students will be carefully conducted in primary schools to record response of young learners with respect to the application.

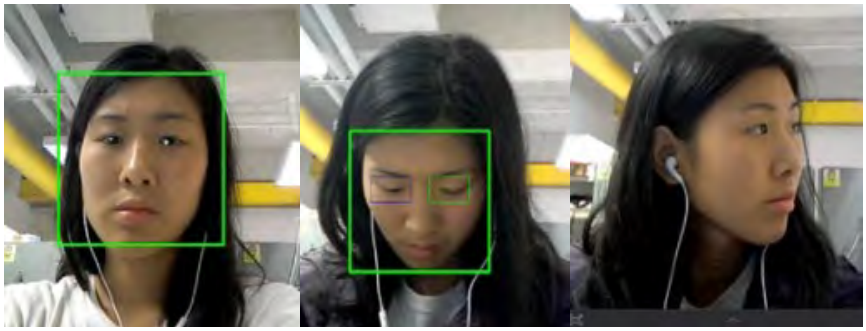

Figure 3. Diagrams Showing the Calibration, Pupil Detection and Its Use to Estimate the Learner's Distraction with a Previous Version of our PETAL system

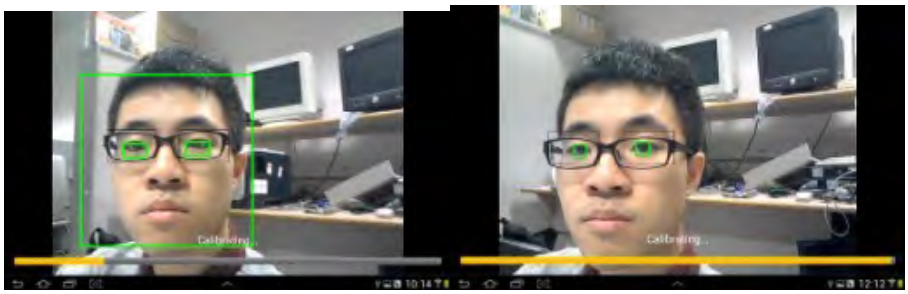

Figure 4. Diagrams Showing the Calibration and Pupil Detection of Enhanced PETAL System to More Precisely Estimate the Learner's Distraction

5. Concluding Remarks

With advancements in mobile and cloud technologies, the reduced costs of mobile devices and cloud computing services and their increased accessibility, the widespread uses of these technologies have been observed in mobile learning environments. In this paper, we have carefully considered an effective enhancement to the original framework of the PETAL e-learning system so as to build an interactive video player application fully integrated with a sophisticated facial analytics technique for detecting eye movement and head orientation, and also an interactive quiz facility to evaluate on the level of learners' understanding. Specifically, we aim to enhance our previous prototypes of the PETAL application to facilitate more effective interactions with the instructors' flexibly added quiz questions and more importantly the uploading of the valuable learners' progress and log data onto the cloud platform for a thorough analysis. Clearly, the enhanced PETAL mobile application together with the new supporting web functions provides a holistic mobile learning platform.

There are many possible directions for future investigations. A possible direction is extending the support to other operating system platforms such as the iOS and desktop environments to cover a wider range of end users. Through widening the user base, the collected data and analysis results can be more representative and thorough. Furthermore, future enhancements in both hardware, such as an increase in the rate of image frames being captured by the underlying web camera, and software with more updated versions of the *OpenCV* library or more accurate facial analytics methods should be carefully considered. On top of it, future investigations in further cascade training and enhancement in the pose detection algorithms may help to promote the capability of the PETAL system to detect other relevant types of student responses like confusion or frustration are worth exploring. Last but not least, it is both interesting and useful to use Machine Learning algorithms to predict class performance based on certain learning models and the collected learners' data, and possibly facilitating the concerned instructor in gaining a deeper understanding on the learning abilities of the whole class, especially on some difficult topics.

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Using wearable technology to improve the acquisition of new literacies

A new pedagogical approach of situated individual feedback coming from the Activity Trackers and reflected upon in the ePortfolio

Michele Notari[9]*, Tanja Sobko*[10]*, Daniel Churchill*[11]

Abstract

In this paper we will show our research approach and discuss its potential outcomes. The research project started in January 2016 at the University of Hong Kong. To understand development of new literacies in higher education in Hong Kong, the researchers will conduct a multiple case study including 24 students from an undergraduate course, Bachelor of Science Exercise and Health. Each of them will use a wearable device over a period of five months, reflect on emerging personal data, document their thinking and action in an ePortfolio-based journal, and engage in an online forum. The ePortfolio, specifically developed for this research, will allow the students to critically reflect on their progress and for the researchers to intervene at any time on the issues related to the participants' postings. Evidence regarding change in eHealth literacy as representation of new literacies at the beginning and end of the intervention will be collected with a well-established questionnaire. To understand the qualitative aspect of changes in eHealth and other new literacies, semi-structured interviews pre and post intervention will be conducted. Interviews and data from reflections and forum posts will be analyzed and triangulated to understand emerging issues influencing the development of the literacies. After establishing a case report for each of the participants a cross-case analysis will be performed. The study will deliver theoretical and practical recommendations for researchers, teachers and policy makers in higher education to track, support and explore development of the mentioned literacies. It will also investigate the applicability of the ePortfolio as a reflective and autonomous learning tool. Furthermore, it will create opportunity for further research on learning using emerging wearable technologies.

Keywords: wearable technology, eHealth literacy, activity tracker, ePortfolio, new literacies

1. **Introduction**

'New literacies' are becoming more and more important for today's living, working, learning and socializing. These new literacies include, for example, visual, information, digital, critical and media literacies. In spite of its importance, eHealth literacy is not well developed for students in higher education (e.g., Stellefson & Hanik, 2011).

Wearable technologies like wristwatch trackers open an opportunity for development of new literacies and especially eHealth literacy by delivering in real-time, situated, personal information. Having

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access to these data and critically using it will stimulate individuals' interests in health issues and mediate deployment of interacting new literacies while locating and engaging with health information resources.

1.1. New literacies

The new literacies (see figure 1) or contemporary literacies mentioned in this proposal emerge from the essential abilities required today to shape and communicate meanings, develop oneself and participate to a society. Some of them like digital literacy, information literacy, media literacy and traditional literacy are part of the eHealth literacy concept formulated by Norman & Skinner (2006a).

Figure 1. New literacies, proposed by Churchill, 2012 see: http://www.slideshare.net/zvezdan/new-literacy-in-the-web-20-world

The mentioned new literacies are based on the definitions proposed by literature:
Traditional Literacy as mentioned by Leu et. a. (2004), Information Literacy (as proposed by Curriculum Development Council, 2001), Visual Literacy (as proposed by Stokes, 2001), critical Literacy (as proposed by Luke, 1997); Media Literacy (as proposed by Hobes, 2010); Tool Literacy; Digital Literacy (as proposed by Anderson & Henderson, 2004).

1.2. EHealth literacy as part of the new literacies?

1.2.1. EHealht literacy a definition

In this section an overview of the evolving concept of eHealth literacy is presented, its interdependence to new literacies, and possible implications related to mediating factors for the development of eHealth literacy using personal biometrical data.

The Education for All Global Monitoring Report (2006) describes literacy as "a concept [which] has proved to be both complex and dynamic, continuing to be interpreted and defined in a multiplicity of ways" and as possible understanding it proposes to use: "literacy as an autonomous set of skills" and "literacy as learning process". The present study will use "literacy" or "development of literacy" following the Global Monitoring Report – namely as - "learning process". The concept of eHealth literacy is based on the definition of health literacy formulated by Ratzan and Parker (2000).

Though it is a widely recognized assumption, that being able to find, interpret, critically analyse and apply health related content using Web services is important, many college students lack health literacy skills (Stellefson & Hanik, 2011). EHealth literacy itself has been formulated by Norman & Skinner (2006a) as the ability to seek, find, understand, and appraise health information from electronic sources and to apply the knowledge gained to address or solve a health problem. This composite skill requires the ability to work with technology, think critically about issues of media and science, and navigate through a vast array of information tools and sources to acquire the information necessary to make informed decisions (Norman & Skinner, 2006b). Norman and Skinner (2006a) propose a validated questionnaire (for English language) to assess an eHealth literacy using a scale called eHEALS. EHEALS has also been validated for different other languages (German: Soellner, Huber & Reeder, 2014; Dutch: Van der Vaart et al., 2013; Chinese: Koo, Norman, & Chang, 2012; Japanese: Mitsutake et al., 2011).

Chan et al. (2009) state that eHealth literacy encompasses a set of knowledge and skills that allows consumers to fully engage in and benefit from the use of eHealth tools. They adapt the eHealth Literacy Model, which describes six facets of eHealth literacy (as defined by Normann & Skinner, 2006c), each of which is necessary to engage in and benefit from eHealth applications (Chan et al., 2009): Computer Literacy; Information Literacy (see also Catts, 2008); Media Literacy (see also Thoman, 1999); Traditional Literacy and Numeracy (see also Norman & Skinner 2006c) and Scientific Literacy (see also Laugksch, 2000).

1.2.2. Development of eHealth literacy

While Norman & Skinner (2006a) describe 8 items in their eHeals scale to assess eHealth literacy. Van der Vaart introduces the term of eHealth categories. The 6 categories emerge from their experiment with rheumatic disease patients asked to find Health related information on two different

Web pages. For the present research we decided to use the eHealth literacy assessment tool proposed by Norman & Skinner (2006a) and to use the term 'category' as issues surrounding the process of development of eHealth literacy.

1.2.3. Biometric tracker and ePortfolio as mediating factors for development of new literacies

The recent NMC Horizon Report (NMC, 2015) predicts that wearable technologies will have an important role in learning in higher education. It defines such technology as follows: "Wearable technology refers to devices that can be worn by users, taking the form of an accessory such as jewellery[..] or a jacket. The benefit of wearable technology is that it can conveniently integrate tools that track sleep, movement, location, and social media. There are even new classes of devices that are seamlessly integrated with a user's everyday life and movements" (NMC, 2015). The integration of metrics for gravity, acceleration, temperature and light sensors (e.g., for heart rate measurement) enables proactive information delivery to the person wearing the tracking device.

The context in which the described interactions between human beings and the wearable technology takes place, can be linked to learning concepts and instructional methods like knowledge building, situated, self-regulated and active learning. In situated learning it is important to create a meaning from the real activities of daily living where learning can also occur in an informal setting and connects prior knowledge to new contexts (Brown et al., 1998). Zimmerman and Schunk (2008) link learner's motivation directly to self-regulation. According to these researchers, a self-regulated student is a student who is metacognitively, motivationally, and behaviorally engaged in its own learning processes and in achieving its own goals. Active learning as defined by Bonwell & Eison (1991) refers to any instructional method that engages students (actively) in the learning process. Active learning requires students to do meaningful learning activities and to reflect what they are doing. Scardamalia and Bereiter (2003) describe Knowledge building by an activity resulting in the creation or modification of so called public knowledge, knowledge that lives 'in the world' and is available to be worked on.

Wearable technologies can also provide a vehicle and act as motivator for the effective use of IT tools and resources from the internet and other information and media channels. Students' learn to work with their own, real data delivered over a long period of time, and through these experiences they may become more critical about encountered information deriving from other sources.

A scaffolded interaction with one or more skilled partner(s) enables a learner to construct meaning through hypothesis formation and testing (Crotty, 1994; McLoughlin & Oliver, 1998; Vygotsky, 1978). In a 10-year study of 800 Canadian graduates, Evers, Rush & Bedrow (1998) identified four generic competencies esteemed by the workplace: 1) managing self, 2) communicating, 3) managing people and tasks, and 4) mobilizing innovation and change. Focusing on the first two of these competencies, the need to foster lifelong learners who possess skills conducive to lifelong learning and peer collaboration is clear. One digital tool, which may have the potential to develop these skills

within a social constructivist paradigm is the ePortfolio. Drawing on a range of literature, the eportfolios adopted in pilot projects implemented by the PI position ePortfolios as a personalised digital collection of artefacts, which are organised in a purposeful way to assess growth over time and scaffolded through continuous formative feedback from the tutor. This contrasts with the ePortfolio's frequent (mis)use as a tool for only summative assessment, absent of formative feedback and student ownership. Thus, in this context, the ePortfolio is a tool with the potential to both *enhance* and *showcase* learning. It is the intention of the investigators to integrate scaffolded peer collaboration/dialogue, enhancing portability and relevance beyond the learning institution, and fostering skills conducive to lifelong learning. Documenting the biometric tracker in their own ePortfolio, it is intended that students will continuously learn to critically assess personal information and the abundantly available on line information, organize it and present for peers/tutor. This in turn will enhance critical literacy, cause concerns about health related topics and stimulate further inquiry, such as searching and finding reliable and relevant health information channels related to their interests. Critical literacy enhancement may also raise questions related to the management of the security of personal data in the internet and lead to a better awareness of the importance of personal data protection.

Table 1. eHealth literacy categories proposed by literature (excerpt)

Category	*Authors*				
	Norman& Skinner (2006)	Chan* (2011)	Van der Vaart (2013)	Gilstad (2014)*	Subramaniam et al. (2015)
Computer Literacy	X	Increasing complexity levels of literacy (following Blooms taxonomy)	Operation of the computer and Internet browser	Type of technology Procedural L. Propositional L. Social and cultural context L.	Access valid information Limit results Understand how search engines work
Media Literacy	X	See above	Navigation and orientation on the Web	See above	Ability to adapt to new technologies
Science Literacy	X	See above		See above	Ability to perform basic mathematical functions Ability to comprehend simple charts
Information literacy	X	See above	Utilization of search strategies Evaluation of relevance and reliability	See above	Develop search strategies Limit results
Health literacy	X	See above		See above	Understand relevant health terms
Traditional	X	See above	Protection and	See above	Ability to listen

literacy	respect of privacy	/communicate self efficacy

*) Chan (2011) and Gilstad (2014) build their eHealth categories upon the ones created by Norman &Skinner. For each 'literacy they create a matrix built upon the mentioned concept

2. Procedure and data collection

To understand the qualitative aspect of the changes in new literacies and eHealth literacy semi-structured interviews pre and post intervention will be conducted on a sub-group of 20 students. For the purpose of quality assessment, a interim questionnaire/seminar will be conducted in the middle of the project.

Participants will be asked to sign ethic clearance and the consent to participate to the study including the permission to publish the results of the study after anonymizing provenience of the collected data. To understand development of new literacies in higher education in Hong Kong an existing ePortfolio tool will be used. Each of the participants will use a wearable device over a period of five month (1 semester), reflect on emerging personal data, document their thinking and share and communicate to other participants (optional) in their ePortfolio. The ePortfolio will allow the researchers to intervene at any time and to ask questions related to the participants reflections. Evidence regarding change in new literacies and eHealth literacy at the beginning and end of the intervention will be collected with a well-established questionnaire proposed by Norman & Skinner (2006a). The same questionnaire will be used for Pre and Post intervention. Interviews and data from reflections and forum posts will be analyzed and triangulated to understand emerging issues influencing the development of new literacies and eHealth literacy. After establishing a case report for each of the participants a cross-case analysis will be performed.

The participants will be asked to reflect weekly about their use of the trackers. It will enable participants to enter their experiences with the biometric data, like relevance of difference sensor data, lifestyle adaptations (like e.g. more sleep), special situations (e.g. hike, changes in hear rate during activity) and how these experiences lead to specific searches and actions in the web and/or in their real social network. Students will be able to publish different formats of reflections as text, hyperlinks to health related web pages and images. The quality of the materials, collected and published within the ePortfolio tool, has been shown to improve during the previously conducted pilot work during the development of this tool. The created eportfolio is expected to provide a fundamental platform for meaningful and sustainable interaction between the students and the teacher in the continuous construction of knowledge towards any undergraduate programmes' intended learning outcomes. It is expected to enhance the metacognition of own learning through repeated reflection. This will be assessed as suggested previously (Parkes KA, 2013). Students have access to all their reflections and can retrieve past events of their reflective ePortfolio, described above.

2.1. Methodology

The presented research will employ a multi case methodology study to explicate the affordances of wearable trackers, as they emerge from the ten students using this technology. The study will constitute an inductive, hypotheses generating naturalistic inquiry, whose aim is to accumulate an understanding and propose recommendations relevant to the study context (see Creswell, 1998; Flyvbjerg, 2006; Merriam, 1988; Yin, 1989). It will focus on "the larger picture, the whole picture, and begin with a search for understanding of the whole" (Janesick, 2000, p.379). The research findings will provide a broad picture of the events taking place in particular contexts, allowing readers to draw their own conclusions (Stake, 2003). The sample size of the presented study, conducted over 5 months with an exemplary group of 20 students across the four key areas, is sufficiently large for a multi case methodology study (see Savolainen, 1994; Small, 2009).. The questionnaire data will be collected by the Research assistants. The data from the tracker (individual reflections and biometric data) will automatically be recorded into a database. Interview and questionnaire will take place at the University, 30minutes for each interview, 20 minutes for each questionnaire (1 hours and 40 minutes for each participant). The Ethical Permission to conduct this study has been obtained from the Hong Kong University Committee of Ethics. Participants will be explained the study asked to sign ethic clearance and the consent to participate to the study including the permission to publish the results of the study after anonymizing provenience of the collected data. A consistency technique will be applied across the 20 cases to allow comparability. The adopted case study methodology is adequate for retrieving a well rooted set of arguments and recommendations related to the learning process performed by the ten students during the intervention related to eHealth literacy.

3. Expected outcomes of the study

- To use the Activity Tracker to elicit non formal, situated learning opportunities through the situated personal reflection in the ePortfolio and individualized feedback from the teacher.
- To investigate a possibility to use eHealth literacy-as indicator for development of new literacies.
- To investigate if an ePortfolio tool/exercise is suitable for enhancement of reflective and autonomous learning and test one of its possible applications, namely using wearable technologies like Activity Tracker as opportunity for development of students' eHealth literacy.
- To use ePortfolio as tool for enhancing reflective learning initiated through the specific feedback based on the biometric information.

3.1 Potential Impact

Apart from several exceptions such as reported by (Nakamura, 2015: Coffman & Klinger, 2015; Wu, Dameff, & Tully, 2014 and Yamauchi & Nakasugi, 2003), most of the research related to wearable computing does not

come from the field of education (Bower & Sturman, 2015). Due to the fact that wearable technologies with biometric data sensors came to market three years ago it is not astonishing, that there is a lack in research related to mechanisms developing eHealth and other new literacies using these technologies.

Using wearable technology students interact with their real personal data delivered in real time and anywhere. Such an interaction has a potential learning impact related to the mentioned literacies as students become more critical about sense, interpretation and reliability of information. The interaction with the personal biometric data will also cause concerns and stimulate further inquiry, such as e.g., searching health information channels for related explanations. The increased confrontation with such inquiries and activities in social networks, has an additional impact on development of new literacies.

The study will adopt explorative, qualitative multiple case methodology (e.g., Merriam, 1988) collecting the data deriving from: interviews with the participating students; an integrated reflective personal and public journal the students will be asked to keep; interactions with the researchers during the students' work on their journal; a proposed forum accessible to all or chosen participants; the biometric data collected by the wearable device and from a questionnaire to assess eHealth literacy at the base-line and post intervention.

Applying the mentioned method is likely to enrich the findings of the performed case study and to advance the work of the research community in relation to assess how different forms of new literacies are interconnected and independent as a system for supporting the development of such literacy. The ePortfolio tool, if correctly evaluated and applied, has the capacity to fulfil the expectation of the Hong Kong University (HKU) to employ 'innovative assessment methods to document student learning, teacher feedback, and student uptake of that feedback and strengthen procedures for gathering and acting on student feedback' (Enhancing the student learning experience. HKU 2014). We expect, and there are already strong indicators, that the ePortfolio platform will provide a unique virtual learning environment, creating richer and more diverse learning experience, complementary to face-to-face modes of learning. This in turn will enhance the students' experiential learning. The final product of this project, an ePortfolio platform is expected to be available for use to any tutor/student of HKU.

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A Snapshot of Teacher Educators' Mobile Learning Practices

Kevin Burden[12], Matthew Kearney[13]

Abstract

This study examines the mobile pedagogical practices of teacher educators. It uses data from an international survey that elicited information about how they were using distinctive mobile pedagogical features in their task designs. Findings indicated high 'self ratings' of features of authenticity (setting, tool and task) and healthy perceptions of generativity and sharing, often involving media production apps. Fewer tasks reported by the teacher educators involved high levels of online, networked collaborations or strong features of personalisation (agency and customisation). In light of these findings, we discuss the development of a mobile learning toolkit for teacher educators to help address their professional development needs evident in the study. This toolkit will help teacher educators develop stronger theoretical understandings of mobile pedagogies through the inclusion of multimedia case scenarios to illustrate and contextualise exemplary practices. It will also encourage them to include students in their own m-learning task evaluations, and provide them with an app evaluation rubric that emphasises the contextualised use of specific apps.

Keywords: teacher educators; mobile learning; authenticity; personalisation; collaboration

1. Introduction

Mobile learning (or 'm-learning') considers the process of learning mediated by portable, mobile technologies such as smart phones, tablet computers and game consoles (Schuler, Winters & West, 2012). Educators are increasing their use of these mobile devices (or 'm-devices') due to growing evidence of effective learning across a range of learning spaces (Pegrum, Howitt & Striepe, 2013; Wu et al., 2012), including reports of enhanced collaboration, social interactivity, in situ learning and sharing, communication between peers, teachers and experts, and customisation of learning (e.g. Kearney, Burden & Rai, 2015; Mifsud, 2014). The increasing ubiquity of these devices, and on-going technical developments such as geospatial and motion detection, image and video capture, augmented reality, connectivity and context awareness (Johnson, Adams, Becker, Estrada & Freeman, 2014), are

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providing educators with new opportunities for pedagogical 'repurposing' (Koehler et al., 2011). However, teachers continue to struggle with effective mobile pedagogical approaches (Herro, Kiger & Owens, 2013) and there has been a tendency to default to traditional teacher-directed approaches (Cochrane & Antonczak 2014; Kearney et al., 2015; Rushby 2012).

Teacher educators are also engaging with mobile pedagogies, responding to the rapid adoption of m-learning in schools (Herrington et al., 2014; Newhouse et al., 2015; Zhang, 2015), and the contemporary mobile digital culture in which many student teachers are immersed in their non academic lives (Broda et al., 2011). M-learning practices in teacher education can be categorised into two areas: teacher 'training' about and with mobile learning (Baran, 2014). Teacher education about m-learning involves student teachers learning how to integrate m-devices into their own prospective school teaching. For example, developing their understanding of how m-devices and associated educational applications (or 'apps') can leverage opportunities for more contextualised, collaborative learning in K-12. Teacher education with m-learning involves the enhancement of student teachers' professional learning with m-devices. For example, student teachers' use of m-devices to mediate their reflection on / in practice during their professional placement and sharing ideas and resources with colleagues through social media (see Fig. 1).

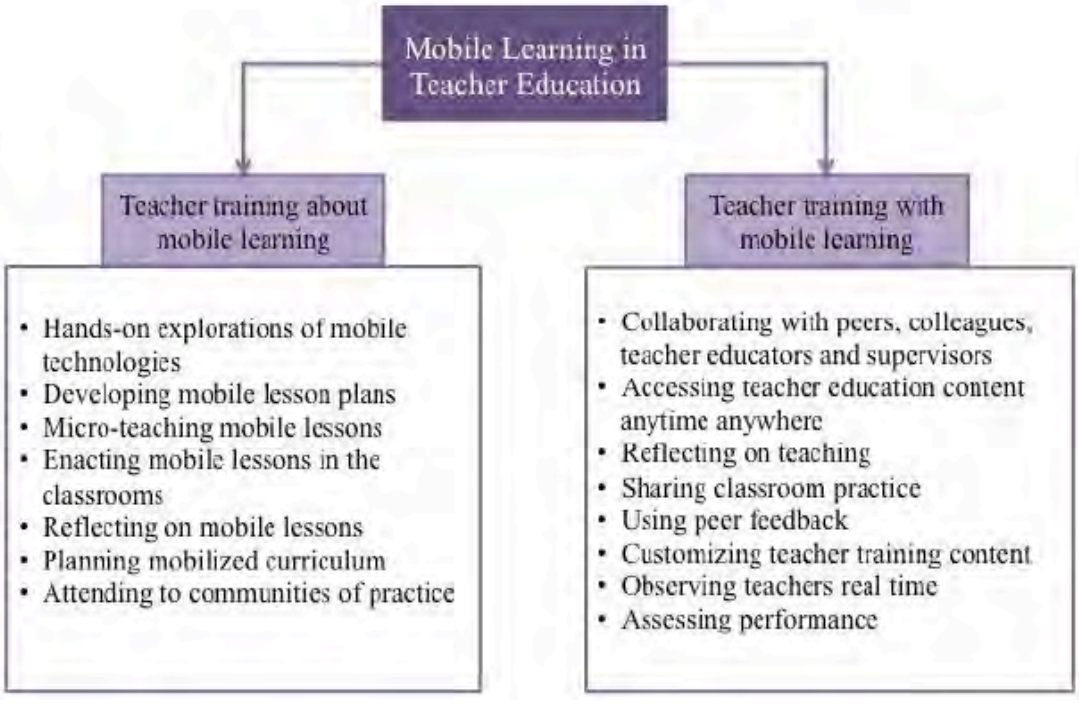

Figure 1. Two categories of m-learning practices in teacher education. From Baran (2014, p.28)

Mobile learning has been raised as a critical aspect of contemporary teacher education (Albion,, Jamieson-Proctor, Fasso & Redmond, 2013; Herrington et al., 2014; Johnson et al., 2014) and prompted calls to update contemporary pedagogical approaches in teacher education programs

(Herrington et al., 2014). However, there is a scarcity of m-learning studies in teacher education exploring pedagogical insights, and the views of teacher educators themselves are often absent (Baran, 2014). This study therefore aims to investigate teacher educators' contemporary mobile learning practices in teacher education, exploring the key research question: how are teacher educators exploiting the pedagogical features of mobile learning? It addresses this question by interrogating teacher educators' self-reported use of distinctive pedagogical features of mobile learning environments: authenticity, personalisation and collaboration (Kearney, Schuck, Burden & Aubusson, 2012). It draws on analysis of survey data collected from mainly Australian and European teacher educators, with a particular focus on these featured mobile pedagogies, before discussing implications for professional development.

2. Theoretical framework

In this paper, we use a well-accepted pedagogical framework of mobile learning (Kearney et al., 2012) that draws on a socio-cultural perspective. This mobile pedagogical framework (or MPF) privileges three distinctive aspects of m-learning: Personalisation, Authenticity and Collaboration (see Figure 2). From this perspective, how learners ultimately experience these pedagogical characteristics is influenced by their context, especially their use of 'time and space' (Ling & Donner 2009), comprising temporal (scheduled/flexible; synchronous/asynchronous etc.) and spatial features (formal/informal, physical/virtual) of the learning environment. The critical influence of this context is signalled by the central location of 'Time-Space' at the core of the framework depicted in Fig. 2.

Figure 2. Mobile Pedagogic Framework (MPF) comprising three distinctive characteristics of mobile learning experiences. Adapted from Kearney et al., 2012, p.8.

The Personalisation feature consists of the sub-themes of agency and customisation and has strong implications for autonomous learning. High levels of personalisation would mean the learner is able to enjoy a high degree of agency (Pachler, Bachmair & Cook 2009) together with the ability to tailor both tools and activities, leading to a strong sense of ownership. Secondly, the Authenticity feature privileges opportunities for contextualised, in-situ, participatory learning (Radinsky, Bouillion, Lento & Gomez, 2001). The sub-themes of task, tool and setting bring to bear the significance of learners' involvement in rich, contextualised tasks, making use of tools in a realistic way, and involving participation in relevant real-life, practices and processes. Thirdly, the Collaboration feature captures the conversational, networked aspects of mobile learning. It consists of conversation and data sharing sub-themes, as learners engage in negotiating meaning, forging connections and interactions with other people and the environment, sharing resources through rich collaborative tasks (Wang & Shen, 2012).

This framework has recently been used to inform research on m-learning in school education (Kearney et al., 2015), teacher education (Kearney & Maher, 2013) and other areas of higher education (Kinash, Brand & Mathew 2012). For example, Green, Hechter, Tysinger and Chassereau (2014) used the framework to inform the development of their own instrument—the 'Mobile App Selection for Science' (MASS) rubric—to aid teachers' rigorous selection and evaluation of K-12 science applications (or 'apps').

3. Mobile learning in teacher education

Part of the 'wicked problem' (Borko et al., 2009) with integrating technology in teacher education is that teacher educators (and often student teachers) are navigating 'unchartered territory', in terms of adopting appropriate pedagogies that were not experienced by them in their own education (Foulger et al., 2013; Zhang, 2015). Most educators have had limited opportunities to observe and experience mobile pedagogies as part of what Lortie (1975) calls their 'apprenticeship of observation'. Compounding this situation, there is a paucity of research examining teacher educators' practices with m-learning (Baran, 2014, p. 28). However, there are some pioneering mobile learning studies in teacher education and they are discussed in this section.

3.1. M-learning practices

Foulger et al. (2013) established a snapshot of how teacher educators are preparing student teachers to use m-devices in their K-12 teaching. They used a survey tool to explore the m-learning adoption practices of 79 teacher educators in US institutions, finding that most institutions were still in early stages of exploration and adoption of m-learning approaches. In terms of Rogers' (2003) diffusion of innovation theory, most teacher educators surveyed in this Foulger et al. (2013) study were still in the initial stage of 'defining the innovation' (mobile learning) and were "taking a certain level of risk by

exploring its possibilities" (p. 27). Pedagogical approaches varied amongst the teacher educator participants in this study, ranging from direct instruction to modelling of good practice for K-12 teaching. Pegrum et al. (2013) investigated how iPads contributed to PSTs' learning, including their learning about teaching. Case studies of eight PSTs were developed as well as focus group interviews of a larger cohort. They found that iPads supported pre-service teachers' learning by developing understanding of content and pedagogy, staying connected, and staying organised. Their use of the iPads also helped PSTs develop a broader understanding of learning spaces and learning networks.

Innovative ways of enhancing teaching and learning using mobile technologies were explored by Herrington et al. (2009) in a project titled New Technologies-New Pedagogies. In conjunction with an action learning framework through sharing and reflection, the project's aim was to explore appropriate mobile pedagogies within an authentic learning environment in a range of different subject areas. For example, primary PSTs "investigated the use of smartphones to facilitate interactions and reflections about K-6 mathematics concepts and the teaching of these concepts in the classroom" (p. 11). Mobile devices in this project were used as 'cognitive tools' in authentic learning environments involving real-world problems and relevant projects. Herrington et al., 2014 further considered mobile pedagogies informed by authentic learning, advocating less prescriptive, more open implementation of m-devices and a move away from a focus on the technology affordances. They advocate a design-based pedagogy, consistent with their views on authentic learning, whereby "m-devices can be used to create polished and worthwhile products that can be shared, published and appreciated widely" (p. 148), in contrast to traditional use of m-devices to deliver content.

Modelling of authentic, best practices with mobile pedagogies is an imperative in teacher education (Herrington et al., 2014) to help student teachers learn how to use m-devices in a pedagogically appropriate manner (Pegrum et al., 2013), and with the hope that they will in turn provide effective mobile learning experiences for their own students. There is a need for teacher educators to model exemplary mobile pedagogies "through collaborative practices, problem solving, creative thinking, interpersonal communication, and digital technology competencies" (Newhouse et al., 2015, p.71). For example, Broda, Schmidt and Wereley (2011) explored meaningful strategies for using iPads both in pre-service teacher education and within K-12 contexts. To help PSTs become comfortable in using the m-devices in their own teaching, they highlighted the importance of modelling iPad use (by teacher educators) to provide "progressive, authentic socially mediated experiences" (Broda et al., 2011, p. 3151). They emphasised the need for all educators to adopt a "progressive ethic for teaching and learning, supporting efforts to think differently and use the technology tools to explore and embody the fluid nature of learning and teaching" (p. 3150). This 'ethic' allows student teachers to realize the potential of mobile technologies in ways that are 'intrepid and creative' beyond what was possible when they (or their own teachers) were educated. Research undertaken recently, however,

suggests teacher educators are not confident in modelling the use of mobile technologies with their student teachers (Burden & Hopkins, 2016) which echoes previous findings about their failure to model the pedagogical practices they expect of their trainees (Lunenberg, Korthagen & Swennen, 2007).

Other studies have looked at the development of teachers' 'technological, pedagogical and content knowledge' (or TPACK – see Mishra & Koehler, 2006) through the lens of mobile learning. For example, Kearney and Maher (2012) investigated the use of iPads to support PSTs' TPACK development in Maths Education. Findings suggested that the teacher candidates used the mobile devices to facilitate their awareness of Maths in everyday contexts, and then applied this knowledge to develop rich, more authentic and contextualized ideas for their own K-6 math tasks. They exploited the iPad's potential to conveniently and spontaneously take notes, observe lessons and make multi-modal reflections. Hodges et al., (2012) also explored possibilities for PSTs to develop their TPACK through the use of iPads in teacher education, including the transfer of relevant skills and techniques to K-12 settings.

A promising area of focus in teacher education has been the use of mobile devices to support PSTs' learning during their school-based professional experience. For example, Maxfield and Romano (2013) explored PSTs' use of m-devices to video record their observations on the first day of their school-based professional experience, and examined the impact that peer review of these videos had on their professional learning. The m-devices enhanced observation, and PSTs were able to connect to a diverse group of peers and other educators; enabling reflection- on- action (Schon, 1987); on both their own first day experiences and their peers' experiences. Videos were later used on campus to enhance collaboration and reflection on campus-based classes. More recently, Dann and Allen (2015) investigated how m-devices (especially iPhones) can be used by PSTs, supervising teachers and teacher educators to provide feedback to PSTs. Improvement of professional learning experiences were recorded for mentors and PSTs. For example, they received powerful visual feedback as part of formative assessment process. Other studies have investigated the use of m-devices to access social media on professional experience. Zagami (2010) investigated PSTs use of Twitter on their school placement (or 'iPrac') to share activities, achievements; attitudes, resources and events. He found that this process reduced the anxiety, isolation and uncertainty commonly experienced by naive PSTs on professional experience. Similarly, Wright (2011) found that PSTs' use of Twitter on their mobile devices during school placements enhanced a sense of community, reducing isolation and helping them to focus their thinking and make more clear, purposeful reflections on their teaching. Finally, Aubusson, Schuck and Burden (2009) discussed teachers' use of mobile devices to facilitate reflection-in-action (Schon, 1987), providing them with "an unrealized opportunity for the facilitation of observation, critique and sharing of activities in the classroom" (Aubusson et al., 2009, p. 244).

3.2. Professional development needs

The need to prepare teacher education staff for mobile learning is a critical professional development challenge (Herrington et al., 2014, p143). Many academic staff are unfamiliar with the use of mobile devices in education and are not effectively prepared to investigate the advantages or make informed decisions (Kukulska-Hume et al., 2009; Schuck, Aubusson, Kearney & Burden, 2013). Some feel that these technologies are changing so rapidly that they lack confidence and feel incompetent in using them for teaching (Herrington et al., 2014), fearing change from more familiar teaching methods. An unfortunate consequence is that student teachers who bring a device to university can become critical of their lack of use (Russell et al., 2014) or may decide not to bring their device to campus (Newhouse et al., 2015).

M-learning studies in teacher education have identified a number of first and second-order barriers to adoption (Ertmer, 1999) that need careful consideration in professional development initiatives. First order factors include a lack of teacher support and training (Baran, 2014), as well as issues of classroom management, concerns over equity (especially in relation to BYOD policies), restricted availability of devices, access to wifi and 3G/4G and technical support (Herro, Kiger & Owens, 2013; Pegrum et al., 2013). A challenging second-order factor to address in the professional development of teacher educators (and more widely in school and tertiary education) is teachers' strongly held beliefs. A common concern is that 'true' m-learning—learning untethered from the classroom— challenges some teachers' beliefs about instruction and the role of the teacher (Sølvberg & Rismark, 2012, cited in Şad, & Göktaş, 2014). In this way, m-learning can be viewed as conflicting with more traditional views of teaching and learning (Burden, 2016). Consequently, some teacher education staff believe student teachers' 'work with technologies' should be confined to specialist education technology subjects, and this reluctance "can create a chasm between student teachers and other academic staff who have not realized the potential of m-learning in across the curriculum" (Herro, Kiger & Owens, 2013, p.36). Furthemore, some educators are concerned about a lack of evidence for the educational value of mobile devices to support learning and this may drive some techno-cynicism (Pegrum et al., 2013, p475).

Another issue is the reductionist view of 'm-Learning' as a way to simply 'deliver information' (El-Hussein & Cronje, 2010), whereby students' use of m-devices to simply access content and resources. This view is unsurprising given the rhetoric around 'm-learning' as a new way to 'deliver instruction', albeit more flexibly (Sharples, Taylor & Vavoula, 2007). The dominance of 'drill and practice' and 'information provision' apps in the Education category of providers such as iTunes (Murray & Olcese, 2011) reinforces this view. Indeed, in their m-learning study in higher education, Churchill and Wang (2014) found a strong focus on the use of content accessing apps and resources by academic staff.

Their study also provided valuable insights into both the educational affordances of iPad technology and the ways in which teachers' personal or private theories mediate these perceived affordances. These theories covered a vast 'territory' ranging from teachers' own theories of learning to epistemological and societal views. To address this important area of teacher beliefs, educators need to explore other possibilities with mobile technologies, where emphasis is placed on collaboration, connectivity, representational possibilities, and analytical uses (Churchill & Wang, 2014).

4. Methodology

The aim of this research project was to gain an understanding of contemporary mobile learning pedagogies in teacher education, exploring the key research question: How are teacher educators exploiting the pedagogical features of mobile learning? A 30-item survey instrument was developed specifically for this purpose, with a focus on three distinctive pedagogies associated with m-learning (Kearney et al., 2012): personalisation, authenticity and collaboration (see Figure 2). Data were analysed according to these three themes. In order to avoid response bias, 'm-learning tasks' were broadly defined in the survey as 'specific learning tasks or activities in which mobile technologies were used'. There were 195 school and university educator participants who completed the survey. This paper focuses on the 46 participants from the teacher education sector. Background on the development and validation of the survey, and sample items, are discussed elsewhere (Kearney et al., 2015).

The data set was coded under the three constructs of collaboration, personalisation and authenticity. Data from open-ended survey item responses were condensed, categorised, and connected over time (Huberman & Miles, 1998) according to emerging themes relating to these constructs. An interpretive approach was employed for this analysis, providing insights into the teacher educators' perceptions (Mason, 1996). A reliability analysis of the entire questionnaire (n=195) was carried out using Cronbach's alpha. Internal consistency of the whole questionnaire (with all three scales combined) was excellent ($\alpha = 0.828$). When considered separately, the internal consistency was in the acceptable range for each of the three constructs: Personalisation ($\alpha = 0.711$), Authenticity ($\alpha = 0.775$) and Collaboration ($\alpha = 0.715$). A statistical analysis of the constructs was performed for the three domains, using mean ranking scores for each multiple-choice item. The survey items contained three response options corresponding to 'low' (rank of 1), 'medium' (rank of 2) and 'high' (rank of 3), and the mean score for each sub-construct was calculated. NB. Informed by the pilot survey trial —see Kearney et al. (2015)— the four questions relating to 'data sharing' (in the Collaboration construct) were divided up into 'generativity' (the extent to which learners shared learner-generated content) and 'networking' (the extent to which they shared data in networked collaborations).

4.1. Participants

There were 46 volunteer teacher educator survey participants, mainly from Australia (14) and Europe (15), where the researchers' institutions were located. The participants were generally very experienced educators, with 85% of them having taught in universities for more than 10 years (51% for more than 20 years). Also, 75% of participants perceived themselves as experienced users of mobile devices in their teaching—defined as more than 2 years experience. So although the number of teacher educator participants was relatively small (n=46), this high level of expertise and experience made the participants' self-rankings and critique of their own pedagogical 'strengths and weaknesses' compelling.

5. Findings

Participants chose a range of task contexts as a focus for their survey responses, with 86% describing a formal m-learning task that was campus-based. Only 14% of teacher educators reported on a m-learning task that was situated in an 'extra-mural' context (school playground, excursion site, museum, home) and no tasks were set in a totally informal location such as a cafe or public transport. Indeed, not one task involved a 'change in context' (or 'boundary crossing' between learning spaces), an increasingly important characteristic of mobile learning in the literature (Schuck, Kearney & Burden, 2016). The most common discipline areas were STEM education (40%), languages and literacy education (14%) and social sciences education (12%). Most tasks involved use of an iPad (28%), laptop (19%) or mobile phone (12%), while 30% of tasks integrated a mixture of devices. 35 percent of tasks involved use of institution-owned devices (23% for on-campus use only) while 33% of tasks involved student-owned, 'bring-your-own' devices (BYOD). The large majority of tasks reported in the (optional) open ended section of the survey (completed by 33 teacher educators) 'fitted' into Baran's (2014) category of teacher learning 'about' m-learning, with only 3 respondees reporting on a task that would fall into the category of learning 'with' m-learning (see Figure 1).

The research literature (see Literature Review above) and our own previous research (2015 paper) suggest that teachers use only a limited range of mobile pedagogies and in terms of the theoretical mobile pedagogical framework informing this study, their use of collaborative strategies, and to a lesser extent those around personalisation, were noticeably low. In contrast, their perceptions of authenticity were more positive. In this section we discuss the teacher educators' self reports of their use of mobile pedagogies, as well as their choices and use of apps. When relevant, the quantitative results are discussed in light of results from the school teacher data set (Kearney et al., 2015).

Table 1. Mean rankings for components of the collaboration, authenticity and personalisation constructs (n=46)

Construct	*Component*	*Mean Rank (Teacher Education staff (n=46)*
Personalisation (5 items)	Agency	2.1
	customisation	2.1
Authenticity (3 items)	Setting	2.4
	Tool	2.6
	Task	2.6
Collaboration (6 items)	Conversation (face to face)	1.9
	Conversation (online)	1.6
	Data sharing (generativity)	2.5
	Data sharing (networking)	2.2

5.1. Personalisation construct

The Personalisation construct which includes the sub-constructs of 'agency' and 'customisation', scored modestly by the teacher educators with a mean score of 2.1 each (compared with 1.9 and 2.0, respectively, for the school teacher data). The use of mobile devices to customise the learning experience for their student teachers is evidently not yet widespread and indeed this has been a consistent finding across all of the different education sectors we have surveyed, not just teacher educators. There were few of the open text exemplars that participants cite in the survey that feature customisation in any great depth indicating this is an area where more professional development is needed.

Surprisingly the other aspect of the personalisation construct – agency – also scored low in the surveys we have conducted and teacher educators are broadly similar in their scores. Low scores amongst school teachers might be attributed to the age of the students and concerns about privacy and online safety that are more common in the school sector than in the post school sector. However it was more surprising to find broadly similar low scores for the agency construct amongst teacher educators which suggest they are also reluctant to grant PSTs more control and choice when using mobile technologies. Also, this lower rating may have been affected by the unexpectedly low use of student-owned devices (33%). In an exception to this generalisation, one participant described a mobile learning scenario that granted PSTs considerable choice in selecting a place or space that had value to them in terms of their background culture. PSTs were encouraged to take a photo (or source a related image) and share it in a Flickr space for everyone to access. The aim was to synthesise ideas across all the images from the class to assist in: "understanding the notion of place as connected to social/personal values; understand how prior knowledge and personal context is vital for 'hooking' learners; understanding how created content can be both personal and interwoven in learning design" (survey response). This teacher

educator noted that she saw her role as 'modelling' how to capture appropriate images, and guiding the context of the task, leaving the choices to the students.

5.2. Authenticity

Authenticity was the highest scoring construct in the survey and was a major priority for the teacher educators. The MPF that informed the construction of this mobile learning survey instrument identifies setting, tool and task as three sub-constructs for authenticity. Although all three of these sub-constructs were scored very highly by participants (2.4, 2.6 and 2.6 respectively), some of them were more prominent in their scenarios than others. Despite 86% of participants describing an institutional setting for their task, the 'setting' sub-construct was rated highly in a number of the scenarios where PSTs were provided with opportunities to participate in authentic networks or work in an authentic location. For example, one teacher educator asked her student teachers to use their m-devices to develop and use a professional learning network (PLN) to enhance their digital footprint and discuss digital citizenship issues. They later used their PLNs to find resources, answer questions and forge authentic relationships with other educators beyond their immediate setting. Another teacher educator created and modelled a 'place-based' m-learning task suitable for a field trip to a river as part of their Geography education studies. The student teachers used their m-devices' geo-location facilities to pick up their location at the three main stages of a river's path. At strategic points, their device presented them with teaching materials corresponding to their position along the river. The aim of this in-situ, contextualised task was for students was to identify river features (e.g. waterfalls, meanders) and processes (e.g. erosion, deposition) associated at each stage of the river, and the impact on the surrounding landscape. As well as creating and testing this authentic task, the teacher educator asked the student teachers to create their own location-based m-learning task for a different topic in Geography (for their peers), in light of their immersion experience. In this way the task had another layer of authenticity in that the student teachers were producing 'real-life' teaching resources for their teaching peers and prospective school students.

5.3. Collaboration

The generative element of data sharing, such as the creation of multimedia artefacts (e.g. video and animation) or the creation of digital stories and narratives (e.g. creating an eBook) featured prominently in the exemplars quoted by the teacher educators and also in the survey items with a mean score of 2.5. This mirrors the similarly high mean score awarded by school teachers (2.4) for this data sharing sub-construct and indicates these digital practices are well understood and widely practised in line with the growing popularity of knowledge building activities in teacher education (cf. Burden, 2016) and the digital maker culture more widely (Niemeyer & Gerber, 2015). Almost half (43%) of the apps mentioned by participants were media production apps (see Table 2). For example, one participant asked the student teachers to create short videos of objects they find in the real world that

they might use in their teaching. The purpose of the task was for PSTs to become more aware of the lessons in the real world that can be brought into the classroom quickly. Secondary aims of this task included "the development of video production skills and to appreciate that the creation of video is now a natural part of teaching practice" (survey response).

However, other aspects that constitute the entire Collaborative construct, such as the networked sharing of the artefacts that are produced (e.g. in order to gain feedback from experts or external peers), and both forms of conversation—face to face (1.9) and networked (1.6)—were not scored as prominently. This networked conversation score also mirrors the low scores awarded to these items by school teachers (1.4), although curiously, face-to-face conversations were rated far more favourably (2.4) by the school teacher cohort, possibly influenced by the tendency for school teachers (especially K-6 teachers) to issue m-devices for small group-work. However, like their colleagues in schools, teacher educators did not yet appear to fully exploit the affordances of mobile devices that support the elements of dialogue and conversation that might be described as 'virtual' and distant. One exception was a Maths Teacher educator who challenged his 1st year education students to take photos to demonstrate a maths concepts and create a collage to share with others online on their course Facebook page. Student teachers were encouraged to report on their Maths experience and learning via Twitter. The aim of the task was to 'think mathematically and discover the concept and demonstrate it authentically' (survey response). The use of social media was emphasised as a medium to 'Talk, discuss, experiment and play'.

5.4. Reported use of apps

All 46 participants answered the following compulsory open-ended question: 'What were the main 'apps' and/or built in tools (e.g. camera) used in the task?' We also used Goodwin and Highfield's (2012)'s classification of educational apps to categorise their responses (see Table 3). Most participants listed several apps that were used in their m-learning task. We were also able to contextualize their use of apps using the (optional) open-ended questions at the end of the survey (completed by 33 participants). Goodwin and Highfield's (2012)'s system uses three main categories, essentially arranged along a continuum from Instructive apps that are used for lower level cognitive, drill and practice style tasks, to higher level Constructive apps, used for more creative or communicative purposes, allowing learners " to create their own content or digital artefact using the app" (p. 12). In the middle of this spectrum is the use of Manipulative apps, demanding more rigorous thinking than instructive apps, and leveraging "guided discovery and experimentation but within a predetermined context or framework" (p.13).

Table 2. Breakdown of apps used in the teacher educators' m-learning tasks

	Instructive 11%	*Manipulative 11%*	*Constructive 78% (43% media production)*
Examples from study	i) Multimedia viewing and 'content access' apps such as Youtube, iTunesU, TED and iBooks reader; ii) Other apps used to access content such as QR Code scanner / reader.	i) Simulations, games and augmented reality apps; ii) Interactive discipline-specific / curriculum apps such as Matlab and Wolframalpha (Maths).	i) Media production apps for video (e.g. iMovie), images (e.g. Skitch), audio (e.g. Sound recorder), presentations (e.g. Keynote, Explain Everything, Showme), location-based learning (e.g. 7scenes); ii) 'Cognitive tools' such as note-taking and mind-mapping apps (e.g. Mindomo) & Communication / social media apps (e.g. Twitter) & Note taking apps (e.g. Evernote).

Over three-quarters (78%) of the apps mentioned by survey participants were used in a way that would be classified under Goodwin's (2012) 'constructive' category: leveraging students' communication and creation of their own digital content. Frequently mentioned apps were social media apps such as Twitter, video production apps such as iMovie, as well as note taking apps such as Evernote. The lower levels of instructive apps and high levels of use of creative, generative apps is contradictory to findings in other studies that suggest educators prefer to use more discipline specific apps rather than the open-ended, content free apps categorised here as 'constructive' (see for example, Churchill and Wang, 2014). The findings from this part of the survey suggest teacher educators are more inclined to use apps that can support a more constructionist approach to learning in line with recent initiatives such as the digital maker 'movement' (Niemeyer & Gerber, 2015) and the recent emphasis on design-based pedagogies in teacher education (Koehler et al., 2011).

6. Discussion and implications

In this final section of the paper we discuss the implications of these findings for teacher educators and their PSTs, and analyse how these findings are being used to inform the design and development of a mobile learning toolkit for teacher educators that aims to support them in expanding their range of m-learning approaches and strategies.

Combined with research referred to already in the Literature Review, and comparable surveys undertaken previously with school teachers (Kearney et al., 2015), the results from this study underline our earlier contention that teacher educators may struggle to exploit the full range of effective mobile pedagogical approaches. Additionally the results from this sample are somewhat confusing, particularly those for the authenticity construct where participants' survey responses point to perceptions of highly authentic and realistic uses of mobile technologies despite their setting in predominantly formal institutional contexts and use in somewhat contrived processes. The results for teacher educators echo those reported in an earlier study of school teachers (see Kearney et al., 2015)

that suggests a need for additional perspectives from other stakeholders such as students to provide greater triangulation.

Taken together the results from this and previous studies raise a number of salient questions and issues around the use of mobile devices in teacher education which are addressed in the remainder of this paper:

- To what extent are teacher educators cognisant of the theoretical foundations and affordances of m-learning?
- How can teacher educators benchmark and measure their current use of m-learning and how can this data be triangulated with other data to make it more valid?
- What constitutes 'best practice' in the use of m-learning in teacher education and how can teacher educators be supported in exploring this for their own practice and that of their student teachers?
- How do teacher educators gauge and understand the educational value of different apps to ensure they can support their student teachers most effectively?
- How can expertise and understanding about the use of m-learning in teacher education be developed at scale to have an impact beyond the 'early adopters' and 'innovators'?

These various issues and questions foreground the design and development of a mobile learning toolkit for teacher educators undertaken as part of a transnational Erasmus+ initiative funded through the European Union (see www.mttep.eu). This will enable them to measure and benchmark their current m-learning pedagogies against a validated and reliable mobile pedagogical framework; expand their understanding of the affordances and potential of m-learning through a series of multimedia m-learning scenarios and case studies; evaluate the pedagogical potential of different apps in different education settings; and undertake on-going support and networking through the provision of a dedicated online course. These features are explored in further detail below.

6.1. Mobile Pedagogical Framework

As noted previously in the literature review, there is a shortage of pedagogical and theoretical models that can guide teacher educators in designing mobile learning experiences, and a need to develop a shared language for describing emerging pedagogies (Herrington et al., 2014). There is an urgent need to provide practical strategies that will support teacher educators in fully exploiting mobile learning (Baran, 2014). The mobile learning toolkit addresses the first of these concerns with the provision of a robust and validated m-learning framework (MBF) which has been widely used across a range of educational settings including teacher education. Developed originally in 2012 (see Kearney et al., 2012), a representation of the framework has been modified and developed through an iterative process that includes field trials and pilots with practising educators and the current version is shown in Figure 2. This compares with the original version in which the construct of authenticity was less

well developed. In response to user feedback and theoretical considerations (see Burden & Kearney, 2016a) the current representation of the MPF includes three rather than two sub-constructs for authenticity, reflecting the growing interest in this particular aspect of m-learning. To help PSTs with relevant language development, 'word clouds' were created as stimulus for discussion. They were created from relevant words used in our previous papers (e.g. Kearney et al., 2012). Figure 3 shows these Word clouds associated with the MPF constructs of Personalisation, Authenticity and Collaboration.

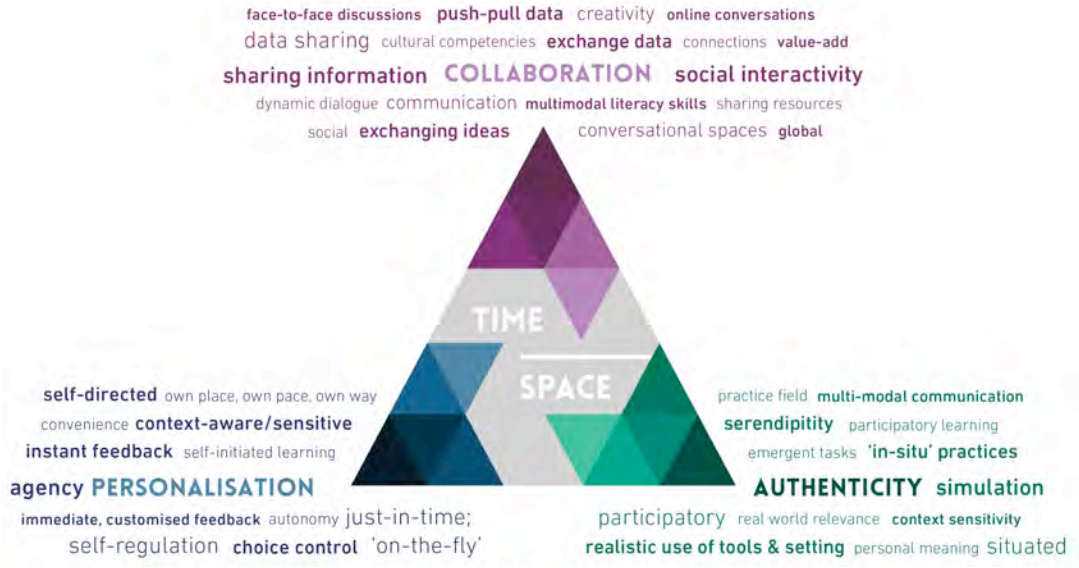

Figure 3. 'Word clouds' relating to the 3 constructs of the Mobile Pedagogy Framework

6.2. MPF survey tools

Based upon the theoretical MPF described above, the toolkit also contains a selection of online survey tools that teacher educators and their students can use in various ways to measure and evaluate their m-learning practices. The student survey was designed to provide an additional perspective to supplement the survey instrument undertaken by teacher educators, thereby increasing the validity of the instrument by providing a perspective based on student voice (Groundwater-Smith, 2007). The student survey tool is based on self reported data that participants provide based around a recent mobile learning scenario or task they have recently experienced. The data generated from the survey is presented to teacher participants to compare with their own responses, providing an m-learning profile with guidance and suggestions for further professional development linked to a growing database of m-learning scenarios and video case studies (see below).

6.3. M-learning scenarios, exemplars and video case studies

The results from this study highlight the need to encourage teacher educators to explore a wider range of m-learning activities such as more in-situ learning contexts, greater consideration of student agency and more use of networked and virtual conversations to share practices beyond the immediate vicinity and access of external expertise (e.g. see Collaborative construct above). It also focuses attention on the need for greater exemplification of how teacher educators use mobile devices for professional learning (both their own and that of their students) and to model and practise approaches to K-12 teaching and learning (see for example, Naylor & Gibbs, 2015). To support these needs the toolkit contains a wide range of exemplar resources in the form of digital eBooks, mobile learning scenarios (based on a common template) and video case studies which are intended to stimulate interest and pedagogical discussion across the teacher education community, facilitated by on online forum and course (see below). These exemplar resources are tagged and matched to the MPF described above, enabling users to interrogate the toolkit by the signature pedagogies of the framework. Following the pilot phase of this initiative (2014-2017) it is hoped the education community will supplement the project's existing resources with m-learning exemplars of their own, adding to the case studies and video vignettes, so becoming a self-supporting and scalable resource in the future.

6.4. Pedagogical rubric for evaluating apps

Although some of the literature reviewed here indicates educators are looking for advice and guidance on how to select and use discipline specific apps (Churchill & Wang, 2014; Green, et al., 2014) our own findings from this study and previous research suggest teacher educators are more include towards generic, content free apps that can be used in a wide variety of ways across all disciplines. This approach appears more sustainable and scalable in the longer term and therefore the project will develop an original rubric, with emphasis on sociocultural aspects of the MPF. The rubric will be supplemented with exemplars and case studies that illustrate and explain how the app might be used in specific contexts, since context is so critical when examining 'tools' from a sociocultural perspective (Wertsch, 1991). Using the rubric, teacher educators and their students will be better placed to assess the pedagogical potential and value of an app and to leverage the various MPF components underpinning the toolkit.

6.5. Online m-learning course

Finally, it is apparent little practical guidance and support currently exists to support teacher educators in their adoption and use of m-learning or to support them in the wider process of networking and collaborating outside of their immediate context. The toolkit will include access to a bespoke online course that will bring together all of the various resources and exemplars described above in a twelve week enabling teacher educators and students to learn as part of an international network.

7. Conclusion

Teacher educators in this study perceived their m-learning practices to be strongly authentic in nature (task, setting and tool) with less positive perceptions of autonomous, personalised learning and networked learning conversations. These results are quite similar to the school teacher cohort (Kearney et al., 2015), though there was more emphasise amongst teacher educators on design-based approaches, typically through the student teachers' use of generative, media production apps. There is evidently a need to encourage teacher educators to consider their modelling of a wider range of mobile pedagogies, especially approaches supporting student agency and networked collaborations. There is also a need to encourage more support of their student teachers' own professional m-learning practices, in an extended range of contexts in and beyond traditional formal learning environments, or what Schuck et al. (2016) call 'Third Space learning'. Teacher educators need to consider m-learning task designs that support more seamless 'boundary crossing' across these contexts (Burden & Kearney, 2016b), for example, from an informal learning space such as a cafe, or a semi-formal field trip learning environment, to a more formal, scheduled classroom. A new toolkit for teacher educators will address these reported areas of concern, including new representations of our mobile pedagogical framework, a student survey to give educators multiple perspectives with their own m-learning task evaluations; video case scenarios and e-books to illustrate and contextualise various dimensions of the framework (and associated language use); and an app evaluation rubric that will encourage educators to consider the contextualised use of specific apps, with strategic links to the aforementioned video case scenarios.

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The growing tendency of mobile-assisted language learning development in Kazakhstan

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Abstract

The paper examines the experience of mobile devices application in personal and professional life of learners - future engineers. The use of mobile phones for English language learning by Kazakhstani students of technical universities is widely considered by practicians. The study revealed some specific uses of mobile devices, a selection of which is reported in this paper. The paper links the findings to further debates about the changing relationship between learners and educational institutions, and the role of mobile phones in learning English.

Keywords: mobile learning, English as a foreign language, mobile-assisted language learning, learner–led learning, spontaneous learning

1. Introduction

Widespread of technology affects the process of teaching and learning foreign languages. Moreover, increasing availability of mobile phones and other portable and wireless devices have been changing the landscape of technology-supported learning. A number of efforts were undertaken by scholars to understand how mobile technologies relate to traditional and innovative ways of teaching and learning languages, showing the applicability of mobile learning through different tasks and software. On the one hand, Kiernan and Aizawa (2004) used mobile phones to have learners exchange e-mails with one another in order to teach targeted structures. On the other hand, Thornton and Houser (2005), asked learners to access video lessons about English idioms from their mobile phones during class time and complete short multiple choice activities about the idioms they had learnt, also on their mobile phones in a class.

Unfortunately, Diaz-Vera (2012) claims that "though mobile technologies offer innovative ways for supporting learning, collaboration and communication, the impact of these transformations on the ways students learn is so far definitely lower than initially expected". Taking into account the opinion of the scholar, and... We made an effort to reflect on what mobile learning has to offer and to consider how languages are learnt among Kazakhstani EFL learners.

Beside self-education, everyday opportunities to access learning resources on mobile devices have increased. Beside self-education, a particular attention belongs to learning resources on mobile devices. When you book a holiday to foreign country or flight, you need a phrasebook to download to

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your mobile phone or handheld device. Another example, when someone wish to improve or advance his knowledge of a language, it is possible, using Internet, find downloadable resources or use mobile application. In fact, there is uncertainty of cost and usability that stand before in the way of such learning and teaching. It is still expensive for some learners in our country to buy a smart phone (mostly in countryside), and stable Internet connection, especially Wi-Fi is another difficulty.

To start with, we note that there is no agreement among researchers about one thing: defining exactly what 'mobile learning' stand for (Kulkuska-Hulme, 2009; Traxler, 2009). The concept of mobility is problematic itself, within definition of mobile learning. On the one hand, one understand 'mobile learning' as *mobility* of *learners* – an ability to learn anywhere, at any time they want by using handheld devices. Other researchers understand it as *mobility* of *devices* themselves that is important too. We think both of the aspects are important, because mobile learning can take place in both classroom and also in self education.

Furthermore, Pegrum (2014) provides a helpful way of differentiating these interrelated aspects of mobile learning. He suggests that the use of mobile devices in education belongs to one of the three categories with an accent on *devices / learners / context:*

- when the devices are mobile;
- when learners are mobile;
- when the learning experience itself is mobile.

The first category assumes the mobility of a device – typical for 'connected classrooms' as Pegrum describes it. It is a classroom, where students use their devices to access the internet, searching for educational resources, etc. In this case, students work within the walls of a classroom, so they are not physically mobile. The second category – when learners are mobile, describes the situation where students may study by themselves while they are on move (learning vocabulary via mobile applications, for example). The last category is when learning experience is mobile – assumes the scenario when learners use their devices in a real-world contexts to access information needed at the moment, or to create a multimedia records of their learning wherever they be at the moment. We believe that last category best suits to language learning in our country.

As for learning languages mobile learning or mobile-assisted language learning (MALL) is a relatively new field, especially in Kazakhstan, within computer-assisted language learning (CALL) and e-learning, so there is little research available.

Actually, MALL has too much in common with CALL. In addition, like CALL, in general, there is limit theoretical framework for MALL against which to evaluate its efficacy that lead to confusion array (Egbert & Petrie, 2005).

So, Shield & Kukulska-Hulme (2008) in overview they have emphasized that MALL differs from CALL in its use of personal, portable devices that provide new ways of learning, making accent on continuity or spontaneity of access and interaction within different contexts of use. In this context

MALL seems to belong to students than it does to teachers, that shift focus on learner-led than teacher-led. In particular, mobile technology promotes learning at the point of need and fits in their mobile lifestyles.

Besides, the main reasons, which make valuable mobile devices, are its *size* and *weight* as well as *input* and *output capabilities* such as keypad vs. touchpad and *screen size* and *audio functions*.

In relation to foreign languages learning, mobile learning seems relevant in number of principles. These principles include providing time for exploration of mobile technologies, blending mobile learning and traditional language learning, using mobile learning both individually and collaboratively, and also employing learners' own mobile phones (Herrington et al., 2009). However, these affordances are accompanied by limitations. While mobile learning allows anytime/anywhere access, learning experience may be limited by mobile device screen size or deceiving environments in which they are used (Reinders & Hubbard, 2013).

It is also necessary to point out, that the devices most Kazakhstani EFL learners use are hardly relevant (only small part of students has smart phones). Today, every learner, who is involved in mobile learning, comes to understanding that everything matters which type of device he uses. First, even learner has more than one device he faces the problems of short battery life and reliability. Moreover, particular mobile devices have been created for specific activity as, for example, work-related device (PDAs, electronic diaries and palm pilots) or for leisure (tablet, mobile phone, laptop).

2. Methodology

To understand how learners' devices might be integrated we decided to look through world experience. In general, the majority of MALL activities appear to make use of mobile phones. However, some researchers divide studies between those that are content-based (development of activities and learning materials) and those that are concentrated on design issues related to developing learning materials and activities for mobile devices.

Designing communicative activities for mobile learning hold to keep in mind four types of MALL suggested by Pegrum (2014). Each type focused primarily on one of the areas:

- content MALL: for example, self-study content such as reading e-books, or listening to podcasts;
- tutorial MALL: such as games/quizzes, vocabulary flashcard apps, pronunciation/repetition apps;
- creation MALL: tasks including creation of text, audio/video, images;
- communication MALL: for example, sharing of created digital artifacts via mobile devices, locally/internationally via networked groups.

What is clear, the guidance and feedback of a teacher should be provided. In addition, Hockly & Dudeney (2014) propose to take into account six key parameters for communicative activities design using mobile devices in the classroom:

- hardware (device affordances including features and connectivity capabilities);

- mobility (of learners, devices and learning experience);
- technological complexity (learners' technological competence);
- linguistic / communicative competence;
- content, tutorial, creation and communication MALL;
- educational / learning context (learning styles and learner's expectations).

The possibility of integration mobile learning into a course book-driven approach is considered to be teacher-led learning. So, teacher's role is very imperative in integrating and implementing technology such as adopting mobile phones in language teaching. On the other hand, encouraging learners to communicate with each other via mobile phones is considered as learner-led learning.

Receiving messages outside the classroom / class hours is the simplest example of vocabulary learning via mobile phones (Andrews, 2003; Levy & Kennedy, 2005) or quizzes and surveys (Levy & Kennedy, 2005; McNicol, 2005). Using mobile phone for vocabulary learning looks like completing vocabulary activities. The intelligent system The software creates a profile of a learner and then delivers activities according to the area they find most difficult. Mobile-based email (Thornton & Houser, 2005) investigated the way in which Japanese learners acquire vocabulary through mobile phones. Japanese students also use their mobile phones to access web-based video clips explaining English idioms. Podcasting and mobile blogging are also not difficult to understand and this technology engage student in learning English.

Although, mobile phones were designed to allow oral interaction, there is an exception, which is found in a study of Alsaleem (2013) who used electronic journaling to improve writing skills of 30 EFL undergraduate female students in Languages and Translation College at Allmam Mohammad Ibn Saud Islamic University in Saudi Arabia. They had to post reflective comments to their peer's work by means of WhatsApp. The experimental study found out that students reacted well with the discussions and enjoyed their dialogue journaling. The pre-test and post-test also showed that students' vocabulary and opinion (ideas) have improved.

Although, mobile phones were designed to allow oral interaction, there is an exception, which is found in a study at Stanford University (Tomorrow's Professor Listserv, 2002) in learning and teaching Irish as a Second Language (ISL), where learners used their mobile phones to take part in automatic voice-controlled grammar and vocabulary quizzes. Even though it was network coverage at any time and from any location, this activity was abandoned because of the problems with voice recognition software.

An example of learner-led mobile language learning is mentioned by Song & Fox (2008) who tracked advanced learners of English to see how they were using a mobile device to support and extend their learning in self-directed ways, especially to build their knowledge of vocabulary. who investigated how learners of English were using a mobile device in self-education, especially to improve their vocabulary. This study shows how the mobile phone helped them communicate with each other in identifying word meanings. Another example, where students had leading role, when they were

proposed the design of a mobile, game based, digital revision space which is learner-centered, self-directed and based around a virtual community (Michelsen, 2008).

Huang and Sun (2010) designed a system composing of two subsystems. A multimedia materials website that uploaded and maintained video materials, and a set of multimedia English listening exercise on the mobile phone for the learners to repeat exercises in English listening in a ubiquitous learning environment. They attempted to implement the mobile multimedia English listening practice system based on capabilities of the mobile technology providing learners download multimedia sound contents from mobile devices, register the learning website, order mobile learning courses and activate reception of learning courses. According to Huang and Sun, mobile multimedia English listening exercise system can enhance learner's English listening abilities to a high degree.

Pocket Eijiro is a web-based Japanese system for English language learning receives more than 100,000 hits per a day. This system was designed for access via WAP-enabled mobile phones.

Extending the idea of using web-enabled mobile phones, Pemberton and Fallahkhair (2005) and Fallahkhair et al. (2007) described the development of a cross-platform approach using mobile phones and interactive television for mixed language learning. While, mobile phones offer a variety of personal activities and learning on move, they are less powerful for learning authentic content. Contrary, television provides rich multimedia presentation of authentic and immersive content. Such programs as news, soap operas, sitcoms and documentaries have a great potential to enhance language learners' experience.

Furthermore, only few activities were created for supporting learner collaboration or communication. So, Lan et al's study (2007) inspired learners to support the idea in developing their skills in reading and listening to each other using their mobile phones, but it does not seem to facilitate synchronous interaction of any other sort, either through text or voice. It seems that mobility and portability not to be fully exploited in design of MALL activities, even though it is precisely these affordances that justify using mobile devices at all.

Many researchers try to define the effective use of mobile devices in learning languages when the members are separated by distance. Petersen & Divitini (2005) bring together mobility of a person with the ways in which mobile devices can be used to empower language learners. They suggest, that language learner visit target culture, a year abroad, as an example, use mobile technologies to collect and share the experiences in that culture with language learners at home. In other words, they create the content either to satisfy the co-learners' request for specific information or to share the material that seems to them relevant to the needs of community of learners.

In the study reported by Lan et al. (2007) students read aloud to each other via Skype and received feedback in the form of mistakes in pronunciation, indicated on screen given by a peer. This activity support interaction and collaboration within a formal context.

Such social networks like Twitter, Facebook and My Space are popular beside language learners. For example, social networks allow group of students or friends to meet, post messages, share pictures,

and generally interact online. Note, that most of the interaction takes place in written form. Learners use English instead of their mother tongue to practice writing skills. More advanced form of using mobile phone for writing tasks is keeping blog. This requires mobile device and Internet access. Learners use text messaging and camera features to add messages and post pictures to their personal blogs. This task is great for personal experiences, places, visited and people met, but it is also useful for collecting information and report it.

Anyway, in formal contexts, teacher should motivate and inspire learners use mobile devices to support language learning, while learners in informal context less concerned on the cost, accessing learning materials at their own convenience and to suit their needs.

3. Statement of the problem

Mobile devices have become a significant part of a daily life and they are used for accessing information and learning.

We are interested in engagement of mobile devices in learning languages, particularly in relation to spontaneous learning or informal learning. To find out how Kazakhstani EFL learners use mobile phones to support their language learning (or even do they know how MALL may support their language learning), we took a questionnaire.

As far as, mobile learning in Kazakhstan is not used enough, participants throw the light on some of the questions and ways in which mobile devices can be used in language learning.

There are 500 participants (EFL learners), first year students of Karaganda State technical University who took part in a questionnaire. MALL questionnaire consists of two parts: part A contains personal information (age, gender, major, job), and part B contains the usage of mobile devices in learning English as a second language. So, part B presented the qualitative questions formulated on familiarity and the use of different types of mobile devices to learn English as a foreign language. The first question asks for differentiating MALL (Mobile-Assisted Language Learning). More than a half of the respondents believe that mobile learning is a learner mobility – convenience to study anytime and everywhere, other part of respondents associate MALL with the application of mobile devices for self-education and small amount of respondents assume spontaneous learning wherever you are at the moment (bus, car, airplane etc.) (See Figure 1).

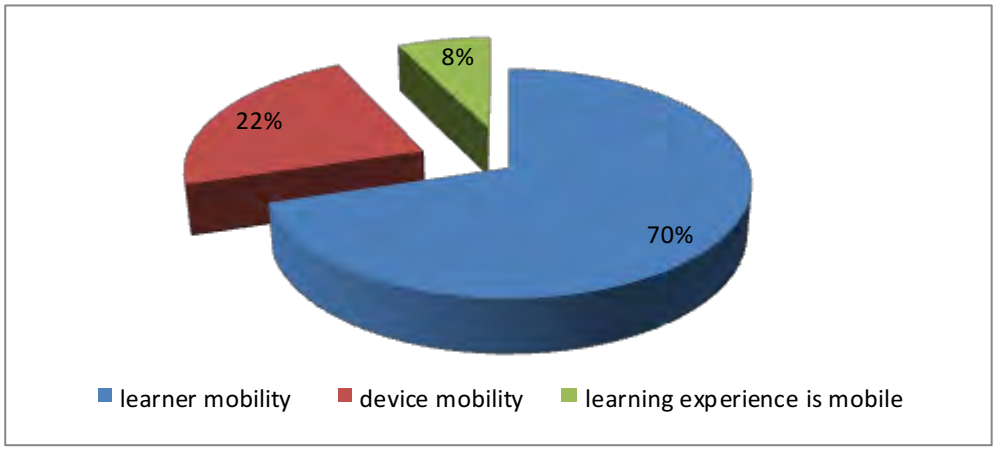

Figure 1 Differentiation of MALL by EFL Kazakhstani learners

The second question looks for language skills, which are practiced by respondents. This question was provided with a list of language skills and components, such as: listening, speaking, reading, writing, vocabulary, grammar and pronunciation (See Figure 2).

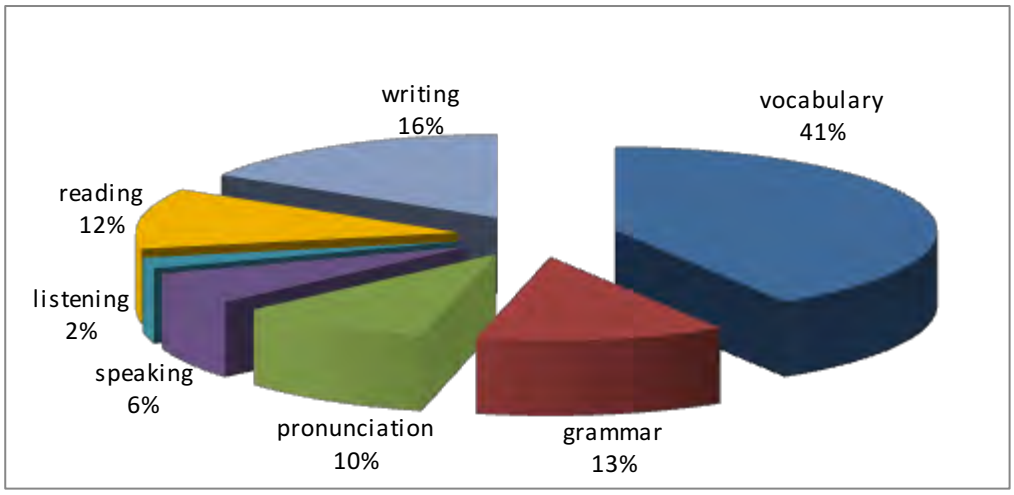

Figure 2 Language skills and components involved in m-learning

Third question was related to advantages of MALL in language learning respondents are provided with some space to describe their opinion. The most popular answers are accessibility (anytime and anywhere), portability, free downloadable learning materials, spontaneous learning or informal learning (no guidance of a teacher).

Next question aimed knowing how many applications / software respondents know and use in their language learning (they are provided with some space to describe their opinion). The most common answers are: Lingua Leo, Busuu, Quizlet, Learn English words free, English Dictionary, English Conversation practice, T&L.

The questionnaire followed by interview aimed at eliciting how mobile-enabled language learning changes the process of learning languages. The participants repeatedly mentioned they felt applications like Lingua Leo or Busuu would make learning the language more fun.

4. Discussion

The study has delivered interesting results into emerging practice of mobile phones, which we can serve as a tool to facilitate learning languages in formal and informal contexts. We believe that, mobile devices support spontaneous learning. There is also a number of benefits, particularly for learning English vocabulary, writing SMS, communication via chat, such as sharing information across social network technologies (Facebook, WhatsApp etc.). Our research confirms the popularity of SMS for vocabulary learning and reporting on the daily activities, using apps. Using mobile device for social networking in English and playing games, like learning vocabulary, or crossword puzzles, which involve a focus on language are also popular among EFL Kazakhstani learners.

Our survey shows that mobile devices are enabling users to create resources for learning purposes, write blogs to keep on touch with friends, take photos and videos, making and taking notes. Nevertheless, mobile applications are fashionable among EFL Kazakhstani learners they are not necessarily cheap and it is important for teachers / institution to keep in mind if they are planning to develop apps they have to understand how students perceive and use their mobile phones. Our findings indicate that apps should be built on the existing preferences of students for social communication, listening to the audio, learning vocabulary.

5. Conclusion

In conclusion we point out that having multimedia online in mobile phones is not new, but how to deliver information effectively for spontaneous independent spontaneous learning or to support pedagogical approach that is not teacher-led learning requires further investigation.

So, the purpose of this paper was to reflect on what mobile learning has to offer and to consider how languages are learned among Kazakhstani EFL learners. The idea is to move beyond a superficial understanding of mobile learning, which does not give sufficient consideration to how mobility, accompanied by digital, location-aware technologies can change learning. Having studied the examples, we find out some benefits and applicability of mobile devices to language learning. What makes mobile learning so intriguing is its using indoor and outdoor, across formal and informal settings, allowing learners choose an appropriate way. Mobile learning also may takes place outside the classroom, beyond the teacher guidance.

Our study has considered the use of mobile devices among students and the next research step is to examine the specific applications that students use for learning English. How, where and when do they use these applications? In what way these applications contribute to students' overall learning? Consequently, there is a number of directions for further research, such as identifying what is the best learnt in the classroom, what should be learnt outside and the ways in which connections between these settings will be made, that also provide useful information for teachers and educational institutions.

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The QR Code→ as a Mobile Learning Tool for Labor Room Nurses at the San Pablo Colleges Medical Center

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Abstract

Labor Room (LR) nurses at the San Pablo Colleges Medical Center need immediate access to medical information at point of care to supplement their understanding of the pregnant patient's medical condition and improve health care delivery. The study explores the use of the QR code- as a mobile learning tool, and examines factors that impact on its usefulness, feasibility and acceptability in assisting the nurses' learning. Study participants consisted of 14 regular, full-time, board-certified LR nurses. Over a two-week period, participants used specially-generated QR codes to access a mobile website, connect to physicians' telephone numbers, and access alphanumeric text information. Research data in the form of observations and insights on their experience in using the QR codes were collected from participants through individual, face-to-face, semi-structured interviews. Findings revealed that QR codes encoded with alphanumeric information of not more than 200 characters, telephone numbers, and URL links to the mobile website all demonstrated a high level of functionality, usability and usefulness. Participants also reported high levels of enjoyability, citing ease of use of the QR code; a high level of satisfaction in the kind and amount of supplementary medical information accessed, as well as the favorable effect it had on their personal learning. These support the acceptability of the QR code as a mobile learning tool, the feasibility of using it as a learning tool in many different contexts, and the potential of the QR code as a learning tool in a workplace environment in the context of continuing nursing education.

Keywords: QR code, mobile learning, nursing education

1. Context and Rationale

Labor Room (LR) nurses of the San Pablo Colleges Medical Center (SPCMC) are registered nurses who provide care to pregnant women during different stages of pregnancy and childbirth. They cross-train and work in all areas of the Operating Room-Delivery Room (OR-DR) Complex related to labor, delivery and post-partum care. Because of their responsibilities, the nurses need immediate access to medical information at point of care to supplement their understanding of the pregnant patient's medical condition, as well as improve health care delivery. The challenge lies in how to achieve this within the limitations of the LR setting.

This study addresses the LR nurses' need for immediate access to medical information at point of care using their mobile phones within an internet-capable work environment. It explores the use of the QR code- as a tool for mobile learning in the LR; assesses the extent to which the affordance of immediate

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access to relevant medical information is realized in this context; and examines factors that impact on the usefulness, feasibility and acceptability of QR codes in assisting the nurses' learning.

An affordance is an "action possibility", a quality of an object, or an environment, which allows an action to be performed by an individual. It exists in relation to the agent, and is thus dependent on its capabilities (Gibson, 1979). In mobile learning, the capability of the device or tool enables the affordance (The Affordances of Mobile Learning, 2014). In this study, the tool is the QR code, the capability is immediate connection or linking to resources, and the affordance for learning is immediate point-of-care access to information and knowledge (The Affordances of Mobile Learning, 2014).

A QR code is a square, generally black and white, two-dimensional, matrix code developed in 1994 by Denso Wave, then a Toyota subsidiary, to track automotive components during the manufacturing and distribution process. It answered the need for a bar code with greater storage capacity and fast readability (hence, QR for "Quick Response"). A QR code holds more information since it contains data in both vertical and horizontal dimensions (unlike a bar code which has only horizontal storage), while a three cornered position-direction pattern enables high-speed reading and scanning from any direction in 360° (omnidirectional scanning).

QR codes can be read by a mobile device equipped with a QR code scanner, a software which is easily downloadable from free sites in the internet. The code is visualized through the camera lens of the scanner-equipped device, the scanner locks onto the QR code, and the information stored in the code is displayed to the viewer (see Figure 1). Although the word "QR Code" is a registered trademark and Denso Wave Inc. holds the patent, from the outset, the developers intended for the code to be made available to as many people as possible at no cost. Thus, code generators and scanners are freely obtainable, leading to its widespread use (Jackson, 2011).

Ramsden (2008) lists the following core types of content that the QR code has the capability of storing: Uniform Resource Locators (URLs), which identify the specific locations of a website in the internet; alphanumeric text information; automated Short Message Service (SMS) or text messages; and telephone numbers which may be immediately dialed. QR codes may be thought of as a means of "linking" the physical world (i.e., the medium where the QR code is placed) to the electronic world (i.e., a web resource, or text information), or facilitating communication through which learning can be acquired (i.e., a phone call or SMS expedited by business card information). This capability of connecting the user to sources of information makes the QR code an ideal tool for mobile learning.

Figure 1. Scanning a QR code using a mobile phone. Image courtesy of smarnad at FreeDigitalPhotos.net. Reprinted with permission.

According to Law & So (2010), the use of QR codes in education is still in its infancy. Among higher education institutions, the University of Bath in the United Kingdom is considered a pioneer in the use of QR codes in an educational context under several scenarios, such as: embedding the Rich Site Summary (RSS) feed address of an instructional website into a QR code to enable the learner's subscription to regular news updates; including QR codes within printed instructional materials; integrating QR codes within alternate reality games that involve collaborative problem solving in different physical locations, and connecting physical lectures and presentations with just-in-time supplementary materials (Ramsden, 2008). Clinical applications in health care include incorporating QR codes providing links to health information in posters placed in waiting areas of hospitals; management of medical records; patient identification; and in the tracking of medications, pharmaceutical products, equipment and devices (Denso ADC, 2011).

Ways in which QR codes can be used for learning in nursing education include: creating QR codes for instructional resources and embedding these into presentation materials, printed learning materials (course materials, syllabus documents, handouts), assessment materials (quizzes), and class downloads; using QR codes to access RSS feeds and solicit feedback from students; creating QR codes for instructional content made by students for nursing education projects; and gathering formative feedback during a presentation or class. Bassendowski (2012) cited the observation of the EDUCAUSE Learning Initiative that QR codes enable a connection between the physical world (i.e. the actual, physical learning environment) and the resources available in the electronic or virtual world by enabling "on-the-spot access to …online resources", thereby making the learning more "experiential" by taking it out of the classroom and bringing it into the realm of the real world (EDUCAUSE Learning Initiative, 2009).

This study explores the potential of the QR code as a mobile learning tool that can link the nurses-on-duty to sources of medical information, despite the absence of instructors and traditional learning materials. This represents a type of informal mobile learning, where the required knowledge and information is accessed by the learner at the time it is needed. LR nurses are expected to carry out the doctor's orders and provide general nursing care; however, they are not routinely briefed about nuances of the patient's medical condition. They usually rely on stock knowledge or previous

experience, since it is uncommon to have traditional learning materials such as books or computers in the LR environment, and physician consultants are not always physically present at all times. Lulls during a duty shift - which represent windows of opportunity to access information that may assist in the understanding of a patient's medical condition - are not maximized, due to lack of access to information. LR nurses may benefit from flexible learning opportunities which are relevant to the patients under their care, and are delivered in a concise manner that will not interfere with other responsibilities. Specifically, the study leverages the QR code's affordance of immediate point of care access to information and knowledge to provide learning opportunities for LR nurses in the context of the "just in time, just enough, just for me" imperative (Peters, 2007).

2. Research Focus

The objective of this study is to investigate the usefulness, feasibility and acceptability of the QR code as a tool for mobile learning for SPCMC LR nurses. The study aims to answer the following research questions:

- How useful, feasible, and acceptable is the use of QR codes as a tool for mobile learning for SPCMC LR nurses?
- What factors impact on the usefulness, feasibility, and acceptability of QR codes as a tool for mobile learning for SPCMC LR nurses?

QR codes currently have limited applications in the field of nursing education; no in-depth studies of a similar nature to the present study have been found in the literature search, and to the author's knowledge, none have been formally carried out in the local setting. This exploratory study seeks to investigate whether using the QR code as a mobile learning tool for nurses in the LR is useful, feasible and acceptable. The findings will enable researchers to assess whether such an intervention involving QR codes in mobile education at point of care is relevant and sustainable for the LR nurses, the patients they attend to, as well as the institution they work in, and whether further appropriate efficacy and effectiveness studies are warranted.

3. Conceptual Framework

The use of QR codes in education occurs within the realm of mobile learning because of their potential to provide effective and efficient access to electronic information, thus facilitating learning experiences beyond that found in traditional classrooms and learning materials (Ramsden, 2008; Shih et al., 2011). While early definitions of mobile learning emphasized learning enabled by mobile devices, the focus has now shifted from the mobility of the device to the mobility of the learner, as well as the learner's ability to access content and communicate with others across multiple contexts, regardless of place and time (Kukulska-Hulme, 2010; Sharples et al., 2007).

The focus of the current study is on assessing the usefulness, feasibility, and acceptability of the QR code as a mobile learning tool for LR nurses. In their framework for planning effective web application development projects with specific target user populations, Lu and Yeung (1998) suggested that a project's merit be evaluated prior to development by assessing its usefulness, feasibility and acceptability. This simplified framework for evaluating the usability, feasibility and acceptability of the QR code as a mobile learning tool for SPCMC LR nurses is illustrated in Figure 2.

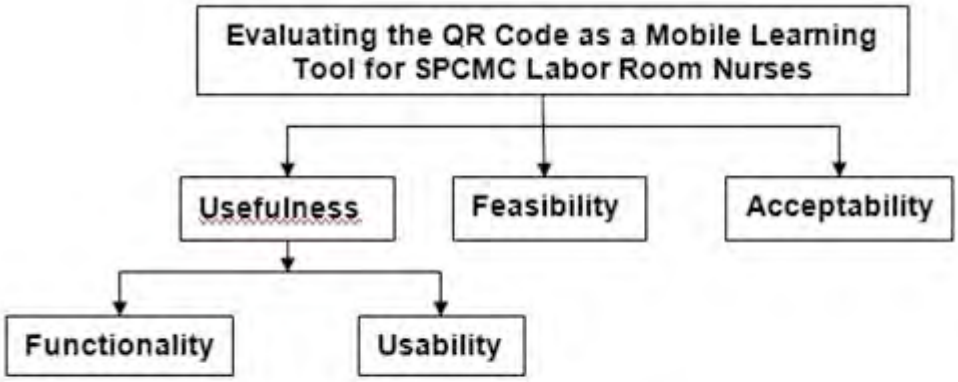

Figure 2. A Framework for Evaluating the Usefulness, Feasibility and Acceptability of the QR Code as a Mobile Learning Tool for SPCMC Labor Room Nurses

The concept of usefulness in Lu & Yeung's framework has been adapted for use in this study, with the QR code as the project or product to be evaluated. **Usefulness** refers to the degree to which a product enables the users to accomplish its intended purpose. It is determined by the product's functionality, and usability (Lu & Yeung, 1998). **Functionality**, or utility, refers to a product's capacity to perform tasks in the particular way it was created for – "Does it do what users need?" (Nielsen, 2012a). **Usability** has to do with how well the users can use a product's functionality. It is often referred to as the "joy-of-use and ease-of-use" of the product (Wechsun, 2014).

Both functionality and usability are important; they complement each other, and together, they establish whether the product is useful. It will be of little use if the product performs the task the user wants, but is difficult to use, or if it is easy to use but does not do what the user wants it to do (Wechsun, 2014). If the product has both the functionality to support the tasks that have to be done, and usability that enables users to use these functions in a pleasurable way, then it becomes useful.

In terms of functionality, while the inherent capability of QR codes for immediate connection or linking to resources has been established in the literature cited, there is a need to investigate whether it actually accomplishes this in the actual real-world setting of the LR. That is, can the QR code successfully connect the nurses either directly to information, or indirectly through a link which can provide that information?

In terms of usability, "the extent to which a product can be used by specified users to achieve specified goals with effectiveness, efficiency, and satisfaction in a specified context of use" (ISO 9241-11, 1998) needs to be assessed. Ease of use is commonly evaluated using five operational criteria:

learnability, efficiency, memorability, errors and satisfaction (Nielsen, 1993). However, such criteria often use *quantitative* evaluation methods which may not be appropriate for the current study, since QR code usability is assessed in terms of being an "enjoyable and user-friendly" tool for connecting people to information, rather than having an "enjoyable and user-friendly technical and operational interface". What may be used instead are Quesenbery (2001)'s five simplified characteristics (the 5 Es – efficient, effective, engaging, error tolerant and easy to learn), which emphasize *qualitative* aspects of the aforementioned operational criteria, as well as four key usability requirements :

- understand how and why people use a product in the context of their environment
  2. watch real people use the product and rely on user-feedback through evaluation
- evaluate the product based on the 5 E's which describes the user's requirements for success and satisfaction
- create a user-centered design based on the user's goals, tasks and requirements, and approached from the user's viewpoint.

A newly designed intervention is evaluated in three stages. In the first stage, the intervention is subjected to exploratory or pilot-testing to evaluate feasibility, acceptability and preliminary effects on the immediate outcome. The second stage tests efficacy, while the third stage tests effectiveness, and in each stage, qualitative research methods may be used to examine various aspects (Sidani, n.d.). To explain concepts of feasibility and acceptability in this study, we will be applying principles used in the first stage.

Feasibility is concerned with the practicality of implementing an intervention, i.e. whether there are available and adequate logistics and resources, and physical and/or psychosocial contexts which may interfere with proper implementation of the intervention.

Acceptability refers to "how well an intervention will be received by the target population and the extent to which the new intervention or its components might meet the needs of the target population and organizational setting" (Ayala & Elder, 2011, p.69). It may be directly assessed using standard qualitative methods such as focus groups and interviews when the intervention (in this case, QR code use) had been completed. Conducting interviews is a standard qualitative method used to assess the acceptability of an intervention for the target population and setting.

4. Methodology

4.1. Research setting

The San Pablo Colleges Medical Center (SPCMC) is a 118–bed, ISO 9001:2000-certified tertiary care hospital located in San Pablo City, Laguna, Philippines, which also serves as the training institution of the San Pablo Colleges' College of Nursing and School of Midwifery.

The study was conducted at the three-bed Labor Room (LR) of the SPCMC Operating Room-Delivery Room (OR-DR) Complex, a designated area which accommodates patients in labor until they

are about to deliver, whereupon they are transferred to either the delivery room (DR) or the operating room (OR). Patients admitted to the LR are regularly monitored by nurses and midwives; their charts are kept in the nurses' station, which is located approximately six to ten meters away from the labor room.

Areas of the OR-DR complex, including the LR, are equipped with internet connectivity provided by the hospital. No desktop or laptop computer is permanently stationed in either the LR or the nurses' station, and learning resources such as textbooks and manuals are not regularly available.

4.2. Research participants

The study participants consisted of 14 regular, full-time, board-certified LR nurses, comprising about nine percent of the total number of staff nurses in the hospital. All were female, with ages ranging from 22 to 42 years.

Nurses were chosen as study participants because they have more responsibilities involving patient care and health care delivery as compared to midwives. They are also required by law to participate in continuing professional education in order to maintain their competence, whereas similar requirements for midwives are imposed only by the national professional regulatory board (The Philippine Nursing Act of 2002; The Philippine Midwifery Act of 1992; Board of Midwifery Code of Ethics, 1988).

4.3. Research Design

4.3.1. Phase 1: Preparation of learning content

This phase involved ocular inspection of the study setting and planning the sites of QR code attachment in the LR (i.e., the wall space adjacent to each of the three LR beds), and planning and setting up of the three types of learning content to be encoded in the QR codes. Testing functionality involved encoding content onto the QR code, and evaluating whether the user can indeed successfully access the information contained in the QR code.

Three core types of learning content representative of the basic capabilities or actions associated with QR codes identified by Ramsden (2008) – 1) text-based information, 2) a telephone number which allows the user to quick-call and/or quick-text a number, and 3) a link to a web resource - were encoded into QR codes using The QR Stuff QR Code Generator (http://www.qrstuff.com/). This site was chosen because it provided the option of creating dynamic QR codes. Unlike static QR codes which are non-modifiable since they contain the actual destination URL, dynamic codes can be re-purposed because the permanently embedded short URL merely re-directs the user to the actual intended destination website URL, which can still be changed. Thus, there is no need to revise the QR code image each time the destination URL changes.

Once the QR code was created, high resolution QR code images were printed out and attached to the wall at bedside, the LR wall, and the consultant physician telephone directory using double sided adhesive tape.

Figure 3. The QR Stuff QR Code Generator (http://www.qrstuff.com/)

The alphanumeric text-based information to be attached to the LR wall (i.e. Wall Info Codes) involved eight sets of pharmacologic drug information - each with a different number of characters - which were encoded into eight different QR codes. Each code, numbered consecutively from Code 1 to 8, had increasing number of characters, with Code 1 having the least number of characters (200 characters, with spaces), and Code 8 having the most number of characters (2329 characters, with spaces). The purpose of using codes with progressively increasing number of characters was to see whether if the amount of information encoded in the QR code affects its ability to be scanned successfully.

OXYTOCIN

ONSET: Uterine contractions: IM: 3-5 min; IV: approx 1 min
DURATION: IM: 2-3 hr; IV: 1 hr.
ABSORPTION: Steady state 40 min after IV admin.
EXCRETION: urinary; elimination half-life: 1-5 min

Figure 4. Wall Info Code No. 1, the code containing the least number of characters in the series (200 characters, with spaces)

All telephone numbers listed in the consultant physician public telephone directory used by nurses for phone referrals and available in the LR-DR nurses' station were re-typed and encoded into QR codes. The new QR code phone directory was placed in an easily accessible part of the LR.

The instructional content was uploaded into a mobile-optimized website created for this study, and set up specifically for the SPCMC LR. It was easier to use for smartphones and tablets compared to a non-mobile optimized or desktop site, because the fonts, graphics and design loaded faster over cellular networks compared and were easier to read and navigate on smaller screens. The ActiveMobi mobile website builder (http://activemobi.com/) was used to create a simple SPCMC Labor Room site. Each of the three Labor Room beds had a designated area in the site. The Universal Resource Locator (URL) of this site was encoded into the QR codes, and the generated QR codes placed in the LR premises.

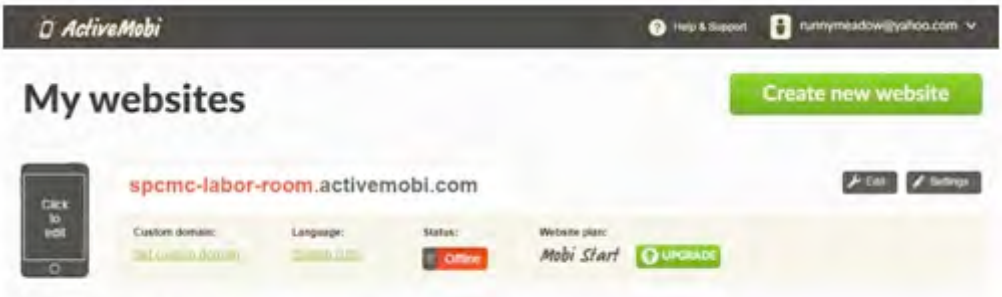

Figure 5. The SPCMC labor room ActiveMobi mobile website URL

Figure 6. The SPCMC Labor Room ActiveMobi mobile website

The learning content to be uploaded depended on the specific diagnosis of the patient occupying the bed at any one time. For example, if LR Bed 1 was occupied by a pregnant woman with a diagnosis of preeclampsia (pregnancy complicated by high blood pressure), the learning content revolved around the topic of pregnancy-induced hypertension.

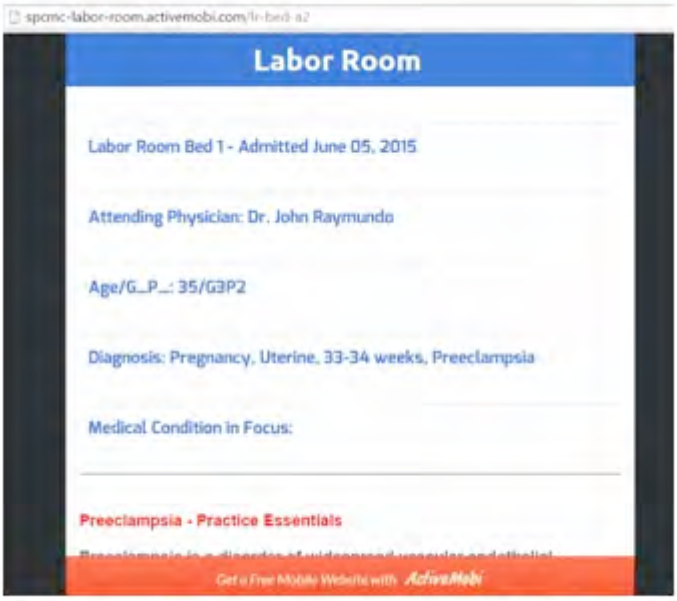

Figure 7a. Instructional content mobile website for Labor Room Bed 1

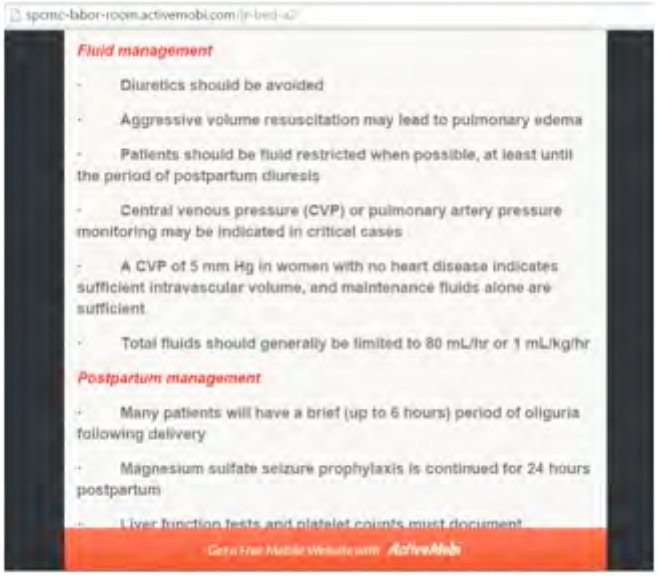

Figure 7b. Instructional content mobile website for Labor Room Bed 1

4.3.2. Phase 2: Recruitment and orientation of research participants

Study participants were requested to sign an informed consent form and requested to complete a preliminary survey questionnaire to obtain basic demographic information, information on mobile phone ownership, and baseline knowledge and usage of QR codes.

The participants then underwent an orientation to QR codes, QR code scanners and mobile devices, where the features were explained. They were given time to practice scanning codes under supervision of the researcher, and technical support was provided by the researcher as needed.

The basic equipment required in using QR codes were:

- A smartphone with a built in camera -- Study participants used their own mobile phones to scan the QR codes. The ownership and type of device were not standardized so that it would simulate the diversity of device ownership in real-life settings.
- A QR code reader which is downloadable from the internet -- Study participants first checked whether or not a QR code reader was already installed in their devices. Those without a QR code reader were requested to download one and install it into their devices.
- Internet WiFi connection
- A Globe Tattoo™ mobile pocket wifi (estimated value: PHP 1495/USD 31, with a prepaid load of PHP 500/USD 10 for the study duration) was provided by the researcher in the LR to boost the existing hospital wifi and provide consistent internet connectivity for study purposes. This does not deviate from usual practice, since the hospital administration provides similar devices in areas with spotty internet connectivity.

4.3.3 Phase 3: QR Code Testing Phase

This was conducted in the SPCMC LR for a two-week period, from June 1 to June 14, 2015 (24 hours a day seven days a week, for a total of 336 hours' evaluation time, coincident with the round-the-clock nurses' duty shifts). The LR nurse-on-duty relayed the LR cases to the study author by phone as they were admitted, so that the instructional content appropriate for each case could be uploaded into the mobile website. This procedure did not deviate from usual practice, since the LR nurses routinely inform consultants of LR admissions.

4.3.4. Phase 4: Data Collection

A face-to-face, semi-structured interview with each of the study participants was conducted to collect the research data, since the researcher believed that the manner and frequency in the way the learners access QR codes in this study is a result of the choices they make (i.e. when, how and how often to access), which, in turn, depend on the learner's internal and external environment. Directly interviewing the learners provides insight into how, why, and in what way they used the QR codes to access the instructional materials, and their reason/s for doing so. Since interviewing the participants confers value on personal discourse as data, a face-to-face semi-structured interview is apt. Such an interview provides depth of meaning, which is important in this exploratory study, in as much as the researcher wants to acquire insight and understanding into their perceptions and perspectives on QR code usage (Gillham 2000, page 11; Ritchie & Lewis 2003, p.138, as cited in Newton, 2010).

The researcher created an interview guide, which consisted of interview questions based on the research questions. After several revisions on both the wording and sequencing of the questions, the interview questions were finalized, and both English and Filipino versions were created.

The interviews were conducted over a four-day period from June 15 to 18, 2015. Each interview lasted between ten to twenty minutes, and was done individually in a quiet and private predetermined interview room. Interviews were conducted in English, Filipino, or a mix of both languages depending on the interviewee's level of comfort, audio-recorded using an RCA™ digital voice recorder and transcribed.

4.3.5. Phase 5: Data analysis

The recorded interviews were transcribed, and the data collected in the transcripts analyzed. In addition to analyzing each individual participant's responses to the interview questions, the responses to each question from all the participants were compared and contrasted, so as to identify similarities and differences in the responses.

5. Ethical Considerations

No significant power relations issues were involved, since the study author's position in the institution had no bearing on the research participants' job tenure, evaluation or advancement. The study did not pose any risk to the participants or the researcher. A professional relationship was maintained between the researcher and the participants, who were informed about the study, after its approval by the hospital administration, during the regular staff meeting. Participation was voluntary, and consent was documented at the outset using a written informed consent form. All information collected from the study participants was held confidential, and no financial incentives were offered.\

6. Presentation and Analysis of Findings

The preliminary survey revealed that eight of the nurses had Apple iPhones with the iOS operating system (OS), four nurses had Samsung Galaxy phones with the Android OS, one had a Samsung phone with the proprietary Samsung OS, and one had a Lenovo S920 phone with the Android OS. This indicated that all of the nurses had cameraphones capable of downloading the software that could scan QR codes.

Only two participants knew what the term "QR code" referred to, with majority stating that either they did not know (8/14) or were not sure (4/14) of what it was. Upon seeing the picture of a QR code though, almost all of them (13/14) realized that they had actually seen a QR code before in merchandise, grocery items, reading material such as magazines, and in phone applications, although most of the participants were either unaware or unsure of how it was called, what it was for, and how it was used.

In investigating the usefulness, feasibility and acceptability of the QR code as a mobile learning tool for LR nurses, the study first looked into usefulness by assessing the functionality and usability of the QR code. To find out if the QR code was functional – that is, if it had the capacity to perform the tasks it was intended for, participants were asked whether they were able to do three things: access the

mobile website created for the study through the Mobile Website QR Codes; connect to the telephone numbers in the physician's directory using the Phone Number QR Codes; and access alphanumeric text information through the Wall Info QR Codes. Participants were also asked whether the information loaded properly and how quickly or slowly it did so.

To find out if the QR code was usable – that is, if it was user-friendly and satisfying to use, participants were asked to rate the ease of using QR codes on a scale of 1 to 10, with 10 as the highest ease of use. They were also asked to similarly rate the enjoyability and usefulness of the codes using a similar scale. Finally, they were asked to share their thoughts about the usefulness of the QR code and the information it provided, what they liked and disliked about it, and whether or not they thought the codes could be used in the labor room on a regular basis.

All the participants except one were able to experience using the three types of QR codes (i.e. the Mobile Website QR Code at the patient's bedside, the Phone number QR code and the Wall Info QR code). The said participant stated that work responsibilities made scanning the bedside codes the most feasible activity for her, so she opted to do only this task.

The Phone Number QR code linked the participants to the telephone number of physician they were calling successfully and very quickly, usually within five seconds from the time of scanning.

The Mobile Website QR code linked the participants to the mobile website created for the study successfully and moderately quickly, usually within three minutes from the time of scanning.

Only the Wall Info QR code that had encoded information with 200 characters (with spaces) – i.e. Wall Info Code 1 – was read successfully and quickly (within five seconds). The rest of the Wall Info Codes which had more than 200 characters could not be read by the QR code scanners. This finding underscores the fact that regardless of the theoretical information storage capacity of QR codes, it is best to use 200 alphanumeric characters or less in codes that display text information, to ensure that it would be successfully read by most QR code scanners.

Majority of the participants (11 out of 14) rated the QR code's ease of use as either 9 or 10 on a scale of 1 to 10, with 10 as the highest ease of use. The remaining three participants each gave a rating of 8, 7 and 5.

Similarly, 11 out of 14 participants rated the QR code's enjoyability and likeability as either 9 or 10 - 10 being the most enjoyable or likeable – with the remaining three participants giving a rating of either 8 or 6.

For usefulness in accessing information, 12 out of 14 gave a rating of either 9 or 10 – 10 being the most useful - with the remaining two giving a rating of either 8 or 6.

These findings indicate that the QR code is perceived by the LR nurses to be functional, usable and useful in accessing information in the labor room. Their enthusiasm was evident in their answers to the questions on what they liked about the QR code experience. Majority of the nurses liked the QR codes' ability to link them to information which was relevant to them at the time of access – that is, information about the patient under their care, as well as concise information about the patient's

medical condition. Some participants stated that the information served as a good "refresher course" for them. One participant said that as staff nurses, they tend to focus more on skills rather than on theoretical knowledge; the information made available to them by the QR codes bridges the gap and actually makes them want to learn more. One important point raised was that they did not need voluminous knowledge in the website, since they have only a limited time to check out the information. Many of the nurses prefer summarized information with highlighted key points; one stated that if they need more information, they could just do additional research during their free time. The participants also appreciated the ease of access, especially while using the phone codes. The nurses who used Apple iPhone devices reported that scanning the phone number almost immediately calls the number automatically, thus facilitating communication.

The aspect involved in QR code use that the participants in the study disliked the most involved the relatively slow and inconsistent internet connection According to the study participants, a fast, consistent, reliable, and preferably permanent internet connection was the major factor that would determine the feasibility of using QR codes to facilitate the access of information in the LR on a regular basis. Other factors affecting feasibility include the need for a reliable cameraphone or smartphone capable of scanning the codes, and a good QR code reader that locks onto the code easily and scans quickly.

7. Conclusion and Recommendations

This exploratory study investigated whether using the QR code as a mobile learning tool for nurses in the labor room of the San Pablo Colleges Medical Center (SPCMC) is useful, feasible and acceptable. Findings revealed that QR codes encoded with text-based information of 200 alphanumeric characters or less, telephone numbers, and a URL link to a mobile website all demonstrated a high level of functionality, usability and usefulness, based on the responses of labor room nurses who engaged with the codes within a two week period. Study participants reported high levels of enjoyability, citing ease of use of the QR code; a high level of satisfaction in the kind and amount of supplementary medical information accessed through the codes, as well as the favorable effect it had on their personal learning. This study support the usefulness, feasibility and acceptability of the QR code as a mobile learning tool, and underscores its potential for use in workplace environment in the context of continuing professional education. Since this is a qualitative study, it did not look into efficacy and effectiveness outcomes, which could be areas for further investigation.

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Teachers' Readiness in Using Mobile Devices for Mathematics Teaching and Learning: A Case Study in Banten Province, Indonesia

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Abstract

This research aims to know mathematics teachers's readiness in using mobile devices for mathematics teaching and learning. The method used is literature review and survey to mathematics teachers in six districts and cities (Cilegon City, Serang City, Serang District, Tangerang City, Tangerang District, and South Tangerang City) in Banten Province, Indonesia. Focus of survey is to know mathematics teachers readiness in using mobile devices for mathematics teaching and learning. The instruments used were (1) questionnaire; (2) guidelines for the interview; (3) observation sheets. The survey shows that the six indicators of the readiness (1) understanding ICT in education, (2) curriculum and assessment, (3) pedagogy, (4) ICT, (5) organization and administration, (6) teacher professional learning already achieved. They are ready for mobile learning implementation using mobile devices. This paper emphasize that mathematics teachers have to be empowered to use their own mobile devices for use in teaching and learning.

Keywords: Teachers' readiness, mobile devices, mathematics teaching and learning

1. Background

Changes and innovations in education will continue to occur and evolve in entering the 21st century. These changes include: easier to search for learning resources, more options to use and utilize ICT, the growing role of the media and multimedia in learning activities, and the availability of mobile devices for use in mobile learning. Thus the teacher must ready in using mobile devices of ICT tools in teaching and learning activities in the classroom. According to Hauge, (2014), there are a wide range of digital media and technologies support and enrich teaching and learning in education. Technologies are available for almost every activity in education, comprising a variety of office and management devices, web-based tools, multimedia tools, social networking environments, learning resources, blog systems beside the increasing availability and the spread of mobile devices.

The rise of mobile technology gives impact on various aspects of human life, including the education.

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Thus, it is necessary to improve the quality of education. Devi (2012) explain that in primary (including nursery and preprimary), High school or secondary level (High and senior secondary levels) and the college or higher level (including college, university levels), this technology can be utilized for better teaching learning process and improving quality of education. Fathurrohman (2014) reveal that new technique in relate to technology can be help in mathematics teaching and learning. Information and Communication Technology (ICT) has a considerable role, especially for teachers. The teacher's role after the entry of ICT is no longer merely as the source of knowledge, but even makes it as a facilitator of student learning partner. Therefore, teachers are required to have the readiness to use ICT.

The use of ICT in the mathematics classroom has long been a topic for consideration by mathematics teachers. Mathematics is closely related to technology, in contents as well as practice. Some examples its use in mathematics teaching and learning include: mobile devices, graphic calculators and computerized graphing, specialised software, programmable toys or floor robots, spreadsheets and databases. Agyei and Voogt (2010) research has shown that a range of mobile devices exists which allow pupils to collect data, and manipulate it using spreadsheets and databases for work in numeracy. In a world of rapid technological change, where learners are becoming increasingly accustomed to new ways of finding information and communicating with each other, teachers are having to face up to the challenges and opportunities involved in learning how to successfully use technology in their teaching practices. This includes supporting students in their use of technology for learning purposes (Holmberg, 2014). One of the problems of education is a priority to immediately sought to solve is the issue of quality of education, in particular the quality of learning, from a variety of conditions and potentials, efforts can be made with regard to improving the quality of schools is to develop a system of learning-oriented students and facilitate the needs of students will need to learn a challenging, active, creative, innovative, effective, and fun to develop and apply learning based on Information and Communication Technology.

The use of ICT in education is performed in the teaching and learning process. The use of ICT in the teaching and learning process led to a shift in the teaching and learning process itself, including the learning activities. Conventional learning activities carried out previously turned into learning utilizing ICT tools as facilities and infrastructure. Thus, it forces teachers to develop their competence in using ICT tools.

The responsibility of mathematics teachers in entering the era of globalization is not only preparing the students, but also to prepare themselves as educators to face all the challenges that are rapidly changing in our society. This causes the mathematics teacher to produce superior students who can compete in this global competition. Improving the quality and ability of students can be done by making use of ICT tools in teaching, especially in mathematics.

The use of ICT has an important role in the learning process. UNESCO (Chaeruman, 2004) stated that the integration of telecommunications and information technology into learning has three objectives:

1. To build a "knowledge-based society habits" such as problem solving skills, communication skills, ability to find, manage and transform information into new knowledge, and communicating it to others;
2. To develop the skills to use technology (ICT literacy);
3. To improve the effectiveness and efficiency of the learning process.

The use of information and communication technology (ICT) brings about a powerful learning environment and it transforms the learning and teaching process in which students deal with knowledge in an active, self directed and constructive way. ICT is not only considered as a tool, which can be added for existing teaching methods but also nowadays ICT is seen as an important instrument to support new ways of teaching-learning process. Information and communication technology (ICT) is being integrated into the teaching-learning process in various educational institutions in the world. Successful integration of ICT in teachinglearning process is highly dependent on the preparation of teachers. The use of ICT in the classroom is very important to provide opportunities for students to learn and operate in the information age (Kaur and Chan, 2014).

According to (Albirini, 2006), teachers' attitudes toward computer technologies are also related to teachers' competence in using the technology. In addition, they have a significant impact on the openness to new experiences, and also reflect and implement the changes. Positive attitude towards ICT, though too limited support their use in classes. ICT should be effectively used in classrooms as this would serve justice to the investments made for the ICT to be available in the classrooms. UNESCO (2002) states that all developed and developing countries, need to gain access to ICT and to provide the best educational facilities, to get the younger generation who are ready to participate fully in modern society and is able to play a role in the state of knowledge. Resource limitations are inhibitors of the education system. However, ICT is very important for health of industrial and commercial countries in the future, so the investment in equipment, teacher education, and support services for ICT-based curriculum should be a government priority.

ICTs make curriculum implementation learner-centred with a self-learning environment that enables the student customize his/her own learning experiences. In this respect, Malaysia initiated the concept of smart school, a learning institution with objectives to foster self-assessed, self-paced, and self-directed learning through the application of ICTs. For a case, the Sri Lankan Government also runs several key initiatives connecting 92 education centres across provinces, regions and sectors to the ministry, and developing computer-training centres at 8 hundred selected schools. (Mikre, 2011). UNESCO (2011) has grouped teacher ICT competencies into six aspects (domains/regions), namely: (1) Understanding ICT in Education, (2) Curriculum and Assessment, (3) Pedagogy, (4) ICT, (5) Organization and Administration, and (6) Teacher Professional Learning. Sixth indicators that will be used in this research to see how the readiness of middle school mathematics teachers in using ICT for learning. The aim of this research is to describe and determine optimization of readiness middle school mathematics teacher in Banten Province in using the ICT for learning.

2. Method

The method used in this research is literature review and survey. Survey method was defined by Guyette (1983) as a method of data collection in consistent way that useful for documenting existing community conditions, characteristics of a population, and community opinion. Survey usually involves constructing a set of questions that are either asked by means of a questionnaire or through an interview. The instruments in this research are (1) questionnaire readiness of mathematics teachers in using ICT, (2) The observation sheet, and (3) guidelines for the interview.

The totals of populations are 2356 mathematics teachers. Determination of the number of samples can be done by statistical calculation by using Slovin formula. Slovin formula is used to determine the sample size of the population that has a known amount is as much as a teacher. For error levels set out in the determination of the sample is 5% or 0.05. The numbers of samples are 551 mathematics teachers. They are dispersed in middle school level that has been accredited A, B and C in the Banten Province. The population is heterogeneous, so that each accreditation of population can be represented, the sample members drawn from each accreditation. The samples in this research were drawn at random, and then this way is called stratified random sampling.

3. Result and Discussion

The readiness criteria mathematics teachers in using ICT for learning is determined by using a percentage adapted from Riduwan (2015: 41).

Table 1. Criteria Mathematics Teachers in Using ICT for Learning

Percentage	*Criteria*
$80\% < P \leq 100\%$	Strongly Ready
$60\% < P \leq 80\%$	Ready
$40\% < P \leq 60\%$	Quite Ready
$20\% < P \leq 40\%$	Not ready
$0\% \leq P \leq 20\%$	Strongly Not ready

The use of mobile devices is closely related to ICT infrastructures, facilities, and resources in teachers area. In addition the use of mobile devices also related to teachers perceived knowledge and experience to ICT. For that reason, main components of the survey includes ICT infrastructures, facilities, and resources in teachers working area, including school and home. ICT devices and services in this research consist of mobile devices such as laptop or PC notebook, Android tablet and iPad, smartphone, and internet access.

3.1. Respondents Demographics

This research was conducted at the level of middle school, or in some countries known as high school (junior high school, senior high school, and vocational), or before university level. The research cover public and private schools with the criteria of the schools have accredited spread across a number of cities and regencies in Banten. This study took place in January-February 2016. The subject of this study is 551 mathematics teachers from various high schools in Banten Province.

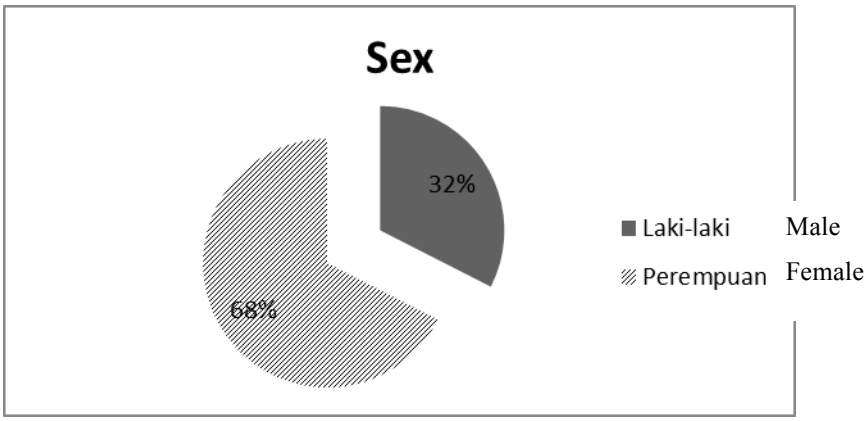

Figure 1. Number of Mathematics Teachers by Sex Diagram

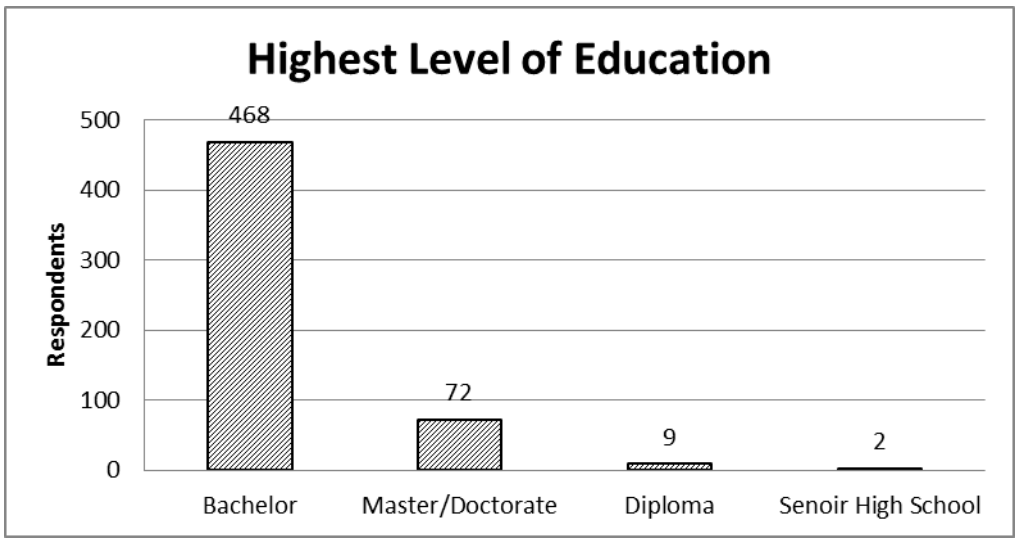

Figure 2. Highest Level of Teachers Formal Education Diagram

Based on the bar chart above shows that the level of education of mathematics teachers in Banten province mostly is Bachelor's degree (S1) as many as 468 teachers, or by 84.5%.

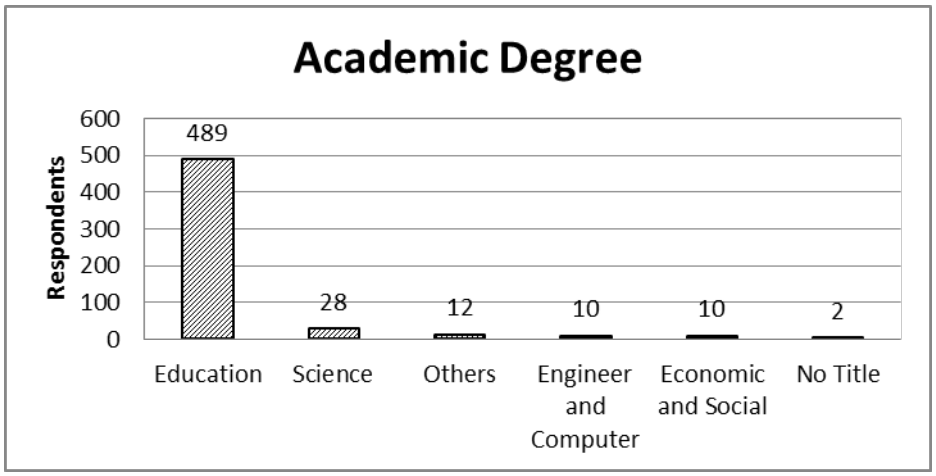

Figure 3. Highest Level of Teachers Type of Degree Diagram

Based on the bar chart above shows that the profile of academic degree mathematics teacher in Banten province largely is education academic degree (Pd) as many as 489 teachers or 88.7%.

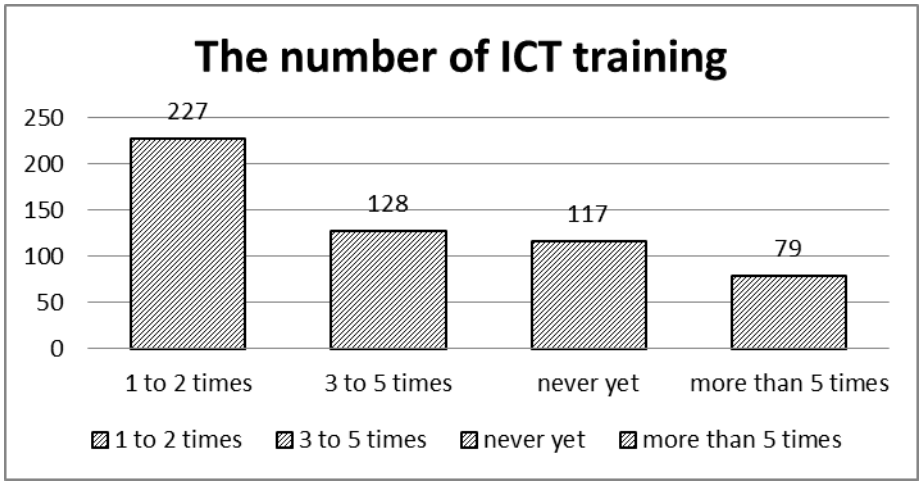

Figure 4. The number of ICT training Diagram

Based on the bar chart above shows that the mathematics teacher in Banten mostly is 1 to 2 times training of technology or computers and related education and learning as many as 227 teachers, or 41.2%. The training include the development of learning resources, the use of computer and mobile devices for teaching and learning. The training also related to website and internet access for teaching and learning.

3.2. Mathematics teachers' readiness on aspects of understanding ICT in education

Table 2. Recapitulation Result of Aspects of Understanding ICT in Education

Ady	*Indicators*	*Percentage*	*Criteria*
1.	Teachers have knowledge of policies on the use of ICT	48.6%	Quite Ready
2.	Teachers were able to implement this policy in the classroom	41.4%	Quite Ready
Average		45%	Quite Ready

Table.2 indicates that the readiness of the mathematics teacher in understanding ICT in education aspects is get into the criteria "quite ready". The results show that as many as 268 of the 551 respondents with a percentage of 48.6% replied that they had knowledge of policies on the use of ICT although mostly only know in outline only. Generally, teachers know that policy through training, books, internet or maybe when they were lecture.

Table 3. Cross Tabulation Between Number of ICT Training and Teacher Perceived Knowledge About The Use of ICT policy

No	*Number of ICT training*	*Policy knowledge on the use of ICT in education*				*Total*	
		No		*Yes*			
		freq	*%*	*Freq*	*%*	*freq*	*%*
1	*never yet*	66	12	51	9.3	117	21.2
2	*1-2 times*	77	14	150	27.2	227	41.2
3	*3-5 times*	41	7.4	87	15.8	128	23.2
4	*More than 5 times*	24	4.4	55	10	79	14.3
Total		208	37.7	343	62.3	551	100

Based on the analysis crosstab between the number of ICT training and the knowledge of the policy use of ICT, Teachers who have not been followed ICT training is mostly included in category "no" that is equal to 12% (66 teachers). Chi-square test shows that the significant correlation between the number of ICT training and the knowledge of the policy use of ICT is less than 0.05, which is 0.00. This imply that there is a significant correlation between the number of ICT training and the the knowledge of the policy use of ICT.

3.3. Mathematics Teachers' Readiness on aspects of the curriculum and assessment

Table 4. Recapitulation Results of Aspect of The Curriculum and Assessment

Indicator	*Percentage*	*Criteria*
Teachers can use technology to prepare a lesson plan design or mathematics	59.82%	Quite Ready
Average	59.82%	Quite Ready

The results showed that the readiness of mathematics teachers on aspects of curriculum and assessment are categorized "quite ready". It seems as many as 95.10% of respondents use a PC at home for preparing mathematics for use in school and generally use the computer as much as 3-5 times per month, and there's 68.25% of respondents use the technology which is laptop or notebook to create learning resources. Then, as many as 30.18% of respondents use powerpoint and learning media-based ICT by using laptop and projector for mathematics learning.

Table 5. Cross Tabulation Between Total ICT Training and Intensity Use of Computers at home for preparing mathematics learning

	The intensity use of the computer at home for preparing mathematics learning for use in schools											
Number of ICT training	*Never*		*1- 2 times per month*		*3 - 5 times per month*		*6 - 10 times per month*		*more than 10 times per month*		*Total*	
	freq	*%*	*freq*	*%*	*freq*	*%*	*freq*	*%*	*freq*	*%*	*freq*	*%*
Never yet	15	2.85	43	8.17	26	4.94	12	2.28	10	1.90	106	20.15
1-2 times	21	3.99	65	12.36	67	12.74	26	4.94	38	7.22	217	41.25
3-5 times	7	1.33	34	6.46	44	8.37	19	3.61	23	4.37	127	24.14
More than 5 times	3	0.57	21	3.99	20	3.80	8	1.52	24	4.56	76	14.45
Total	46	8.75	163	30.99	157	29.85	65	12.36	95	18.06	526	100

Based on the analysis crosstab between a number of ICT training have been followed and the intensity use of the computer at home for preparing mathematics learing for use in schools, teachers who have not been followed ICT training, the highest is including in the category of "1-2 times per month" by 8.1% (43 teachers) and the lowest is included in the category "more than 10 times per month" amounted to 1.90% (10 teachers).

Chi-square test show that the significant correlation between the number of ICT training and the intensity of using computer at home for preparing mathematics learning was less than 0.05, which is

0.001 This imply that there is a significant correlation between the number of ICT training and the intensity oft using computers at home for preparing mathematics learning. It concluded that the more often teachers followed ICT training, the more often teacher use a computer at home for preparing mathematics learning.

3.4. Mathematics teachers' Readiness on pedagogical aspects

Table 6. Recapitulation Results On Pedagogic Aspects

Indicator	*Percentage*	*Category*
Teachers use the computer lab for learning mathematics	25.1 % (139 teachers)	Not ready
Teachers apply mathematics-based computer or internet to students	65.7 % (363 teachers)	Ready
Teachers use technology as a source of additional learning	56.6 % (313 teachers)	Quite Ready
Average	49.1 % (272 teachers)	Quite Ready

The results showed that mathematics teachers' readiness on aspects of pedagogy are categorized as "quite ready". This is seen the most teachers have applied mathematics-based computer or internet, including by assigning students to browse or search for content on the internet amounted to 40.8%, using power point to deliver learning materials amounted to 24.3% and using mathematical software in the learning amounted to 7%.

Based on the interview with several teachers who apply computer or Internet-based learning, they give assignment to students to use computer or internet to search for learning materials on their own. Another use is to provide powerpoint presentation in classroom or creating technology-based quiz.

In terms of using technology as additional learning resources, most teachers in Banten use powerpoint with percentage of 14.1%, GeoGebra 10.6% and e-book 7.4%. Several teachers said that by using GeoGebra it makes students' understanding geometry concepts much easier.

Tabel 7. Cross Tabulation Between Sex and Intensity Use of Computer Lab for Learning Math

Sex	*The intensity of the teachers use the computer lab for learning mathematics*								*Total*	
	Never		*1-2 times per month*		*3-5 times per month*		*6-10 times per month*			
	Freq	*%*	*Freq*	*%*	*Freq*	*%*	*Freq*	*%*	*Freq*	*%*
Male	119	23.7	29	5.8	10	1.98	4	0.8	162	32.2

Female	289	57.5	38	19.1	12	2.4	2	0.4	341	67.8
Total	408	81.1	67	13.3	22	4.4	6	1,2	503	100

Based on the result of crosstab between the sexes and the intensity of the teachers in using the lab for the study of mathematics shows that the teacher-sex men are in the highest category of 'never' by 23.7% (119 teachers) and the lowest is in the category "6-10 times per month" amounted to 0.8% (4 teachers). Teachers who are female are in the highest category of "never" of 57.5% (289 teachers) and the lowest is in the category "6-10 times per month" by 0.4% (2 teachers). So, both of male and female teachers tend to never use the computer lab for the study of mathematics, but only a few teachers who uses the computer lab during the learning of mathematics. Chi-square test show that the significant correlation between the sexes and the intensity of the teachers in using the lab for the study of mathematics was less than 0.05, which is 0.03. This imply that there is a significant correlation between the sexes and the intensity of the teachers in using the lab for the study of mathematics.

3.5. Mathematics teachers' readiness on aspects of information and communication technology

The results showed that mathematics teachers' readiness on the aspect of technology, information and communication are categorized as "ready". This looks at teachers using notebook and projector for teaching mathematics in the classroom is as much as 1-2 times per month. Based on the interview with several teachers, they always use a notebook and projector in their class. This is because they feel by using a notebook and projector makes them easier to teach. By using a notebook and projector, they are no longer write or draw learning materials on the board. It also helps students understand mathematical concepts, especially related to the field of geometry.

Tabel 8. Recapitulation Results on Aspects of ICT

Indicator	*Percentage*	*Category*
Teachers use a notebook and a projector for learning mathematics	41,15%	Quite Ready
Teachers use a smartphone to access the Internet at school and at home	72,95%	Ready
Teachers use software for learning mathematics	84,66%	Very Ready
Teachers use android tablet or iPad for learning mathematics	49,83%	Quite Ready
Average	63,40%	Ready

Teachers often use smartphones to access the Internet at school and at home. It's related to the interview with several teachers, the teachers argued that among teachers in schools and MGMP *Matematika* (*Musyawarah Guru Mata Pelajaran Matematika)* or mathematics teachers community, teachers are communicating by social media such as Whatsapp, Blackberry Messenger, and other chat applications that are accessed using a smartphone. Thus, access the Internet at school and at home has become one of the needs of teachers today. However, there are also teachers who do not have a smartphone, although the number is only 0.09% (52 teachers).

Software for learning mathematics most widely used by teachers is Microsoft Office, either Microsoft Word for 67.81% (335 teachers), Microsoft Excel amounted to 67.61% (334 teachers), as well as Microsoft Powerpoint by 70.85% (350 teachers), GeoGebra amounted to 43.33% (78 teachers) and Pesona edu 13.33% (24 teachers). Microsoft Office is the basic software that is currently to be controlled by the teacher. So, many teachers have used it. This is because the administration of learning, such as lesson plan, analysis, learning materials, attendance and others must be made by the teacher using Microsoft Office.

The most teachers, 304 from 551 teachers, have android tablet or iPad that used for learning mathematics as much as 1 to 2 times per month. They use it to find learning materials and have never used android tablet or iPad for learning in the classroom. However, there are many teachers who do not have a tablet, for reasons already have enough with their smartphones and tablets do not require.

Table 9. Cross Tabulation Between Number of ICT Training and The Intensity of Using *Notebook and Projector for Teaching Mathematics*

Number of ICT training	*Teachers use notebook and projector to learning mathematics*											
	Never		*1-2 times per month*		*3-5 times per month*		*6-10 times per month*		*more than 10 times per month*		*Total*	
	Freq	*%*	*Freq*	*%*	*Freq*	*%*	*Freq*	*%*	*Freq*	*%*	*Freq*	*%*
Never yet	61	11.36	40	7.45	6	1.12	0	0.00	3	0.56	110	20.48
1-2 times	76	14.15	89	16.57	44	8.19	8	1.49	6	1.12	223	41.53
3-5 times	28	5.21	55	10.24	28	5.21	7	1.30	7	1.30	125	23.28
More than 5 times	20	3.72	27	5.03	14	2.61	6	1.12	12	2.23	79	14.71
Total	185	34.45	211	39.29	92	17.13	21	3.91	28	5.21	537	100

The analysis crosstab number of ICT training and the intensity of using notebook and projector for teaching mathematics, teachers who have attended training at the highest in the category "Never" amounted to 11.36% (61 teachers) and the lowest is in the category "6-10 times per month" of 0%. Teachers who attended the training as much as 1-2 times the highest in the category "1-2 times per month" amounted to 16.57% (89 teachers) and the lowest is in the category "more than 10 times per month" 1.12% (6 teachers). Teachers who attended the training as much as 3-5 times the highest in the category "1-2 times per month" 10.24% (55 teachers) and the lowest is in the category "6-10 times per month" and "more than 10 times per month" 1.30% (7 teachers). Teachers who attended training by more than 5 times the highest in the category "1-2 times per month" amounted to 5.03% (27 teachers) and the lowest is in the category "6-10 times per month" 1.12% (6 teachers).

Thus, teachers have not been trained tend to never use a notebook and a projector for teaching mathematics. Meanwhile, teachers who attended training either 1-2 times, 3-5 times or more than five times had the same trend, using notebook and projector for teaching mathematics as much as 1-2 times per month. Chi-square test show that the significant correlation between number of training and the intensity of using notebooks and projectors for teaching mathematics was less than 0.05, which is

0.00. This imply that there is a significant correlation between number of training and the intensity of using notebooks and projectors for teaching mathematics.

3.6. Mathematics teachers' readiness on the organizational and administrative aspects

The results of the above table shows that the readiness of teachers on the organizational and administrative aspects included in the category "ready" with the percentage of 60.75%. This is evidenced by the results of each indicator can be achieved with good teachers. In the first indicator, teachers have used email or social media with an average of 3-5 times per month. On the second indicator, the teacher explains that the infrastructure and facilities in the school enough to support the learning process of mathematics-based computer and the Internet so that it can be a learning experience for the students.

Table 10. Recapitulation Results on Aspects of Organizational and Administrative

Indicator	*Category*	*Percentage*
Teachers communicate via email or social media with students / other teachers	Quite ready	56.10%
Teachers use a resource or learning material math-based computer or internet experience in supporting the learning of mathematics	Ready	76.41%
Teachers provide support to fellow teachers for the creation of community-based ICT in schools	Quite ready	49.73%
Mean	Ready	60.75%

Table 11. Cross Tabulation Between Number of ICT Training and Intensity of Teachers Communicate Via E-mail or Social Media

Number of ICT training	*The intensity of the teachers communicate via e-mail or social media with students/other teachers*											
	Never		*1-2 times per month*		*3-5 times per month*		*6-10 times per month*		*more than 10 times per month*		*Total*	
	freq	*%*	*freq*	*%*	*Freq*	*%*	*Freq*	*%*	*freq*	*%*	*Freq*	*%*
Never yet	29	5.42	42	7.85	21	3.93	11	2.06	8	1.50	111	20.75
1-2 times	36	6.73	77	14.39	52	9.72	23	4.30	34	6.36	222	41.50
3-5 times	9	1.68	39	7.29	30	5.61	13	2.43	33	6.17	124	23.18
More than 5 times	10	1.87	27	5.05	14	2.62	7	1.31	20	3.74	78	14.58
Total	84	15.7	185	34.58	54	10.09	54	10.09	95	17.76	535	100

The result of cross tabulation between the number of ICT training and the intensity of teachers communicate via e-mail or social media with students/other teachers by using Chi-square test show that the significant correlation between the number of ICT training and the intensity of teachers communicate via e-mail or social media with students/other teachers was less than 0.05, which is 0.002. This imply that there is a significant correlation between the number of ICT training and the intensity of teachers communicate via e-mail or social media with students/other teachers.

The table above shows the intensity of most teachers communicate via e-mail or social media with students/other teachers is 1-2 times per month by 185 teachers (34.58%). While the teachers who have been trained at the most, followed by 222 teachers (41.50%) of 1-2 times. Apparently from the table above, most teachers have had training 1-2 times have been using e-mail or social media to communicate with students/other teachers with an average use of as much as 1-2 times per month.

3.7. Mathematics Teachers' Readiness in The Aspect of Teachers Professional Learning

Table 12. Recapitulation Result on The Aspect of Teachers Profesional Learning

Indicator	*Percentage*	*Category*
Teachers use the Internet for learning mathematics	43.80%	Quite Ready
Teachers access the school website or blog address as a source of information and use personal websites or blogs to the learning experience	43.69%	Quite Ready
Teachers use the internet access available at home for preparing mathematics learning	60.27%	Quite Ready
Teachers create or develop resources or learning material math-based computer or internet	53.55%	Quite Ready
Teachers follow the activities of community learning math teachers	68.24%	Ready
Average	53.91%	Quite Ready

The results of the study after the recapitulation shows that mathematics teachers' readiness in the learning aspects of professional teachers are categorized as "quite ready". This looks at network usage indicators for the learning of mathematics, the intensity of math teachers in using the Internet for learning math as much as 1-2 times per month. Based on the interview with one of the teachers who use the Internet for learning say that the teacher never use quipper school's quiz online. Learning with the Internet would create a wider knowledge of the students, in addition to the teachers also can innovate and not monotonous using the textbook only. Currently, the development of more advanced age, by utilizing the Internet as a learning resource to improve the quality of education in Indonesia. In this case of course dependent on the ability and readiness of a teacher in utilizing the Internet as a source of learning in the learning process. However, there are still schools that are not facilitated by the Internet. They said that the inadequate facilities at schools so as to access the internet the teacher should use a private facility that has, such as modems, smartphones and so on. In addition, other teachers say that the school is unable to reach the location of the signal and teachers are also still not really need. Based on the analysis of data readiness level math teachers in using the Internet for learning mathematics by 43.80% to the category of "quite ready".

Furthermore, the intensity of teachers in accessing the blog of the school as a source of information as much as 1-2 times per month because many teachers said that the school blog is not always up to date so that teachers very rarely access it. And the reason the teacher said the school does not have a website or blog address because until now the school has not made it so most no information about the school teacher that can be accessed online. In addition, for the possession of personal blogs, a mathematics teacher in Banten say never use blogs pribadinnya to the learning experience. Based on interviews with one of the teachers who use personal blogs in teaching that the use of personal blogs to experience the learning of mathematics, teachers download materials and tasks into a personal blog for further downloaded by the students. As for the reason teachers do not have a website address or personal blog because teachers do not require a website or personal blog for learning activities and some other teachers who answered do not understand how to create a website or blog and not interested in using it. Based on the analysis of data readiness level math teachers in accessing the website or blog address of the school as a source of information and use personal websites or blogs to the learning experience by 43.69% to the category of "quite ready".

Intensity of the teachers in the use of Internet access show 3-5 times per month. However there are teachers who do not provide internet access at home. Teachers said the teachers have not installed internet access and now the Internet can be accessed by smartphone. Based on interviews with dalah teachers who use the Internet in preparing study says that Internet use is very helpful because teachers will be easier to set up, especially learning to look for additional materials and images in support of learning materials. In this case the use of Internet technology in the preparation of learning should be done by teachers for teachers to further develop teaching methods to be more varied and not monotonous because on the internet provided a variety of information teachers need to develop learning. Based on the analysis of data readiness level math teachers in using the Internet for learning mathematics by 60.27% to the category of "quite ready".

The results show that amounted to 53.55% of teachers said that they had create or develop resources or learning material math-based computer or internet. How teachers develop instructional material resources or math-based computer or internet is the most to make the material using PowerPoint. There was also a teacher who made a computer or internet-based quiz, editing teaching materials obtained from browsing the Internet, making peembelajaran digital media and others. The reasons teachers who said she had never developed a resource or learning material math-based computer or internet because so far only the adoption and use of resources or learning material math existing ones, as well as the lack of school facilities and there are many teachers who are not adept at using technology. By developing media technology-based learning will make the learning becomes more varied and make teachers become more creative, because professional teachers is essential in improving the quality of human resources quality and competitive in the era of globalization. Based on

the analysis of data readiness level math teachers in making or developing resources or learning material math-based computer or internet by 53.55% to the category of quite ready.

Teachers participated in the study community mathematics teachers by join the activity MGMP *Matematika* amounted to 68.24% of respondents. This shows that many math teachers in Banten province who had participated in a learning community of teachers of mathematics. Based on the resulting data, activities that have been carried out relating to ICT teacher at MGMP *Matematika* is at most create ICT-based learning materials. In addition there are also teachers who attended the training GeoGebra, training, e-learning, training value analysis using software and others. The reasons teachers say not follow due MGMP *Matematika* not get the schedule, have not received an invitation, there were other teachers who represents the school, MGMP *Matematika* less active, collide with the teaching schedule and others. In line with the results of interviews with several teachers who attended MGMP *Matematika*, activity in this community are very helpful math teachers to interact and share experiences in teaching. But the material covered is not always based technology, materials discussed more frequent discussion of difficult issues and making of math problems. Based on the results of data analysis the degree of readiness of teachers participated in the study community mathematics teacher at 68.24% by the category “ready”.

Table 13. Cross Tabulation Between Period to be A Teacher and Intensity Use of Internet Access Provided at Home for Preparing Mathematics Learning

Period to be a teacher	*The intensity of the teachers use the internet access provided at home for preparing mathematics learning*										*Total*	
	Never		*1-2 times per month*		*3-5 times per month*		*6-10 times per month*		*more than 10 times per month*			
	freq	*%*	*freq*	*%*	*freq*	*%*	*freq*	*%*	*freq*	*%*	*freq*	*%*
0-3 years	4	0.90	20	4.51	18	4.06	9	2.03	18	4.06	69	15.58
4-7 years	7	1.58	23	5.19	21	4.74	7	1.58	13	2.93	71	16.03
8-11 years	3	0.68	26	5.87	27	6.09	9	2.03	13	2.93	78	17.61
12-15 years	4	0.90	26	5.87	24	5.42	12	2.71	9	2.03	75	16.93
16-19 years	3	0.68	10	2.26	11	2.48	9	2.03	9	2.03	42	9.48
20-23 years	2	0.45	8	1.81	3	0.68	6	1.35	8	1.81	27	6.09
24-27 years	4	0.90	18	4.06	11	2.48	6	1.35	6	1.35	45	10.16
28-31 years	8	1.81	6	1.35	5	1.13	1	0.23	2	0.45	22	4.97
32-35 years	1	0.23	4	0.90	4	0.90	0	0.00	3	0.68	12	2.71
36-39 years	0	0.00	2	0.45	0	0.00	0	0.00	0	0.00	2	0.45
40-43 years	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Total	36	8.13	143	32.28	124	27.99	59	13.32	81	18.28	443	100

It can be seen that the readiness of teachers in using the internet access provided at home to set up a long teaching mathematics learning with the teacher there is a relationship. Teachers who use the internet to access the learning set up more than 10 times per month at most is the teacher, who had been a teacher of 0-3 years, which amounted to 4.06% or as much as 18 teachers, teachers who use 6-10 times per month at most is teachers who become teacher 12-15 years old, ie 2,71% or as much as 12 teachers, teachers who use 3-5 times per month at most is the teacher, who had been a teacher 8-11

years, in the amount of 6.09% or as many as 27 teachers, teachers who use 1-2 times per month at most is the teacher, who had been a teacher 8-11 years and 12-15 years, respectively 5.87% or as much as 26 teachers, while saying do not use it most are teachers who become teacher 28-31 years old, ie by 1.81% or as much as 8 teachers.

Chi-square test show that the significance correlation between period to be a teacher with intensity use of internet access provided at home for preparing mathematics learning was less than 0.05, which is 0.046. It shows that young teachers become teachers experience less motivated to use the internet access available at home for preparing mathematics as compared with the more senior teacher and has experience as a teacher much longer.

Teachers have an obligation to promote and develop academic qualifications and competence on an ongoing basis in line with developments in science and technology. One of the technologies that will be addressed in this research is the information and communication technology (ICT). As discussed in the Ministerial Regulation Number 16 of the year 2007 on Academic Qualification Standards and Competencies Teacher, teacher as an educator should have competence as agents of learning, namely pedagogical, that one of its core competencies is to utilize information and communication technology for the sake of learning. In addition to pedagogical competence, teachers must also have the professional competence that one of its core competencies is to utilize information and communication technology to develop themselves.

Information technology (IT) has opened wide opportunities for educators to integrate technology-supported materials in the teaching-learning process and to improve the achievement of students. The use of computer-aided technology in the classroom will, no doubt, inspire the teachers to approach their tasks with a greater sense of purpose and, more importantly, a sense of play to make the learning process fun for students. Using computer-based technology such as data-logging and simulations is important for modeling subjects such as science and mathematics (Kumar et al, 2008).

The Education Office of Banten Province, Indonesia also have paid more attention to the teachers to be able to master ICT tools. Government regularly conducting training for elementary school teachers and junior high school teachers. The training with the name of the "Training and Development of Teaching Materials Based E-Learning, aims to enable the participants to utilize, develop, utilize, Information and Communication Technology (ICT), especially the use of e-learning as an alternative medium of learning and media information, so that teachers can improve the effectiveness of professional learning as a teacher, this phenomenon illustrates that the government was also concerned about education and understand the importance of ICT in learning at school. In addition, through the facilities of communication and information technology we can transfer ideas and adopt a system of education in developed countries education. This will provide a positive impact on improving the quality of education in Indonesia in the eyes of the international community. The adoption of the idea

and the system happen because look at the quality of education in Indonesia is very low. The low quality of education is less quality impact of human resources and the absence of educational equity in each area.

It makes some areas in district began build themselves, one of which is Serang District. On 1st to 4th September 2015 and on 16th and 19th September 2015 the government hold "training and development of teaching material based E-learning" which aims to enable the participants to utilize, develop, utilize Information and Communication Technology (ICT), especially the use of e -learning as an alternative medium of learning and media information, so that teachers can improve the effectiveness of professional learning as a teacher. It shows that teachers of the area of the district also has the potential to develop ICT in learning, in addition to some teachers in district have also started using gadgets in everyday life even though there are several obstacles to using gadgets such sophisticated smartphone or other gadget.

4. Conclusion

The survey shows that the six indicators of the readiness (1) understanding ICT in education, (2) curriculum and assessment, (3) pedagogy, (4) ICT, (5) organization and administration, (6) teacher professional learning already achieved. They are ready for mobile learning implementation using mobile devices. This paper emphasize that mathematics teachers have to empowered to use their own mobile devices for use in teaching and learning

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The Effect of Multimedia Blurb on Second Language Narrative Reading Comprehension

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Abstract

This study investigated the effect of Multimedia Blurb (MMB) on second language narrative reading comprehension, after controlling for reading attitude. The MMB is a strategy to aid comprehension using internet-based tools and a specific language for text processing. Three groups participated in the study. Two were exposed to the MMB. Of the two groups, one used their first language (L1) or Filipino and another group used their second language (L2) or English. The third group (Control) was not exposed to the MMB. They did not develop a MMB that reflected the specific use of internet-based tools and language to make sense of the text read. All groups took a comprehension test after reading the given text. A one-way between groups analysis of covariance was used to determine the impact of the MMB on students' comprehension. Results showed that the MMB L1 and L2 groups performed better significantly in comprehension than the Control group, with the MMB L2 group showing the highest mean score among the three. Hence, it could be inferred that integrating digital tools and a specific language for making sense of text may have enhanced learners' comprehension. It is recommended that elements of the MMB be studied further to determine their role in the significant increase in students' second language narrative reading comprehension.

Keywords: Multimedia blurb, new literacies, second language narrative comprehension

1. Introduction

Reading comprehension is critical to learning and learners' academic success (Luz, 2007). Students are faced with reading demands to learn different subject areas increasingly as they move up the academic ladder. Developing the reading habit enables them to cope with the literacy demands of school and the environment. In the Information Age, learners are bombarded with an abundance of information brought about by the internet. Beyond print reading, they must also be able to read multimodal formats of information. This situation poses as a challenge for teachers to equip learners with the ability and motivation to read widely for their own benefit. But do students want to read? And if they read at all, do they read well?

The more students read, the more their comprehension improves (Malloy & Gambrell, 2008). It has been observed, however, that most students do not like to read. The dismal performance of pupils in their school subjects reflect their poor reading comprehension. Based on Filipino students' National Achievement Test scores in 2009, it was revealed that public school learners' reading skills hardly attained a mastery level competence (Philstar, 2010). Moreover, a study conducted among high school

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students' performance in reading comprehension and Science also showed low mastery of reading skills (Imam et al., 2014).

1.1. Reading and Motivation

Motivation is a critical component of reading (Cambria & Guthrie, 2010). Without the will to read, improvement in comprehension is difficult to achieve. Motivation fuels the reading habit. It influences how much and how well learners will read (Schiefele, Schaffner, Moller & Wigfield, 2012). Frequent reading makes them familiar with vocabulary, language and paragraph structures of texts that aid comprehension of different reading materials.

Studies show that attitude toward reading is one of the manifestations of the intrinsic motivation to read. It reflects certain feelings toward reading which affects how they approach a reading activity. McKenna & Kear (cited in Schiefele et al., 2012) stated that there is a strong overlap between reading attitude and intrinsic reading

motivation. Intrinsically motivated learners experience joy in reading and tend to read more and deeply. This interest in reading thus, enhances comprehension.

Specific beliefs and strategies in reading may improve text comprehension (Ilustre, 2011). Instructional intervention that fosters motivation, engagement and achievement has a significant effect on reading comprehension (Guthrie, Klauda & Ho, 2013). Ryan and Deci (2000) suggested that providing supportive conditions that nurture psychological needs of competence, autonomy and relatedness promote intrinsic motivation. Cambria and Guthrie (2010) identified success, thematic unit, choice, relevance and collaboration, and relationship-building as important elements in teaching that develop intrinsic motivation. Also supporting Ryan and Deci's emphasis on control as essential for personal involvement in activities, Malloy and Cambrell (2008) highlighted the value of giving learners choice in the learning tasks. According to them, if students have a sense of being in control and have opportunities to select how they express their knowledge, then they grow in their reading motivation and comprehension. In designing literacy tasks, they recommended that activities must be characterized by authenticity, self-selection, open-endedness, relevance, challenge and social collaboration.

1.2 Reading and Technology

The advent of the internet and other Information and Communication Technologies (ICTs) and the instruction associated with it has transformed the concept of reading into a complex sense-making process involving technologies that are driving the Information Age. Leu, Kinzer, Coiro & Cammack (2004) define reading based on the "New Literacies" theory, as a "broad range of knowledge and practice with developing technologies" (p. 1585). Beyond simple decoding of traditional linear texts, to meaning-making based on prior knowledge, interactions and transactions, and evaluation of texts in

print, the current definition of reading has evolved to incorporate the demands of electronic environments.

Literacy today is believed to be multiple in nature and includes multimodal channels in text sense-making that enhance comprehension (Coiro, 2003; Boche & Henning, 2015). Technology is utilized to support understanding through a combination of sounds, images and text that students can control and manipulate to develop their literacy skills (Boche & Henning, 2015).

1.3. Reading and Language

The language used to process a text is also a factor that affects reading comprehension. Reading is both a thinking and a linguistic process (Hittleman, 1988; Savage, 1994). Learners read many texts in the second language, particularly English in learning many of their school subjects. The native language or L1 reading skills and second language or L2 linguistic knowledge are said to influence second language (L2) reading comprehension. The Linguistic Interdependence Hypothesis (LIH) contends that L2 reading ability is founded on the native language ability which supports L2 reading. The Linguistic Threshold Hypothesis (LTH) reinforces the LIH and further asserts that a specific level of language proficiency is needed before L1 reading skills and strategies can be transferred (Jiang, 2011). L2 reading comprehension is considered as a dynamic interaction of two language systems. Based on a review of studies supporting the two theories, Jiang found that both L1 reading ability and L2 language proficiency influence L2 reading ability significantly but L2 language proficiency is the stronger predictor of L2 reading than L1 reading ability. Hill (2011) explained that comprehension is a highly complex process that involves the application of skills, thinking, receiving language, taking in of information, analysis of segments to arrive at an understanding that is integrated and accurate. It was found that L1 reading skills and L2 linguistic knowledge contribute to L2 reading comprehension.

1.4 The Multimedia Blurb (MMB)

The present study incorporates the perspectives of all four theories specifically on intrinsic motivation, the New Literacies, the LIH and LTH discussed previously, in designing a reading strategy that is intended to help learners comprehend texts better. Motivational elements in reading such as choice; nurturing competence by giving them opportunities to apply skills in reading and internet-based technology skills; the choice of a language to best express their understanding of the reading material were considered in crafting a product known as Multimedia Blurb (MMB), that expresses their comprehension of a given narrative text.

The MMB is adapted from the word "blurb" coined by American humorist and illustrator Gelett Burgess which means a brief, written description of a book or something else, the purpose of which is to advertise it. The MMB on the other hand, is a strategy to help learners comprehend a reading text. Comprehension is hopefully enhanced by using digital tools to express their understanding of the text. A MMB is aimed at concretizing learners' understanding of the story. They focus on making sense of

the story's elements such as character/s, setting, problem, plot or theme supported by appropriate internet-based multimedia tools such as text, audio, visual, video and interactivity, integrated in one powerpoint slide. Just like the blurb, its intention is to promote the story so that others may be enticed to read it. The MMB must capture the essence or highlight important aspects of the story considering the intended viewer. Learners are guided by a specific criteria in the MMB development namely, relevant content, proper organization, creativity, appropriate mechanics and impact. Learners are allowed to use their first or second language to express their ideas best through a text that sums up their understanding of the story. In planning the MMB, learners also follow specific visual design principles to be effective.

The focus of this investigation is to determine if there will be a significant difference in the second language (L2) narrative reading comprehension of participants exposed to a MMB and those who are not, controlling for attitude which according to previous studies influences reading comprehension positively. Based on recent research on reading comprehension, the ability to apply new literacies of the internet enhances comprehension as varied channels for meaning-making are explored. It is hypothesized that learners who process a reading text using multiple media formats i.e., text, graphic, audio, video and other visual elements would have better comprehension than those who do not apply internet-based multimedia in processing the reading text. The MMB allows learners to apply the aforementioned media and literacy skills to help them understand the text better and consequently motivate them to read it well. Furthermore, by providing them choice in applying specific reading and new literacies skills in developing their MMB, their competence and reading proficiency are expected to be enhanced.

Literature on second language reading has revealed that the language used for reading matters. In this study, it is also hypothesized that learners who are proficient in their second language or English will perform better in the L2 narrative reading comprehension than those who are more proficient in their first language or Filipino. Earlier studies indicate that proficiency in two language systems is more advantageous because two communication systems are at work in the meaning-making process. Being proficient in L1 but less proficient in L2 is less likely going to promote a satisfactory comprehension in L2 narrative text comprehension. But being proficient in L2 enables both the L1 and L2 language systems to function to support the comprehension process more fully.

The present study was conducted during the last week of the participants' formal classes which might have a possible impact in the participants' concentration on the MMB-related tasks. As such, considering their busy schedule, their preoccupation with final examinations, and submission of final requirements, it was deemed essential to give them adequate time so that reading the text and developing their respective multimedia blurbs can be done whenever convenient for them. This situation may test the students' interest in reading and engagement in the MMB activity as well. Students who are not keen in reading may not be inclined to pursue the assigned tasks and may opt to

drop-out rather than persist. Hence, only those who are interested in reading are expected to finish the reading task, develop the MMB and take the post-test.

2. Method

A quasi-experimental research design, using non-equivalent groups was applied in this study. Pre-existing intact sections that have taken courses on Developmental Reading which equipped them with reading skills, and Educational Technology which afforded them a training on technology-integration skills were selected. Specific classes were assigned to the experimental conditions based on their language proficiency. Learners who were proficient in their first language or Filipino (L1) were assigned to the MMBL1 group. They comprised of a group of Filipino majors and those who specialized in other disciplines who opted to use Filipino in their MMB. Learners who were proficient in the second language or English (L2) were assigned to the MMB L2 group. They were composed of a group of English majors and those who specialized in other disciplines who opted to use English in their MMB.

2.1 Participants

A total of 209 third year Education students participated in the study but only 113 of them were finally chosen after a thorough data screening. Participants who did not read the text but took the post-test, those who failed to follow instructions, and those who were absent either during the pre-test or post-tests were not included. Of the initial number, 23 Filipino, 37 English, 29 and 33 Physical Education (PE) from two sections, 24 Physics, 11 Social Science and 35 History majors took the pre-test.

The final participants were assigned to the three conditions of the study. The Control group was made up of 11 Social Science majors; the MMB L1group was composed of13 Filipino and 3 History majors, a total of 16 participants; and the MMB English (L2) group was comprised of 31 English, 8 PE, 21 Physics, and 26 History

majors who chose to do their multimedia blurbs in English, a total of 86 participants. Among the participants, 105 used Filipino as their mother-tongue and the rest other native local languages at home. In the L2 group, one spoke Bikol, two Pangasinense, two Ilokano, and two Cebuano. All participants in the L1 group used Filipino at home. And among those in the Control group, all spoke Filipino except for one whose dialect is a variety of Bisaya found in Romblon.

2.2 Procedure

The participants were first given the attitude test. Except for the Control group, the MMB L1 and L2 groups were oriented briefly on the nature of the MMB which they were tasked to do after reading a

text that they downloaded from their class website. The MMB gives them an opportunity to process the text by creating a representation of what they understood about the story using internet-based multimedia tools. The participants were allowed three to seven days to read the text and to complete their MMB during their free time. Then their outputs were compiled and sent to the teacher-researcher. The participants were given the comprehension test on the last meeting and the experimental groups had a chance to view the multimedia blurbs they produced.

2.3 Measures

Data were gathered based on two instruments. To determine learners' attitude toward reading, a 40-item Adult Survey of Reading Attitude developed by M Cecil Smith (1991) with a Cronbach's alpha reliability of .93; and a test-retest reliability of .87 was used. Its construct validity when correlated with another attitude measure, the Rhody scale of reading attitudes was .80 ($p < .01$). For the purpose of this study, only six items focusing on one of the five dimensions of reading attitude specifically, reading activity enjoyment were used. The other subscales on anxiety and difficulty, social reinforcement, modalities and tutoring were not included because they were not applicable for the study.For the six items used in the study, the Cronbach's alpha is .82, indicating a high level of internal consistency.

The text used in the study underwent readability testing. Based on the text readability consensus calculator that applies seven commonly used readability formulas to look into the average grade level, reading age and text difficulty of a text, the article "Cupid and Psyche" (Apuleuis,n.d.), was categorized under the Grade 10 level or standard/ average readability for 14-15 year-oldsand most suitable for ninth to tenth graders (Text Readability Consensus Calculator, n.d.). This implies that since the participants are in their third year college level coming from a ten-year basic education, the text should be relatively easy for them and therefore, not threatening for participants who may be struggling readers.

A 15-item researcher-constructed comprehension test based on the narrative text was used to determine how well the learners understood the story. It focused on four essential reading comprehension skills namely, (a) noting details (5 items); (b) making inferences (4 items); (c)sequencing (2 items); and (d) analysis (4 items). The

comprehension test underscored the story's major elements. The article "Cupid and Psyche" was selected based on the following criteria:(1) it stimulates interest; (2) has easy to average readability level; (3) has a relevant theme; and (4) is appropriate in length, not too short or too long.

2.4 Data Analysis

For the preliminary analysis, descriptive statistics were determined to establish normal data distribution. Means, standard deviations, skewness and kurtosis were obtained for the three conditions

studied. To satisfy the important assumptions of the main statistical analysis, tests to determine the independence of covariate and treatment effect and the homogeneity of regression slopes were conducted. A Pearson *r* was also computed to find out if attitude and comprehension scores were correlated as indicated by previous researches. The homogeneity of variances was determined through the Levene's Test of the Equality of Error Variances.

The main analysis used the Analysis of Covariance (ANCOVA) to find out if a difference exists in the participants' comprehension scores after controlling for attitude.

2. Results and Discussion

The study sought to find out if a statistically significant difference exists in the L2 narrative comprehension of learners who are exposed to the MMB and those who are not.

In the preliminary analysis, the descriptive statistics show that the data is a little skewed and platykurtic but it still approximates normal distribution. The means, standard deviations, skewness and kurtosis of the Control, MMB L1 and L2 groups are presented in Table 1.

Table 1. Mean Values, Standard Deviations, Skewness and Kurtosis

	M	*SD*	*Skewness*	*Kurtosis*
Multimedia Blurb L1 Group				
Reading Comprehension	9.00	2.42	-.386	-1.09
Attitude Toward Reading	4.09	.526	-.132	-.558
Multimedia Blurb L2 Group				
Reading Comprehension	10.09	1.87	-.400	-.809
Attitude Toward Reading	4.02	.716	-.985	.831
Control Group				
Reading Comprehension	8.90	2.34	-.551	-1.05
Attitude Toward Reading	3.83	.521	.215	-1.43

A computation of the correlation between attitude and comprehension revealed a moderately small positive correlation based on Pearson's $r(113) = .263$, $p > .01$. This means that attitude toward reading is related to comprehension. A positive attitude is associated with a high level of comprehension. This finding validates what

Cambria & Guthrie (2010), Hill (2011), Schiefele et al. (2012), Guthrie, Klauda & Ho (2013) say about the positive relationship between intrinsic motivation and comprehension. A comparison of the three groups' attitude toward reading using the Levene's Test of Equality of Error Variances, $p = .132$ showed that the participants were not significantly different from each other in terms of reading attitude. Preliminary checks were conducted to ensure that assumptions of normality, linearity, homogeneity of variances, homogeneity of regression slopes and reliable measurement of the covariate were satisfied. An important limitation of this study

should be noted. Strict control of the conditions that may have contributed to the quality of their comprehension specifically when and how often students read the text, the students' reading abilities, and other factors that such as the metacognitive strategies they might have applied within the one week period was not done. Only attitude was controlled.

In the main analysis, the one way between-groups analysis of covariance was conducted to compare the effectiveness of the MMB on the participants' comprehension. The independent variable was the MMB and the dependent variable consisted of the scores in the comprehension test. The participants' scores in the attitude test were used as the covariate in the analysis. The ANCOVA $F(2,109) = 3.31$, $p = .04$, partial eta squared = .05, showed that after controlling for attitude, a significant difference was observed in the comprehension test scores of the MMB L1, MMB L2 and Control groups as shown in Table 2.

Using the Least Significant Difference (LSD) post hoc test, results demonstrated that the MMB L2 and L1 groups posted a significant difference of $p = .032$, with the MMB L2 group manifesting the highest mean score of $M = 10.08$ after controlling for attitude. When compared with both the MMB L1 and L2 groups, the Control group did not show any significant difference. It appears that the MMB and the corresponding language used in processing the text served important roles in accounting for the significant difference in the comprehension scores.

Table 2. Analysis of Covariance

	MMB L1 Group (N=16)		*MMB L2 Group (N=86)*		*Control Group (N=11)*		*F*	*SE*	*Partial Eta Squared*	*p*
	M	*SD*	*M*	*SD*	*M*	*SD*				
Attitude Toward Reading	4.09	.52	4.02	.71	3.83	.52	8.23	.27	.07	.00*
Reading Comprehension	8.93	2.42	10.08	1.87	9.05	2.34	3.31	3.77	05	.04*

*$p < .05$

By using the strategy, learners' L2 narrative comprehension could be improved, validating the hypothesis of the study that those who are exposed to the MMB will perform better in the L2 narrative reading comprehension than those who are not. The significant difference may be explained by the conditions under which the MMB was developed. Learners were afforded choice and an opportunity to feel competent as they engaged in the meaning-making process in their own terms, own ability and own understanding.

Allowing learners to use technology tools to express themselves and to communicate their thoughts and ideas to others meet specific self-determination needs that enhance success and competence in using reading and technology-integration skills. This corroborates the findings of past researchers on

the elements that boost reading motivation (Malloy & Gambrell, 2008; Cambria & Guthrie, 2010; Schiefele et al., 2012; Guthrie, Klauda & Ho, 2013). In addition, using a language that communicates their text understanding bestmost likely contributed significantly to the major difference in the comprehension scores of learners exposed to the MMB.

Results showed that the MMB L2 group had the highest mean score among the three conditions. This result confirms what Jiang (2011) contended about the roles of L1 and L2 on L2 reading comprehension. Proficiency in both the L1 and L2 promotes better L2 text comprehension than being fluent only in L1 and less proficient in L2.

Higher levels of thinking, new strategies for making sense of texts, the use of various digital tools, multimedia channels for text comprehension were new literacies which learners in the study applied to generate a product that reflected their comprehension. The significantly higher comprehension scores of the MMB L1 and L2 groups compared with the control group may have been influenced by the application of the new literacies which Coiro (2003), Morrell (2012), Leu et al. (2013), Leu et al. (2014) described as essential for reading comprehension in the internet era. However, to determine which of the features of the MMB and how they specifically contributed to the significant difference in the comprehension performance of the participants is beyond the scope of this study.

Since the significant difference in comprehension among the three groups is evident in the MMB L1 and L2 groups, as presented earlier, with the L2 group manifesting a higher mean score than the L1 group, fluency in L2 appears to have a greater effect in the L2 narrative reading comprehension. This outcome points to the advantage of MMB L2 group's proficiency in L2.This is similar to what Jiang (2011) and Hill (2011) have highlighted in their respective researches. They emphasized that between the L1 reading ability and the L2 proficiency, the latter plays a more crucial role in the L2 reading comprehension.

To sum up, the study showed that there was a statistically significant difference in the comprehension scores of participants in the MMB L1 and L2 groups compared with the Control group. This validates the hypothesis of the study that those who are exposed to the MMB will perform better than those who are not exposed to it. It may be inferred that the specific language and the technology-related elements of the MMB used in expressing understanding accounted for the marked improvement in the L2 narrative reading comprehension of participants exposed to the MMB. This may be further investigated considering that the present study is limited only to determining the significance of the difference in the comprehension of learners who are exposed to the MMB and those who are not .

It can be concluded that MMB is a promising reading strategy teachers may use to engage learners in understanding texts in a second language better. Results of this study indicate the importance of the language and the digital tools used in processing the reading text. It is recommended that further studies be conducted on the elements of the MMB which are likely to have caused the significant difference in the comprehension performance of the MMB L1 and L2 groups. A closer examination of the language component of the MMB will determine how each of the languages contributed

significantly to the L2 comprehension performance of the participants that would be most useful to Language and Literacy teachers including other teachers who want learners to maximize their comprehension of texts written in L2 in other subject areas. And looking into the technology-integration skills applied in the MMB development will provide more insights into the new literacies of learners in the Information Age. All these have implications for the improvement of teaching and learning.

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Developing Hong Kong Community College Students' Digital Literacy through Digital Storytelling

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Abstract

This paper examines how student' digital literacy is developed through digital storytelling activities of a post-secondary institution in Hong Kong. Through a case study, this study explores what levels of digital literacy can be developed through different phases of digital storytelling activities in a multimedia course. To gauge the level of digital literacy skills and how digital literacy is developed, data via interviews with students, students' digital stories, and students' reflective journals were collected and analysed. This study demonstrates that digital storytelling is an innovative pedagogy to enhance student's digital literacy. The findings show that the students are motivated and engaged in different stages of producing digital stories. This study further reveals that the viewing and representing skills of digital media can also be improved.

Keywords: digital literacy; digital storytelling; motivated and engaged; innovative pedagogy; viewing and representing

1. Introduction

Students are required to express ideas in digital media in their study. It is expected that students are equipped digital literacy skills for their study. It is well established in the research literature that effective communication today requires not only ability to read, write, speak and listen but also skills of viewing digital media and representing through digital media (Frazel, 2010; Jolls, 2008; Kress, 2003; Kress & Van Leeuwen, 2006; Ohler, 2008; Potter, 2010). Screen is becoming an increasingly dominant medium for communication. Students need to develop digital literacy skills in order to effectively learn in today's world.

Educational institutions understand it is a challenge to ensure that students develop such digital literacy skills. Although institutions around the world are beginning to integrate these skills across the curriculum, relatively little is known about how to effectively develop the digital literacy skills through appropriate classroom activities.

The purpose of this study is to explore development of digital literacy of students at a community college in Hong Kong through digital storytelling activities. For these students, developing digital literacy skills is critical as they prepare to further their studies or enter work-places that nowadays require use of information technology.

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The study advances understanding of digital literacy development and informs theoretical work in relation to the skills of viewing and representing through contemporary media (Barrett, 2006; Potter, 2010; Robin, 2006, 2008; Sadik, 2008). Furthermore, the study results in a set of guidelines for effective development of digital literacy skills for students at community college through digital storytelling. In addition, the study develops recommendations for teachers in core disciplines how to engage students is deploying these digital storytelling in learning.

1.1 Digital literacy

Digital literacy skills are important to students. The way of writing has been shifted from the dominance of the medium of paper to the dominance of the medium of screen (Kress, 2003). Gee (2003, pp. 13-14) points out that the new information and communication systems involve many other visual, symbols, such as images, graphs and diagrams, and the skills to use and interpret them. And also, the texts are multimodal that is they mix words, images and other forms of information. Therefore, multiple literacies are needed because there are different ways of reading writing diverse multimodal text.

Churchill (2010) determines that the 'Today's (New) Literacy' should include traditional literacy, information literacy, visual literacy, critical literacy, media literacy, tool literacy, and digital literacy. The website of the 'Framework for 21st Century learning' (http://www.p21.org/) has the similar ideas. Digital literacy has been defined as an umbrella framework for a number of complex and integrated sub-disciplines or literacies – that comprised of skill, knowledge, ethics and creative output in the digital network environment (Calvani, Cartelli, Fini, & Ranieri, 2008). There are different definitions of digital literacy. Eshet-Alkalai (2004) points out that author emphases on the technical skills, while others focus on cognitive and socio-emotional aspect. Digital literacy changes from time to time. Martin (2008) has pointed out that digital literacy can be conceived on three levels.

> We may approach digital literacy in the same vein, seeing it as operative first at the level of technique, of the mastery of digital competences, secondly at the level of thoughtful usage, of the contextually-appropriate application of digital tools, and thirdly, at the level of critical reflection, of the understanding of transformative human and social impact of digital action. (Martin, 2008, p. 117)

The three levels of digital literacies (Martin, 2008) are listed below:

- Level I: Digital Competence (skills, concepts, approaches, attitudes, etc.)
- Level II: Digital Usage (professional/discipline application)
- Level III: Digital Transformation (innovation/creativity)

In summary, digital literacy can be seen as the ability not only to read, write speak and listen but also skills of viewing and representing through digital media (Frazel, 2010; Jolls, 2008; Kress, 2003; Kress & Van Leeuwen, 2006; Ohler, 2008; Potter, 2010).

1.2 Digital storytelling

Digital storytelling is about the idea of combining the art of telling stories with a variety of digital multimedia, such as images, audio, and video (Robin, 2006). Digital storytelling is also seen as the practice of combining still images with a narrated soundtrack including both voice and music (Robin, 2008; Sadik, 2008).

Joe Lambert coined the Seven Elements of Effective Digital Stories. They are (1) a point of view, (2) a dramatic question, (3) emotional content, (4) economy, (5) pacing, (6) the gift of your voice, and (7) an accompanying soundtrack (Bull & Kajder, 2004). Robin (2008) realizes that digital storytelling as an effective tool to engage students in their learning process. Students are taught to create their own stories through the four phases including pre-production, production, post-production, and distribution of digital storytelling (Porter, 2004), which are shown below:

- Pre-production phase:
  - Writing a narrative script
  - Planning the project
  - Organizing project folder
- Production phase:
  - Making the voiceover
  - Gathering and preparing media resources
- Post-production phase:
  - Putting it all together
  - Distribution
  - Delivering to the audience

One important issue that teachers need to consider is the assessment of the digital story – the students' product. The assessment criteria of the digital storytelling project must be carefully planned (Hofer & Swan, 2006). Barrett (2005) provides some rubrics for assessing digital stories. The Scott County Digital Storytelling Rubric (RubiStar Website, 2012)includes eight categories of assessment items - point of view, dramatic question, emotional content, the gift of you voice, the power of the soundtrack (emotion), the power of sound track (originality), economy, and pacing. So, this rubric was adopted with modifications as a tool to gauge the skills.

1.3 Bringing digital literacy and digital storytelling together

Digital storytelling enables students to effectively develop digital literacy (Robin 2006). Students use productive tools including digital cameras, microphones, audio recording device and video editing software in constructing technology-enhanced artefacts. Student use a variety of media and formats to represent ideas to others in a creative way.

Digital storytelling can generate interest, attention and motivation for the "digital generation" students in today's classroom. Students are motivated, engaged, and interested in digital storytelling (Hofer & Swan, 2006) Digital storytelling engages students in the 'language of their generation' (Hofer & Swan, 2006, p. 679). Students are interested in multimedia (Kajder, 2004). Barrett (2006) identifies that

digital storytelling is beneficial to students with different aspects including student engagement, reflection for deep learning, project-based learning and motivation.

2. Context and background

This study was conducted at the post-secondary college that the first author was teaching. This college offers two-year associate degree programmes for secondary school leavers. They are unable to obtain an undergraduate place yet. The college offers different programmes such as journalism, business administration, wealth management etc. The author taught three classes of a multimedia course with about 30 students each. The course is an elective to the year-one and year-two students. Two classes (Class 1 and 2) are year-one journalism students and another class (Class 3) is a mixture of year-two business administration and year-two wealth management students. All students are native Chinese speakers. The assessment components are composed of a short video of self-introduction, four personal reflective journals, a digital story (group project), two quizzes and a final exam. Students can form project groups with a group size between three and six on their own.

For this study, four students from four different project groups were selected. Two of them were journalism students of Class 1 and 2 and the other two were business administration and wealth management students of Class 3.

3. Method

3.1 Case study

This study adopted case study approach, which is used to study phenomenon systematically and seek holistic description and explanation (Merriam, 1988). Yin (2009, p. 10) emphases case study approach is suitable to 'the situations where it is impossible to separate the phenomenon's variables from their context'. According to Merriam (1988, p. 16), case study can be defined as 'an intensive, holistic description and analysis of a single entity, phenomenon, or social unit.' The researcher hopes to determine what and how each of the four students can develop digital literacy skills through digital storytelling.

At the beginning of the semester about Week 3, students submitted the self-introduction video and the first personal reflective journal. Then each of the four students was invited for the first interview. The teacher-as-researcher tried understand participants' prior knowledge on digital literacy. In the interview, the interviewer gave feedback to the students on the challenges they faced during the process of creating the one-minute short video. Students would move onto different phases of digital storytelling after formulating the theme and storyline of their digital stories. They were required to submit second, third and fourth reflective journals at an interval of three to four weeks respectively. Feedbacks to students' reflective journals were provided. The teacher-researcher also provided immediate comments to the students in different phases of digital storytelling. Through the second

interview conducted at the end of the semester, the researcher could have an overall picture on how students had learnt through the digital storytelling activities.

3.2 Data collection

Data were collected from student participants. First, to understand the prior knowledge of digital literacy skills, a short video created by the students at the beginning of the semester is assessed against the Scott County digital storytelling rubric (Barrett, 2005). A semi-structured interview was conducted at the beginning of the semester (See Appendix 1 for the questions in the first interview). The students were asked about their prior knowledge of digital literacy skills, and what kind of digital artefact they had produced before. Student participants were also asked how they created the self-introduction short video. To understand how the digital literacy skills were developed, each student prepared four personal reflective journals at different phases of digital storytelling. The students' learning experience and the obstacles the students faced in the digital storytelling can be reflected. Students were given with constructive comments for improving the digital story preparation. The students submitted digital stories (about five minutes in length) after participating in the digital storytelling activities at the end of the semester. The students' artefact was evaluated against pre-set rubrics. To understand the overall learning experience of the digital storytelling, a second interview was conducted at the end of the semester (see Appendix 2 for the questions in the second interview). The student participants were asked what they have learnt and what the obstacles they faced in the digital literacy acquiring process. All data in the interviewed were collected in Chinese (their mother tongue) and translated into English for analysis.

3.3 Data analysis

Different forms of data were reviewed and analysed to identify to the issues related digital storytelling activities, including the digital literacy levels achieved by the student participants and how the levels were achieved. The levels of digital literacy skills were identified against the pre-set rubric for the short self-introduction video and the digital stories. To investigate how students develop their digital literacy skills, initial codes were identified based on the issues suggested by the literature review and the analysis of interview transcripts and students' reflective journals. Similar codes were grouped to form categories or themes. For the themes identified in the study, a frequency count was conducted and converted in percentages to show the trends in the findings. After major themes were identified, relevant quotes in the interviews and reflective journals were listed to explore students' perception of the learning process. Some major themes identified the interviews were discussed in the findings. After analysing qualitative data, the next step is to interpret its meaning (Wolcott, 1994). All data analysis was carried out by the first author. The second author (the doctoral supervisor) played the role of giving advice and guidance to interpreting the evidence collected. The interview transcripts were sent to the interviewees for checking. That was to avoid misinterpretation of participant' ideas.

Triangulation between the data sets from the interview transcripts and reflective journals, and benchmarking by the third-party marker establishes a major means of trustworthiness. First, the themes identified from the reflective journals can be cross-checked with the interview transcripts. Second, to avoid bias opinion from the teacher-researcher in marking the digital stories, a bench-marking was conducted. A colleague teaching the same course of the first author from the same college was invited to mark and offer comment student's artefacts (digital stories submitted at the beginning and at the end of semester). The grade and comments were cross checked by the teacher-researcher. Triangulation against human bias of the teacher-researcher was achieved.

4. Finding

The levels of digital literacy achieved after going through the digital storytelling activities were improved in this study. Significant improvement could be observed in the Level I Digital Competence and Level II Digital Usage for the four cases. The ability of viewing and representing ideas in digital media has been improved through digital storytelling activities.

4.1. Improvement of digital literacy through digital storytelling

Students master the concepts of multimedia elements, such as graphics, video and audio. In the meantime, students learnt how to create story. In the digital story project, students were required to determine a theme on their own. Cindy's (pseudonym) group had identified a theme "Discovering Hong Kong" which was an open short film competition for tertiary education at Hong Kong. The digital literacy skills of the four participants were improved after taking part in the producing the digital stories. The results are shown in Table 1.

Table 1. Students' digital literacy skills after digital storytelling activities.

Digital Literacy	*Prior knowledge*	*After Digital Storytelling Activities*
CINDY(pseudonym) (Year-two business administration)	Emerging	Competent
Level I: Digital Competence	Emerging	Competent
Level II: Digital Usage	Emerging	Basic
Level III: Digital Transformation		
RITA (pseudonym) (Year-two Wealth Management)	Emerging	Competent
Level I: Digital Competence	Emerging	Basic
Level II: Digital Usage	Emerging	Basic
Level III: Digital Transformation		
EVA (pseudonym) (Year-one Journalism)		
Level I: Digital Competence	Emerging	Competent
Level II: Digital Usage	Emerging	Basic
Level III: Digital Transformation	Emerging	Competent
ALEX (pseudonym) (Year-one Journalism)		
Level I: Digital Competence	Basic	Exemplary
Level II: Digital Usage	Emerging	Competent
Level III: Digital Transformation	Emerging	Competent

Note: The measurement of digital literacy in the rubric includes emerging, basic, competent and exemplary.

The following section explains what digital literacy skills are developed during the digital storytelling activities. The skills that the four participants learnt are similar. So, Cindy's case was described in detail. The skills she learnt are shown in Table 2.

Table 2. The Cindy's skills mastered in relation to the three level of digital literacy

Prior knowledge	*Skills mastered in digital storytelling activities*	*After digital storytelling*
Level I: Digital Competence *Emerging*	• Digital multimedia concept such video, graphic and sound • Photo and video editing skills learnt in the computer lab • Video production skills • Using camera, tripod and mic • Using different angles and shots in filming • Voice over recording in a quiet place for better quality	Level I: Digital Competence Competent
Level II: Digital Usage *Emerging*	• Applying point-of-view angle, high angle, low angle, over-the-shoulder shot, wide shot and close-up shot in the story • Applying video editing techniques, including lighting effects, transitions and music to video to create atmospheres • Using inter-cut technique to connect scenes. • Using slow motion • Putting sub-titles with strokes • Adding credits at the end of video	Level II: Digital Usage Competent
Level III: Digital Transformation *Emerging*	• Forming project group on her own with group mates • Choosing a favor theme for the digital story "Discovering Hong Kong with Love" • Discussion with group members on storyline • Preparation of storyboard • Script writing • Introducing the buildings, streets and restaurants of Hong Kong together with a mood of love story	Level III: Digital Transformation Basic

4.1.1. Pre-production phase

In the pre-production phase of digital storytelling, Cindy identified a theme "Discovering Hong Kong" for the digital story and started to brainstorm on the plot. Through group discussion, she planned that the storyline could include the places such as streets, temples, restaurants and characters. She had to think what the main messages she tried to convey to the audience. After script writing and storyboards preparation, her group mates could visualize the storyline with different shots and scenes along the time line. She was motivated to contribute to the project with a theme they had agreed with. That could provide a way to enhance her creativity in making the video. Therefore, the digital literacy (Level III – Digital Transformation) could be improved.

4.1.2. Production phase

In the production phase of digital storytelling, Cindy shot video and recorded voiceovers according to the script and storyboards. She learned that good planning could help them shoot video and edit video effectively. She used a digital camera with a tripod to capture videos with different shots and angles to express her idea. She realized that those restaurants were part of many people's daily life. They captured the shots of food and drinks in the restaurant when actor sat opposite to the actress. She used point-of-view shots to let the audience view the settings inside the restaurant. It was observed that her digital literacy (Level I Digital Competence and Level II Digital Usage) were be improved.

4.1.3. Post-production phase

In post-production phase, the video was edited by using a software package called Adobe® Premiere® Pro. A rough-cut video was made according to the storyboard to provide an overall view by gathering the footages, voiceovers and images along the timeline. The flow of the story and the order of the scenes were rearranged. She discussed with her group mates on the storyline of the video and also asked comments from the teacher. The feedback of teacher helped them modify the flow in the early stage.

In the final cut stage, the rough-cut was fine tuned. Titles, sub-titles, audio and video transitions, special effects, and credits were added. This could enable her to have a creative way to communicate with the audience. Appropriate music was added to promote the mood. In the video, the actress lost her hair-clip. The actor picked up the clip and tried to return it the actress by tracing her in the street and the restaurant. Finally, they met in a building. When the actor returned the hair-clip to the actress, a music track of Stephanie Sun called "Meeting you" was added. Other video editing techniques such as inter-cuts, slow-motion and lighting effects were applied to the digital story. Based on the above description, the digital literacy skills of all the three levels were enhanced.

4.1.4. Prior knowledge

The following quotes are extracted from the transcript of the first interview carried out at the beginning of the semester. Cindy's group produced a short video of introducing a group member. She was considered that she "emerging" on Level I Digital Competence.

> I have not learnt video editing software before. I felt quite satisfactory as I adopted Gangnam Style MV to introduce my funny group mate. But it is not professional enough. The sound quality is not so good. The voiceover is not loud enough. The screen jumps suddenly from one shot to another without continuity as I don't know how to connect those footages.

4.1.5. Knowledge after digital storytelling

After learning different techniques in the digital storytelling activities, she knew how to operate the camera, tripod and mic to shoot video with a variety of angles and shots. She used video editing software to create lighting effects and video transitions in the digital story. She connected different scenes together using inter-cut. She has reached "competent" of Level I Digital Competence. The Level II Digital Usage emphasizes on the application of skills. To understand how Cindy applies skills in making the digital story, the following quotes from her reflective journals are extracted as follows:

> I used more editing techniques such slow motion to create funny and happy atmosphere. I added lighting effects to make the atmosphere much stronger feeling. More techniques may help me have some new creative ideas to create the video. We went to the same site for three times to shoot video, but we could not capture satisfactory footage. So, we prepared the storyboard and followed it. We can make it finally.

Cindy has created a satisfactory video by applying video shooting and editing skills. She expressed her idea according to what she has planned. The Level III: Digital Transformation emphases on the

innovation and creativity. The following quotes indicates that how she introduces High Street at the Hong Kong Island to the audience in the digital story.

> The more techniques I learn, the more the creative ways for me to present my ideas in filming. I glad that the multimedia course enhances my technology skills and gives me a chance to be a film director. I can introduce the places together with romantic feeling. In the film, the actress loses her hair-clip in the street. The actor returns it to her. When they meet, a touching music sets a romantic mood. I put part of a love song call "Meeting You" by the artist Stefanie Yiu as background music. Over-the-shoulder shots between the actor and actress are captured.

4.2. How digital literacy skills are mastered during the storytelling activities

Cindy was the director of the digital story. She also contributed in video shooting and editing tasks. She was interviewed at the end of the semester. Her learning process including the self-reflections, difficulties encountered and skills mastered are documented.

Based on the transcriptions of the interviews and the four reflective journals of Cindy, initial codes of the activities and views are determined. Views or responses are counted. After analysing the coding and theme making, the factors that could help her in the learning process of developing digital literacy skills are identified. They are student engagement, reflection on deep learning, project-based learning, motivation, filming skills developing, video editing skill learning and story aspect shown in Table 3.

Table 3. Factors affecting Cindy in developing the digital literacy skills

Theme	*Student engagement (%)*	*Reflection on deep learning (%)*	*Project-based learning (%)*	*Motivation (%)*	*Filming skill developing (%)*	*Video editing skill learning (%)*	*Story Aspect (%)*
Views and responses n = 122	13.1	28.7	9.0	9.8	16.4	18.0	20.5

4.2.1. Student engagement

From the quotation below, we infer that the Cindy was engaged in the development of digital story by contributing ideas and drawing the storyboards to communicate with her group members. Then the group members understand that a theme must be identified in the earlier stage of the project.

> Every member in the group proposed an idea. Then, one of the ideas was finally chosen. I sketched storyboards to show my idea to my teammates. I found that adopting digital storytelling approach can make the video more meaningful. We all agreed to put "love" to be part of the theme of "Discovering Hong Kong".

4.2.2. Reflection on deep learning

Cindy tried to prepare an excellent video and she always reflected on the how to improve the process of making the video. She found ways to overcome difficulties encountered in different stages of digital storytelling.

> I think our video is not good enough because the voice in video is not loud enough. The angles can have improvement as well. I hope I can have an improvement on video production because making video is very fun and can be applied in future. More techniques may help us have more new creative ways to produce video. I believe that we can do it well and look forward the production stage. When we

> organized the video, we found that some parts of videos were very strange. Therefore, we decided to shoot video again.

4.2.3. Project-based learning

Digital storytelling activities provide a group work environment for Cindy to work together and communicate with team mates. She exchanged ideas and helped one another in the group project from the earlier planning stage to the post-production stage. It could improve the communication skills.

> I like brainstorming and planning stages the most. Although the initial ideas are not perfect, after discussing with others and considering other's ideas, I come up with a good idea. I like working with group mates. So we planned for the workflow of video project. I am glad that I can finish the project successfully with them.

4.2.4. Motivation

Cindy is motivated in producing videos with her groupmates. She also wants to get an excellent grade in the course no matter how hard she has to try. She felt satisfaction once she contributed to the group work. She committed in achieving excellent result in each stage.

> I get a passion on multimedia in the class. Everything is getting rush but it is happy. Our objective is to get A Grade in the multimedia course. At the beginning, our group failed in video shooting without good organization. But, luckily, the failure became positive power to push us to perform better. Other groups are also good at video shooting. So, we must put lots of effort to produce high quality videos. I feel strong satisfaction being a director and working with my group mates.

4.2.5. Filming skills developing

It is observed that Cindy has the ability to express her ideas by shooting video in appropriate angles, including point-of-view shots. She could apply the skills learnt in the classroom including use of cameras equipment and video shooting techniques to make the digital story better. She appreciated that she could master different skills.

> In one scene, the actor eats in an old style restaurant. The camera acts like his eyes to look around. It is a kind of point-of-view shot. In the opposite side of the street, the actress passes-by and the actor cannot see the actress clearly. These shots match the theme of the video "meeting" and "memory". I plan the video shooting angles. If one angle is impossible to capture, an alternative one will be taken. We use both cameras for different angles. Then we check which one is better. Video shooting angles make the film lifelike. I check and adjust cameras to appropriate settings after seeking advice from the course lecturer.

4.2.6. Video editing skills learning

The following quotation indicates that Cindy has mastered the video editing techniques. Special effects such as change of speed, colour correction, lighting effects, intercuts and background music help her create appropriate moods of the story.

> Since I picked up Adobe Premiere Pro in the class, I think it won't be difficult at all. It is interesting. I have learnt techniques such as change of speed, special effects to correct the colours. These kinds of functions are useful to create a desired atmosphere. For example, use lighting effect to create sunshine to make to atmosphere stronger. All the video clips are assembled in the timeline. The screen is split into two halves. The upper half is the actor in the tram and the lower half is the actress in another tram. When the actor is walking into the temple, short intervals of videos about the temple in different angles are shown. Intercuts allow the audience see the scenes taken at different places and time. When actor and actress meet together, a touching music is added to set a romantic mood.

4.2.7. Story aspect

Cindy has the freedom to choose a favourite theme of digital story. This encourages Cindy and her groupmates to develop the digital story in their own way. She planned carefully and tried to express her ideas by capturing different angles and shots to the audiences.

> We all agree to use "love" to be part of the theme. Our video title is "Discovering our Hong Kong – Love". If we can't bring out the feeling to the audience, it may be boring. A place at Sheung Wan of Hong Kong Island is chosen. The value behind those buildings is that people think of those things happened in the past. These restaurants are part of the many people's daily life. When the actor returns the hair-clip to the actress, I added part of the song called "Meeting You" by Stefanie Sun. The meaning of the song matches the theme of that part of video.

In short, through the digital storytelling activities, the three levels of digital literacy skills are developed. Cindy's digital competence (Level 1) is enhanced through technological skills learning in production and post-production phases of digital storytelling. The skills can be applied to the other courses. It indicates that she could apply the skills in her profession (Level II). When more skills are acquired, she could express her ideas in creative ways (Level III).

4.3. Viewing and representing

In developing the digital story, Cindy had gone through the process to collect digital media from the internet, including images and videos. She had to select the digital media to be included through careful viewing and understanding the meaning. The previous section indicates that the digital literacy skills are enhanced via digital storytelling activities. The ability of representing ideas in digital media was improved. Finally, an excellent result together very positive comment on the storyline, narration, special effects was obtained in the project. It is observed that the skills and knowledge were mastered through digital storytelling.

5. Conclusions

The findings in this study presented that developing students' digital literacy skills through digital storytelling activities were favoured. Students' ability of viewing and representing ideas with digital media was also improved.

Implementation of digital storytelling as an effective way of enhancing student learning in other courses at the college level would be likely possible. Students are motivated in the group work of the digital storytelling activities while developing digital literacy skills. The course coordinators are recommended to review existing curriculum, including the assessment components and assessment methods. Rubrics of assessing the digital stories for different courses are required to be identified. Additional learning resources including more computers with video editing software packages to support the courses may be required. Training workshops for the lecturers are required to be carried out before the semester starts. The lecturers could experience the challenges and difficulties that the

students may face in different stages of digital story making process. The college may need to review the existing facility such as computer lab and ensure the computers are installed with the software for photo and video editing. A technical team may be required to support the teachers and students in need.

One limitation of this study is the small sample of interviewed student participants. Also, based on the findings, it is difficult to measure the levels of digital literacy skills at each phase of making the digital stories. The teacher-researcher can only know the digital literacy skills when the digital stories are graded against rubrics at the end of the semester. Therefore, a deeper investigation on the learning process and learning outcomes of digital literacy in larger number of cases would be needed. For this aspect, regular meetings and discussions with students would enable the researcher to understand the challenges and difficulties they would face.

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Appendix 1. Questions in the first interview
Conducted at the beginning of the semester:

1. Can you tell me your name, the concentration you are studying and the year of study?
2. Have you ever represented your ideas with digital media, for example creating a digital video in your study or daily life? Such as the group assignment video.
3. What was the work about?
4. How did you create the digital video? What steps had you gone through?
5. What tools (hardware and/or software) did you use?
6. Were you satisfied with your work? Why or why not?
7. Have you encountered any difficulties of creating the digital video?
8. To understand your prior knowledge of viewing digital media, a poster (or pamphlet) will be shown to you. What do you perceive from the poster?

Questions related to the short self-introduction video:

9. What is the message that you want to say in the video?
10. How did you prepare the video?
11. Did you experience any difficulties?

Appendix 2. Questions in the second interview
Conducted at the end of the semester:

1. Can you tell me the title and theme of your video and describe what you and your group did in the project? (Follow-up questions related to storyline, storyboard, script, video shooting, video editing will be asked)
2. What is the rationale that you put ideas in your video?
3. How did you decide to develop the structure of the story?
4. What steps had you gone through in creating the digital story?
5. What reasons did you have to put the background music?
6. How did you decide where you put special effects in your video? (Refer to particular portions of the digital story)
7. What reasons make you shoot video in that angles (high, low, and eye-level), and shots (wide, medium, and close-up) in a particular scene?
8. Which part of digital storytelling did you like most? Why?
9. What were the difficulties that you encountered during the process of creating your digital story?
10. How did you resolve the difficulties, if any, in the processing of developing your digital story?
11. Do you have any suggestions how to teach digital storytelling?
12. Do you have any suggestions to the college on how to support you better in learning digital literacy skill, in any aspects including computer system (hardware and software), photo and video shooting equipment, teaching and learning activities, etc.?
13. What have you learnt from this digital video experience?
14. Can you apply what you have learnt in this video project to other courses or in future study?

The role of Universitas Terbuka-Indonesia as an Institution of Higher Education in Establishing the Existence of the Unitary Republic of Indonesia through Multicultural Education

Darmanto[21]

Abstract

As a multicultural country, Indonesia has a variety of ethnic groups, cultures, and religions that has the potential to be a conflict. This paper discusses the role that can be performed by UT as a higher education institution in providing multicultural education through distance education system.Multicultural education is necessary for the Indonesian people who has a multicultural character.Multicultural education is comprehensively designed and packaged in a module format, and integrated into an existing program at UT.Implementation of multicultural education at UT involves various activities such as registration, independent study, tutorials, and evaluation of student learning.To help the students' learning process, UT provides academic services either face to face or not face-to-face.Multicultural education is expected to remove the existing differences and mutual distrust in the society with the hope of forming the Indonesian people are more tolerant and open.

Keywords: multicultural education, distance education, open university

1. Introduction

Indonesia, from demographical aspect point of view, is one of the biggest multi cultural nations in the world that has about 13,000 big small islands, its population is more than 200 millions people, consists of about 300 tribes using about 200 different languages and there are various religious like Islam, Catholicism, Protestantism, Hinduism, Buddhism, Confucianism and many more belief sects. Indonesia as a multicultural country is also influenced by globalization. As stated by Tilaar (2004), globalization radically changes the life of the society, transforms traditional society into the modern one. The radical change results in culture shock that not only ruins the economy but also social structure, the values of life and the cultures of tribes especially (mainly) in the developing countries. Mahfud (2007) further explained, diversity or pluralism itself can create potential conflict such as separatism, natural resources dispute, economic disparity, crime caused by unemployment, civil war, rebellion, political conflict and losing the sense of humanity. The diversity is a conducive factor for the emerging of conflict in various aspects of life and Indonesian has various languages, social structure, religious, cultures and so on.

Besides globalization influenced, internet has had an impact on moral education of Indonesian people. This is challenge for our educational world in which we have to keep up with the advancement of science and technology on one hand and there is a clash between cultural values from abroad and our own moral values on the other hand. In anticipating global development and the advancement

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of communication technology, it is necessary to incorporate distance learning into national education system as a new educational paradigm. Distance learning can be carried out at all levels kinds of education that function to provide educational services for social groups that cannot get regular education (face to face).

Conducting multicultural education through distance learning is meant to increase social awareness, tolerance and decrease prejudice among groups. To maximize the process and result, various strategies are developed to make use of technology development. One of the strategies chosen is to make use of information and communication technology (ICT) as learning facilities in distance learning especially in higher institutions, formal and informal education (Khaerudin, 2008). ICT such a radio, TV and computer as distance learning media can be made use optimally so that in can reach vast areas and big number of students without limitation of time and space. According to Suryadi (2007), there are two important aspects of learning process which are progressiveness of learning approach that includes the essence, content and learning as well as the use of ICT to support learning success.

2. Multiculturalism in Indonesia

Multiculturalism is an idea of equality of local cultures without ignoring the right and existence of other culture. This is very important for all of us together to understand in the context of multicultural life of society like what we have here in Indonesian. Since in reality Indonesians have various languages, social structures, religions and so on. This variety is very conducive for conflict to erupt in various aspects of life (Mahfud, 2007).

The character of multicultural society tends to cause a conflict. Pierre L. Van de Berghe in Purwasito (2003) states that the characteristic is as follows:

- Society segmented into groups with different culture or subculture background.
- Social structures are divided into non-complementary institutions.
- Lack of determination to make consensus among society members on fundamental social values.
- Lack of awareness to make consensus so that it can create conflicts among those sub-culture groups.
- Conflict can be avoided and social integration can be realized by coercion and creation of interdependency in economic life.
- Political domination by a group on the others.

Referring to the multicultural characteristics Pierre L. Van de Berghe points out, conflicts in Indonesian can be said as an effect of cultural diversity and this shows that this nation has diversity that could not be uniformed. Multiculturalism that exists in Indonesian society conforming furthermore the existence of ethnic groups or communities within the society. Besides, a lot of people see themselves as a particular cultural community that has their own language, religion, brotherhood, physical characteristics (skin color). Therefore, we have to appreciate and enjoy the diversity Indonesia owns.

To incorporate multicultural reality, this requires understanding of cultural aspects. This understanding is needed so that the ethnic groups can relate to each other harmoniously and this can lead to the unity of the nation. This can start with early introduction to multicultural concepts. By introducing this, Indonesian society is hoped to be more tolerant, open, care, self-confident, have respect, and be patient enough when faced by injustice, abuse, un- civilization and cultural brutality.

3. Globalization Influence

Indonesia nation as part of global society now live in the third millennium, marked by the fast advancement of information communication technology (ICT) as well as transportation. Society in this millennium has high mobility in interaction with each other by making use of ICT and Transportation, Revolution in ICT transportation has changed the world so fast that appears a self conscious process that people are not only part of their region out also part of bigger life which is world society. This means that we will gradually live in one world where individuals, groups and nations are interdependent (Giddens, 2000).

Awareness as part of world society is marked by human awareness as part of globalization as Steger in Mas'oed (2003) points out: … a social condition characterized by the existence of global economic, political, cultural, and environmental interconnections and flows that make many of the currently existing borders and boundaries irrelevant." Or like Holton (1997) says, "a single interdependent world in which capital, technology, people, ideas, and cultural influences flow across borders". Globalization we experience is not just an economic phenomenon but a symptom formed by influences of political, social, cultural and economic factors (Giddens, 2001).

For Indonesian society who are multicultural, globalization has significant impact as it is felt by many social groups as some force that steps on everything on their way" (juggernaut). This force brings big social change that brings world economic and cultural insecurity. In Indonesia this uncertainty is already felt against "economic sovereignty from social groups against "foreign ownership" and "foreign culture". Globalization is also considered to be able to damage nation –state concept through globalization economic power (unstoppable economic juggernaut) and destroy the

legitimating of the state nation concept marked by the development of international terrorism (Vail, 2005) and "global (organized) crime".

Beside the impact of globalization stated above, the other impacts on Indonesia as multicultural nation are first, stronger ethnic sentiment. Ethnic has strong primordial bond such as blood relation and brotherhood, the same language and culture. This ethnic bond can result of the availability of facilities such as communication and transportation. Second, religion. In Indonesia nationalism cannot only be seen from political and ethnic points of views. Ethnicity is the substance of politics and even it becomes a spirit for living together in certain community. However, plurality in ethnicity in Indonesia is also united by religion. The elements of various religions are the formulated in the first pillar of Pancasila (Five Basics of Indonesian Principles) so that religion becomes the inspiration for brotherhood regardless of his/her religion. However, when religion is segmented again into its own clement, separation in society is unavoidable. This happens in Poso, Sampit, or Ambon. Third, welfare. Welfare is a form of strong nationalism to grow loyalty to the nation and country. Nationalism does not equal destiny but create justice, social, economic and political welfare. When the welfare as the bond of nationalism is ignored, it could be a time bomb that one day can explode to destroy the unity of the country. The demand for separator from the Republic of Indonesia by Aceh, Papua, Ambon and Riau Province is caused by unfairness in having an access into welfare.

Based on future prediction faced by Indonesia this is the impact of globalization, the Indonesia nation should predict its step in the future. The danger of disintegration as a result of Indonesia diversity can be avoided by raising their awareness to respect diversity. This starts with introducing to the concept of multicultural education through applying educational strategies and concepts on the basis of social diversity such as ethnics, cultures, religions, social status, gender, ability, age and races. Although the multicultural education is relatively new in the educational world in Indonesia, it is time to start it in order to meet the goal of the unity of Indonesia.

4. Multicultural Education in Indonesia

Multicultural education as a concept does not come out of the blue, but there are political, social, economic and intellectual interests behind it. According to Tilaar (2004), multicultural education starts from the idea and awareness of "interculturalism" related to the development of international politics that includes human rights, independence from colonialism, race discrimination, and also the escalation of plurality in the western countries as a result of migration from new independent countries to America and Europe. The awareness of interculturalism finds its place in multicultural education, as stated by R. Stavenhagen in Delors (1996): religious, linguistic, and national minorities, as well as indigenous and tribal peoples were often subordinated, sometimes forcefully and against their will, to the interest of the state and the dominant society. While many people had to discard their own cultures, languages, religions and traditions, and adapt to the alien norms and customs that

were consolidated and reproduced through national institutions, including the educational and legal system.

In simple way, multicultural education can be defined as "education in diversity of cultures in response to demographic and cultural change of particular social milleu or even the whole world. This is the same as Paulo Freire in El Ma'hady (2004) that education is not "an ivory tower" that tries to stay away from social and cultural reality. According to him, education should be able to create an educated social order not a society that is only concerned with social prestige as a result of the wealth and welfare they have. For this reason, in multicultural education there are aspects such as:

- Its aim is to form 'culture human' and 'civilized society'.
- Its content contains human values, national values and ethnic group values.
- Its method is democratic, that respects aspects of differences and diversity of national culture and ethnic groups.
- Its evaluation is determined by evaluation on student's behavior that includes perception, appreciation, and action towards other cultures.

Therefore, the main objective of multicultural education is to internalize sympathy, respect, appreciation, empathy towards followers of different religions and cultures. To meet the objective there are several approaches in multicultural education process. First, multicultural education is not denoted to equalize education and schooling or multicultural education and formal education. The main responsibility to develop cultural competence among students is not in the hand of the government but in the hand of many parties because school programs should relate to informal learning outside the school. Second, to avoid the perception of equalizing cultures with ethnic groups. It is not necessary to associate culture only with ethnic groups as happened so far. In the context of multicultural education, this approach can omit the tendency of perceiving students as stereotype according to their ethnic identity and on the contrary. This will increase understanding of similarities and differences among students from various ethnic groups. Third, the effort to support schools that are ethnically separated is contradictory to the objectives of multicultural education. Maintaining group solidarity can inhibit socialization into a new culture. Four, multicultural education can increase the understanding of cultural diversity, which culture that can be adopted is determined by situation. Five, education may play role in increasing the awareness of cultural diversity. This kind of awareness will then stay us away from cultural dichotomy between natives and non natives. Dichotomy as such limits individuals to express cultural diversity wholly.

In the context of Indonesia and diversity, the five approaches should fit the situation of Indonesia society. Because conducting multicultural education in the social order like Indonesia that is full of intergroup conflicts is very challenging. Multicultural education does not mean of 'celebrate diversity' but an advocacy to create a tolerant society. Multicultural education such as 'to care' and to understood or 'politics of recognition' towards minority groups. In this context, multicultural

education perceives society more deeply. Based on basic views that indifference an non recognition are not only rooted from racial structure, but from multicultural education paradigm that includes injustice, poverty, suppression and disadvantage of minority groups in social, cultural, economic and educational domains. This finally finds its place in educational curriculum from elementary school to higher education. The main objective of this subject is to empower minority and disadvantage groups.

5. The Roles of Distance Education in the Development of Multicultural Education in Indonesia

Multiculturalism, as pointed out by Goodenough in Muqtafa (2004), is human's normal experiences. It exists and presents in real or empiric realities. Therefore, the management of Indonesia's multicultural society cannot be taken for granted or based on a trial and error. This, on the other hand, should be done in systematic, pragmatic and sustainable ways. This is where the strategic functions of multicultural education lies, that is, as a process of developing one's competence through a standard system in order to have a perception, to evaluate, to believe and to perform actions. Through multicultural education, one is able to respect plurality and diversity as a consequence of heterogeneous culture, ethnics, tribes and religious sects (Dawam, in Naim and Sauqi, 2008).

As far as the meaning of distance education is concerned, experts have defined distance education on the basis of their own views. According to More (1973), distance education system is a learning method in which both teaching and learning process take place separately. Hence, communication between teachers and students are facilitated through printed material, electronic media and other kinds of media. However, Holmberg (1977) pointed out that distance education system was a form of education comprising a variety of learning activities at different levels of education without having the tutor's direct and/or continuous instruction for the students in the same location. It, however, needs planning process, organizing, and observing from an educational institution, as well as providing counseling process and tutorial, either in the form of direct mode (real conversation) or simulation (simulated conversation). Keegan (1980) further explained that distance education system has two components: distance learning system and distance teaching system. Distance learning system gives emphasis on the students and the process of learning (learner-centered); while distance teaching system is focused more on the process of teaching, organization system and teachers (teacher and system centered). On the other hand, distance education system has been more emphasized on both sides − the students and learning process and on the process of teaching organization system and also the teachers. Based on different definitions and descriptions of distance education system, it can be seen that distance education system seems to be highly potential not only for the sake of fulfilling the needs of self-study (individual and independent learning), but also for equal distribution of educational opportunities in the form of mass education, particularly in developing countries like Indonesia which greatly needs for the acceleration of improved quality of human resource required for development (Panen, 1999).

The capacity of face-to-face higher education is far much less than the society's needs. On the contrary, the needs of society to get access to education are enormous. Thus, distance education can give promising solutions to the needs of educational and training programs. Therefore, institutions of distance education should make use of the available infrastructure and public services, as well as technology, or a combination of the three aspects in order to deliver learning materials and also for the provision of learning services (Hardhono, 1999; Anggoro, 1999). The use of technology can improve the mastery of learning material. If carefully designed, correctly implemented and fulfill the student's needs, then technology can contribute to high quality of education in a very short time which is designed for the majority of learners (Sayidiman, 1999). Moreover, as regards the characteristic of distance education, most learning material can be delivered through various media, either printed media like books, or nonprinted media such as audio-visual material and computer-based ones (Padmo&Pribadi, 1999). In general, developing countries use printed media mostly as the main media; whereas electronic media is considered as support (Suparman & Zuhairi, 2004).

Distance education can be used both in formal and informal education. Informal education can be characterized as study programs which generally speaking do not aim to achieve certain academic qualifications, but have to do with obtaining knowledge and practical skills in the efforts to fulfill the needs of daily life and work. Multicultural education can be taught formally and informally both through distance education. Nonetheless, developing multicultural education, either formal or informal in nature, faces many challenges. The big population of Indonesia is often regarded as an obstacle in the efforts to improve the quality of life standard. The numbers of people who do not have a chance to receive education are getting bigger; whereas not all of their expectation have been fulfilled. In general, developing countries possess limited number of educational resources to be distributed. As a result, one of the strategies to deal with those constraints is through distance education (Suparman & Zuhairi, 2004).

With reference to heterogeneity of the Indonesian society and also in association with various vertical and horizontal conflicts that have taken place have impact on weakening the harmonious unity of some Indonesian citizens; it is therefore necessary to implement multicultural education through distance education. Below are some supporting factors which consider that distance education needs to be applied:

- It is necessary to seriously develop human resource and cover all aspects of national development and also all levels of the community.
- The efforts made in association with human resource development are not always successful due to limited funds, facilities and time.
- It is important to have an educational system that can reach the have-not and
- unfortunate groups. For example, those who live in rural areas.

- A conventional method involving teacher's instruction is not the only party who provides knowledge and build social attitude as expected.
- The use of telecommunication, especially satellite technology, along with the
- development of learning systems based on information and communication technology, can provide educational services up to remote areas.
- The demand of age development and rapid global changes in various aspects of social life, economics, politics and technology require high level of human resource competencies (Suparman &Zuhairi, 2004).

Due to the fact that face-to-face education has some limitation, distance education can be an alternative to sort out the educational needs of the huge number of Indonesian people. The use of information and communication technology in distance education system is extremely helpful for comprehensive development of human resource and can also reach wider areas of Indonesia. Distance education can also solve financial burden of education which many people consider as being very high. Since multicultural education is greatly needed by the society in solving multicultural conflicts, it is therefore possible to do this through distance education since some practical aspects and also advantages it has.

6. The Roles of Indonesia Open University in the Development of Multicultural Education in Indonesia.

Indonesia Open University or *Universitas Terbuka* (UT), as an institution which employs distance education system, has its own characteristics reflected in its organization structure. As a consequence, UT has its organization system which is different from other face-to-face institutions. There are basic differences in terms of facilities between what UT should have and what other face-to-face institutions should have. If face-to-face institutions are required to have adequate number of classrooms that are equivalent to the volume of their own students, than UT does not have to. In its operation, the head office of UT in Jakarta is assisted by 36 Regional Offices for Student Services (UPBJJ-UT) spreading across Indonesia. It is these regional offices who have a direct contact with the students.

Having such characteristics, UT, as an institution of distance education, has an important role within the context of multicultural education in Indonesia, as follows (Ratnawati, 2004):

- By using communication and information technology, UT is able to reach a wide range of students, even those who live remote areas and do not have access to transportation.

- As part of the national education systems, UT provides greater opportunities for the society in preparing reliable human resource and is able to compete globally.
- UT collaborates with other partners in order to increase the quality of education.

The most important thing that UT should take into account in helping the government in the area of multicultural education is by designing a system and learning material in accordance with the state priorities and by maximizing teaching facilities effectively and allocating cost efficiently and by using the available sources. The roles of UT can be optimum by using information and communication technology it owns bearing in mind that Indonesia has specific geographical conditions and limited transport facilities. The development of multicultural education can be implemented by a collaboration with other relevant institutions. The roles of UT to develop multicultural education through distance learning can be maximized as distance education has become an important part of the national education systems.

Some Constraints and Challenges in the Implementation of Multicultural Education Through Distance Education in Indonesia. There is no doubt that the application of distance education in Indonesia is extremely important as regards the characteristics that Indonesia has. However, the implementation of distance education also has some weaknesses (Suparman & Zuhairi, 2004):

- The community considers that distance education system is still below the level of standard. Such worry and doubt toward distance education is mainly caused by the belief that distance education graduates are mediocre, compared to those graduates from face-to-face education.
- For some people, learning through distance education is very difficult because of time limitation to learn at home or daily life disturbance.
- The number of drop-out students from distance education institution is always higher, as opposed to those taking education through face-to-face mode.
- Developing efficient instructional package is not always easy since it requires specific skills to do so.
- There are many other factors such as student's age, knowledge, work experience and media preference that can have influence on the success of learning through distance education.

Although the discourse of multicultural education have not yet comprehensively investigated by various parties concerned, including those experts and educational observers, multicultural education seems to be of an urgent need and also suitable for the Indonesian society which is heterogeneous.

This is even relevant during the era of autonomy that has have effect since 1999. It is necessary for the government to pay more attention to multicultural education, particularly within pluralistic and heterogeneous society.

The weaknesses of distance education mentioned above closely relate to the development of multicultural education. Some Indonesian people are still illiterate and not familiar with distance education. The state budget to implement national education is still limited. This in turn has impact on improving the quality of human resource. With such limited amount of budget, distance education which relies heavily on information and communication technology will also experience the same impact.

Although there is limitation of budget, technology and human resource, it does not mean that multicultural education can be ignored. The government together with the society, especially those who are closely linked to multicultural education and distance education, need to continuously make attempt so that multicultural education can be implemented through distance education since it has some advantages.

7. Conclusion

As a country with a big population and also as a pluralistic society, Indonesia is facing some problems associated with heterogeneity. Since the early Indonesian Independence Day, such diversity has been forced by the government to be a false equality. As a result, under these conditions, conflicts among different communities, groups or ethnics are often unavoidable. Those unsolved conflicts will certainly lead to community's separation which in the end creates national disintegration. A conflict taken place in one region caused by wealth- related issues might lead to separatism that puts the national unity at risk.

Although multicultural education is still regarded as a relatively new kind of discourse, there is still a possibility to implement multicultural education here in Indonesia. In addition, multicultural education goes hand in hand with the principles recognized in the national education systems which strongly support the education implemented democratically, fairly and not discriminatively while upholding human rights, religious values, cultural values, national diversity at the same time.

Multicultural education can be carried out through distance education because of the advantages it has. Distance education can reach wider area of operation giving equal opportunity of education for the society, as well as easy access to distance education. Although it is realized that distance education has some weaknesses, it can play a crucial role in developing multicultural education while taking the characteristics of Indonesia as a nation into account. UT as an institution of distance education should play an important role in helping the government to develop multicultural education. In doing so, UT should collaborate with other related institutions. UT can also develop multicultural education based on information and communication technology that allows the

students to get access to education through distance mode. UT can also play a role in maintaining national integrity and unity which is multicultural via a large number of programs of distance education it offers.

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LOWA operator in application on online student assessment

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Abstract

The innovation of eLearning method has changed the traditional teaching and learning, this method also led to new requirements in order to meet the goals of education and training. The evaluation of the effectiveness of student learning process are also becoming more complex as there are so many data related to the students' activities are exported from LMS systems. In this paper, we would like to propose a new method of assess online student learning performance by application LOWA (linguistic ordered weighted average) operator in evaluation process. This method does not use the traditional averaging operator in aggregating data collected from the LMS system such as student activities, test result, forum activities, online time, final exam result, etc., but using a fuzzy linguistic operator LOWA. We hope this operator will more effective and more accurate in assess student because it considers weight of each operand in the average function.

Keywords: student assessment, online learning, linguistic operator

1. Introduction

The application of information technology in the field of education has brought many significant achievements, help change traditional teaching methods and in accordance with the development trend of the times. Most of the leading universities in the world and a lot of universities in Vietnam provide eLearning services, allowing students access to a whole new learning environment, more challenging, but also bring more value to the learners themselves.

To organize the online training, the universities need to build a online learning environment through learning management system (LMS - Learning Management System). Then they design and construct learning scenarios based on the provision of electronic learning materials and learning activities that students need to do to participate in the course. These activities include the self-study on electronic lectures, perform a self-assessment tests or more complex activities such as group exercises, case studies and discussion on the forums, social network. Based on the results of these activities by students, lecturers and academic managers will know the knowledge level of student and make some adjustments to content of activities if necessary.

This assessment is primarily based on the results of subjective statistics, rigid, does not ensure accurate evaluation of academic performance of students participating in the online learning environment. The online learning management system provides a wide range of information related to the activities of the students, however, when the number of students quickly increases, the volume of information is huge, the statistics and evaluation will take a lot of time and effort, while the results were unlikely to be reliable. For example, Moodle – the most popular online learning management system now also provides approximately twenty different information related to the learning activities of students: number of logins, logins time, test scores, and post on

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forums, system areas on which students usually visit, etc. The training organizations sometimes only selected a few elements in which to evaluate the effectiveness of their online training. The evaluation is calculated and using a certain scale, popular 10 and 100 with an average operator normally. This methodology can not consider all perspectives of academic performance and students' activities on the system.

Within the scope of this article, the authors want to suggest a methodology to allow applying the LOWA operator (Linguistic Ordered Weighted Average) to evaluate the performance of students with the data obtained from the online learning management system (LMS).

2. Problems

2.1. Mathematical model of effective learning assesment of students

Each online learning management system has ability to track and provide information related to participation in the system with different criteria. In essence, we can consider each of these information is a two-dimensional matrix to determine (measure) values of the students' results be achieved in any "coordinate" of knowledge, skill or attitude. Any "coordinate values" of the learners is identified and described in detail in accordance with standards, criteria (indicators) and quality levels.

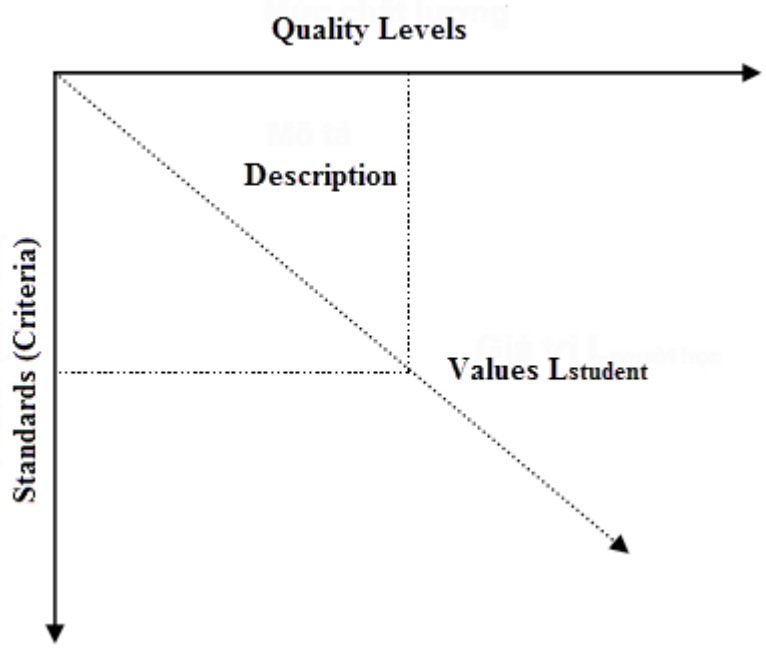

Figure 1. Values of the students' results in a two-dimensional matrix

By convention certain, we can fully consider the value or the quality of the respective criteria to a scale, in the scope of this article, we used a scale of 100.

Set number of criteria is n, and the value of the corresponding criteria are X_1 to X_n. Due to the nature of the criteria is different, so the criteria have different importance level, we call W1 to Wn is the importance (or weight) of criteria from 1 to n. Thus, the assesment for learning performance E of student will be the sum of the value of X and W via a function F.

$$E = F(X, W)$$

Usually, E is calculated by the average value as follows:

$$E = \frac{\sum_{i=1}^{n} W_i * X_i}{\sum_{i=1}^{n} W_i}$$

2.2. Issues arising

With the method for calculating the average value, the criteria to be classified according to the weight and not shown the role of criteria in evaluating students, since it can not come up with the evaluation or review properly. Therefore, the necessary research to make the new method of calculating the value is the thing to be considered.

3. Proposal of new evaluation method based on lowa operator

3.1. Operator OWA (Ordered weighted averaging) and improved

Definition 3.1*: [Yager, 1] An OWA operator of dimension n is a mapping F : Rn* $\rightarrow$ *R, that has an associated n vector w =[w1,w2, ... ,wn]T, such that* $0 \le wi \le 1$, $\sum_i W_i = 1$.

Let a = (a1, ..., an) $\in$ *Rn, we define*

$$F(a) = \sum_j wjbj,$$

where bj is the j th largest of ai .

An example: Assume $W=[0.4, 0.3, 0.2, 0.1]^T$, a =(0.7, 1, 0.3, 0.6) ,then the vector b is

b =(1, 0.7, 0.6, 0.3), and F(a) = (0.4)(1)+(0.3)(0.7)+(0.2)(0.6)+(0.1)(0.3) = 0.76

The LOWA operator is based on the ordered weighted averaging (OWA) operator and on the convex combination of linguistic labels defined by Delgado et al. [9].

Definition 3.2: *Let A =*$\{a_1, ..., a_m\}$ *be a set of labels to aggregate, then the LOWA operator is defined as*

$Low(A,W) = W.B^T = C_m\{w_k, b_k, k =1, ... ,m\}$

$= w_1 \otimes b_1 \oplus (1-w_1) \otimes C_{m-1}\{\beta_h, b_h , h =2, ..., m\}$,

where $W=[w_1, ..., w_m]$, *is a weighting vector such that,* $w_i \in [0,1]$ *and* $\Sigma_i w_i = 1$, $\beta_h = w_h/(1-w_1)$, $h=2,...,m$, *and B is the associated ordered labels vector. Each element* $b_i \in B$ *is the i th largest label in the collection* $\{a_1, ..., a_m\}$. C_m *is the convex combination operator of m labels and if m= 2 then it is defined as*

$$C_2\{w_i, bi, i =1,2\} = w_1 \otimes s_j \oplus (1- w_1) \otimes s_i = s_k,$$

$s_j, s_i \in S$ $(j \ge i)$ *such that* $k = i +round(w_1.(j-i))$, *where round is the usual round operator, and* $b_1 = s_j$, $b_2 = s_i$.

If $w_j = 1$ *and* $w_i = 0$ *for all* $i \ne j$, *then the convex combination is defined as* $C_m\{w_i , b_i , i=1,..,m\} = b_j$.

Yager suggested the way to compute the weights of LOWA aggregation operator using linguistic quantifiers Q, is given by the expression:

$$w_i = Q(i/n) - Q((i-1)/n), \quad i = 1, ..., n.$$

Herrera et al. used this way to their LOWA.

The application of LOWA operators to aggregate fuzzy preference relations were given in [5 – 8]. In these papers F.Herrera et al presented some new aggregation procedures in group decision making in linguistic setting.

3.2. Operators LOWA integrated language enhancements

However, in many real cases the presented way to obtain the weights is not suitable, so based on the original LOWA operator, Bui Cong Cuong were introduce a improved LOWA operator in oder to have result closer to mathematical average when applying to specific problems. New operator is defined as follow:

Definition III.3. *Let $a = \{a_1, ..., a_m\}$ be a set of labels to aggregate, and b is the associated ordered labels vector. Each element $b_i \in b$ is the i th largest label in the collection $\{a_1, ..., a_m\}$, i.e.*

$b = \{a_{im}, a_{i(m-1)}, ..., a_{i1}\}$, $a_{im} \geq a_{i(m-1)} \geq ... \geq a_{i1}$.

The Low operator is defined as follow:

$Low(a,w) = C\{(w_{im}, a_{im}),(1- w_{im}, Low(a',w'))\}$

where $w = [w_1, ..., w_m]$, is a weighting vector such that, $w_i \in [0,1]$ and $\Sigma_i w_i = 1$, $a' = \{a_{i(m-1)}, ..., a_{i1}\}$, $w' = \{w'_{i(m-1)}, ..., w'_{i1}\}$, $w'_j = w_j/(1- w_{im})$.

C is the convex combination operator of 2 labels s_j, s_i, $j \geq i$ with $w_j > 0$, $w_i > 0$, $w_j + w_i = 1$, $C\{(w_j,s_j).(w_i,s_i)\} = s_k$, here $k = i + round(w_j.(j-i))$, where round is the usual round operator, remark that we can compute only with j such that $w_j > 0$.

With this operator, if the label set S come from R set, Low operator will be average function in which consider weigt of each factor.

3.3. Recommended LOWA operator applied to evaluate the effectiveness of student learning

Referring to conclusion upper, then if S come from R set, the Low operator can considered as the average operator with weighted, this operator has a certain priority for the higher valuable weights. So we choose to apply this operator to evaluate the activities of the students on the online learning management system because the evaluation criteria given by the LMS is very diverse, the Low operator will help to consider priority between criteria beside weighted values. For example, who had a high point in the self-assessment tests will be given priority over people high frequency access into forums.

Thus, the implementation of performance assessment of students will be based on function:

$$E = Low(X,w)$$

With:

$X = \{x_1, x_2, \ldots, x_i\}$, x_i is the assessed value of the i^{th} criteria on LMS

$w = \{w_1, w_2, \ldots, w_n\}, w_i = \frac{W}{\sum_i W_i}$ where W_i is the weight of the i criteria, this value can be defined by experts at first.

4. Conclusion

The application of research in the field of information technology in education opens up a new direction in both areas, making training can bring greater efficiency. For the scope of this article, only the original idea of our, the application to the assessment LOWA operator also huge space for further development, such as weights building improvements or led to weights self-calculated in order to refine the most appropriate weights. We are looking forward to receiving comments and reviews to help to study in depth and can go on to apply in practice.

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The Development of An Open Educational Resources (OER) Model based on Connectivism Theory to Enhance Knowledge Sharing between Thai OER and Malaysian OER.

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Abstract

This paper presents the development of an Open Educational Resources (OERs) model based on Connectivism theory with the aim to enhance knowledge sharing activity between Thai and Malaysian Open Educational Resources. Connectivism theory was used to emphasize on the connection of a learning network in the digital age where learning is no longer seen as an individual cognitive process but rather a distribution of massive knowledge across network. Knowledge sharing plays a prominent role based on Connectivism concept (Wiley 2009). It is therefore significantly important to develop the OERs that promote the sharing of knowledge. Based on this concept, this research propose a model which could be used to promote knowledge sharing in OERs by using Thailand and Malaysian OER tools as a case study based on Connectivism theory and knowledge sharing.

Keywords: Open Educational Resource (OER), Connectivism, Knowledge Sharing

1. Introduction

Due to the advancement of technology, more information and knowledge becomes available, accessible and ease to retrieve from diverse resources through the use of Internet. Learning is no longer obtainable solely based on face-to-face classroom learning but also through the Open Online Learning environment. (UNESCO, 2012). This learning environment allows learners to gain access to the open courseware and content, open software tools, open material and repositories of learning object in various forms. Knowledge is available through the use of website, personal blog writing or even through social media. Various visualization and knowledge transfer approaches are used such as text, graphical illustration, audio and video. These allow an individual to depict, illustrate, explain and distribute the knowledge in a creative and innovative way.

In education, the concept of "learning at anywhere, at any time" is one of the most interesting research topics. Especially, in higher education level which emphasize more on "self-learning" and "student-centered learning". (Kuei-Ping Shih, Hung-Chang Chen, Chih-Yung Chang and Tai-Chien Kao, 2010). The higher education curriculum as this level tends to emphasize more on activities comprehended with documenting, project, as well as training course in

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order to develop researching skills in information searching, gathering and analysing. Students can therefore generate new knowledge based on the information, understanding and analysing technique they used. Teachers are acting as the instructor or advisor and in some circumstance might also act as an information provider to support and motivated learning (Attard, 2010; European Higher Education Area, 2010). In digital age, learners can connect and access information promptly, given them the ability to gain more information and create knowledge faster than they could previously.

Open Educational Resources allows learners to access the information such as learning materials, research materials in form of digital resources from public domain at no cost. The license indicates the constraint of user in obtaining, modifying and redistributing of the material with the respect to the intellectual property rights and copyright as defined by related international conventions (UNESCO, 2012; West and Victor, (2011. This public copyright license is accordance to the international standard licensing. The most frequently used copyright license is called "Creative Commons (CC) Licenses" which allows freely distribution of copyrighted work by enable other people to share, use, and make some modification on the owner's piece of work. This work could be in form of audio, text, graphical illustration, multimedia work or other types of work.

Some examples of the well-known Open Educational Resources are MIT Open Courseware, Connexions, Khan Academy and MERLOT. MIT Open Courseware is one of the enormous open educational resources disseminated by the Massachusetts Institute of Technology (MIT). MIT distributes and offers learning material which include video lecture in numerous subjects. Connexions are another example of Open Educational Resources which contains worldwide learning materials. Connexions can be considered as a library which allows learners and teachers to freely access and retrieve the information. Khan Academy is non-profit educational institute offering free courses with the aims to provide video lecture from earliest age as pre-school to grade 12 (K12). MERLOT provides multimedia learning material for online learning by utilizing the existing technology in supporting learning.

Recently, learning through the use of Open Educational Resource is grabbing the attention of both learners and teachers in South East Asia, especially in Thailand and Malaysia. Massive amount of Open Educational Resources and research works regarding OER are available and rapidly increasing. In Thailand, the OERs is emphasizing more on supporting distance learning (Thailand-Malaysia Think Tank and Scholar Network, 2012.) It has been used as a tool for asynchronous self-learning through various forms include web-based learning, e-Learning, Project-based learning. Several multimedia channels are used to distribute these

OER such as TV Channel, LMS, Podcast, Text, Video and YouTube channel. The copyrighted license is used and stated clearly to indicate the right of utilizing these resources. Undergraduate students are the most common group to access the OER in Thailand. However, high-school and those who interest in particular subjects are also accessing the OER. Most OER content was developed in order to be accessible via the Internet. Therefore, the web design development principles are applied in the development of OER. These principles include 1. Page and Site Design, 2. Content Design, 3. Navigation Design 4. Information Accessibility and 5. Usability testing. Since OER system is relatively new areas of research. There is no specific guideline to evaluate the competency and efficiency of the OER system. e-Learning is considering the close area and therefore the guideline used to guide the development of e-Learning could been applied in order to ensure the efficiency of the OER system. Khan, (2005) proposed a guideline on e-Learning development, referred as an e-Learning Quick Checklist. In order to study the current using OER system, a quick survey was done by taking into account the most visited OER systems in Malaysia and Thailand and comparing the percentage fulfilment of the e-Learning developed website over these checklists. These could therefore show the competency of the design and development of OER systems. 7 mostly visited OER systems in Thailand had fulfil 77.5 percent over the identified checklist. Meanwhile, the OER system in Malaysia tends to focus more on supporting learning in higher education (Thailand-Malaysia Think Tank and Scholar Network, 2012.). Students need to register in particular subject in order to gain access to the information and learning materials. It focuses more on supporting self-learning by using the provided tools according to the curriculum and syllabus of that particular subject. OER is acting as a database for students to search and download the information they need. Based on the principle proposed by Khan (2005) the checklist completion is 56.42 percent. One of the principles proposed by Khan which still lack in Malaysia and Thailand universities is Navigation Design. This principle emphasizes on the connection to the other resources as well as providing the platform for students to connect to their peers and teachers. Based on this finding it showed that the OER in Thailand and Malaysia are still lacking of the connectivity. Besides, there is still week connection between these two networks as the sharing of resources and connection between the two countries are not presented in the survey. As a result, it is necessary for both OERs to develop a connectivity of information such as the sharing of information between the two countries to support self-learning which therefore could yield to create the lifelong learning. (OECD, 2004). Despite the fact that the rapid evolvement of technology results in evolvement of knowledge and the development of nation. The amount of

knowledge increase exponentially. It is essential for educational sector to be evolved in order to cope with these changes. Because the knowledge that prove to be true today might be proving wrong tomorrow.

As the ASEAN countries are going to launch the ASEAN Economic Community which shows a great impact on every country in South East Asia. Education is one of the important aspect that will be fully support by this agreement. The importance of connectivity of knowledge between Thailand and Malaysia is undeniable. The theory of "Connectivism" is therefore could be used to guide the design and development in order to create the connection and sharing of knowledge between the community, in particular, Asian community.

Therefore, the research paper is aimed to propose the Open Educational Resource model based on Connectivism with the aim to close this gap by enhancing the knowledge sharing between the OER system. OER in Thailand and Malaysia are used as a case study.

2. Literture Review

2.1. Connectivism

The theory of Connectivism was developed by George Siemen (2005). He mentioned that Connectivism is one of the educational theories that could support the rapid change of knowledge and discovery of new knowledge. In current digital age, the knowledge life is shorter than it used to be in twenty year earlier (Gonzalez, 2004). This is due to the fast development, progressively evolving of the technology which consequences shorten the time spent on new knowledge discovery from the immense available of information. As a result, learning solely through classroom based is not sufficient anymore. People need to develop themself to handle with the changing of technology and culture as well as new knowledge that might impact their lives.

Siemens (2005) defined eight principles of Connectivism:

- Learning occurs through diversity of perspectives and opinion regarding the subjects.
- Learning is constructed through the network of particular node from a particular important sources of information
- Learning is not merely a result of learners but also technology discovery
- Capacity to continuously acquire knowledge is more important than what knowledge had existed.
- Supporting and maintaining the connection is vital in supporting continuous learning.
- The ability to recognize the connectivity between the existing information, opinions, and concepts is one of the central skills in learning

- To have an up to date and accurate knowledge is the main aim of Connectivism theory
- *"Decision-making is one of the learning process";* which learners need to pay particular attention by taking into account the reality. This is due to the knowledge as of today might be obsolete or otherwise proving to be wrong in the future.

Siemens (2005) also proposed six main components required in learning based on Connectivism theory, which are:

- A platform where both instructors/teacher and students/learners could be connected
- A platform for individual to express their ideas (blog, journal)
- A platform where everyone can discuss, share and exchange the ideas (discussion forum, open meetings)
- A platform to search and explore the existing knowledge (portal, website)
- A platform where students/learners can learn in a structured course (courses, tutorials)
- A platform to be update regarding the new information or knowledge (news, research)

Connectivism drawing the concept of knowledge acquisition in the digital age where information and knowledge distribute and spread all over the network. Learning can occur at any places and in the informal learning environment. Learning is no longer an individual cognitive process but rather in a network of a community. In a network, learning arose from the sharing of knowledge, exchanging of ideas and opinion, communication between each node of knowledge by taking into account the rapid change, up to date and accuracy of information. The connection between each node of knowledge required different kind of supporting activities, learners and suitable time in order to create the most effective learning environment.

2.2. The Concept of Knowledge Sharing

Various definitions were given to explain the concept of knowledge sharing based on various perspectives and the domain that knowledge sharing is being applied to. Van Den Hooff and De Ridders (2004) defined knowledge sharing as a procedure of "mutual exchange" of knowledge to generate new knowledge. This definition denotes two different stages of knowledge which are essential to knowledge sharing. This includes the previous knowledge on certain subject and the new knowledge which could be created from the existing one. Therefore, knowledge sharing can be considered as the redistributing of one's knowledge in combining with other members' knowledge that pay the same interest in a particular matter in order to create new knowledge. Furthermore, there are different behaviors on transferring of

knowledge from one person to another person. For example, one is generally communicating to present ideas and other one might be consulting or given advice to other person. These two actions are considered as a knowledge sharing behaviors too. In order to promote knowledge sharing, the activity used in an organization or educational sector should encourage the knowledge sharing behaviors too. Besides creating a new knowledge, knowledge sharing also reflects one's thinking and analysing skills too. Hass and Hansen (2007) indicated that implementing knowledge sharing in an organization showed a positive impact on the performance and innovation of the organization too.

2.2.1 Knowledge Sharing in Education

Knowledge sharing in education is referred to the sharing of knowledge for a particular group who share the same interest in particular issues. The sharing of knowledge requires the organization, construction and managing of knowledge which called Knowledge management. It is necessary to create the environment which motivates the sharing of knowledge within the learning community. To create this environment, three components are required, this included 1. People; 2. Place; and 3. Infrastructure (Chotmanee, 2009).

- People: people are the most important component. This is because people are the main source of knowledge which they can acquire the knowledge through their cognitive process and experience. People are the main actor in sharing the knowledge too.
- Place: place is considered as another important component. Place can create the environment which encourages the members in a community to share their ideas, exchange the opinion and knowledge.
- Infrastructure: infrastructure refers to any application, system or platform which assists and supports the sharing of knowledge. For example, the computer use in a community to distribute the idea of a person.

Knowledge sharing is a driven factor to support the distribution of knowledge in a network. Learners acquire knowledge based on a variety of resources, then analyse and synthesis accurately to generate their own knowledge. These could yield to create the demand in sharing of the knowledge in order to distribute, discuss with those who pay the same interest for deeper and clearer understanding of particular subject of interest. This could be one of the reasons which increase the volume of information progressively in the digital age.

2.3. Open Educational Resource

Knowledge sharing can distribute through various approaches such as writing blog, sharing on social media, uploading on YouTube. Open Educational Resource (OER) is one of the effective approaches which allow everyone to have a free access to the educational related materials. The development of OER system requires information technology management and other supporting tools. OER is accessible through public domain which defined by the copyrighted license indicated the permission to use the material for educational purposed. The information available in OER cover from learning material, course material, modules, text book, video lecture, course exercise and assignments as well as examination papers. To access this information, related applications and tools are required. Current use OER systems and applications available in public domain are include Open Courseware, Open Education Resources free software, Open Source software, Open Source Initiative, Open Content, Open Publication License and Creative Commons. OER can be categorized into 3 main forms which are content, tools and capacity (Downes , 2009).

- Content: in general, most of Open Courseware applications can be considered as a content form which focused more on offering different kind of learning materials.
- Tools: tools can be used to develop learning material and medium. Currently, both free and commercialized versions are available worldwide.
- Capacity: referring to the EOR systems that contain large amount of information and providing with the effective searching capacity. This type of OER systems is sometimes referred as a digital library.

Wiley (2009) identified 4 "R's" characteristics of OER as:

- Reuse – is considered as fundamental characteristics. Each person is allowed to access, download and use it for their own plans.
- Redistribute – in general, materials in OER are allowed to be shared to others
- Revise – OER permits people to make some modifications towards the material
- Remix – OER allows to combine different resources in order to make a new one

However, accessing, reusing, redistributing, revising and remixing the available materials in OER is restricted by the copyright license and different type of license offering different degree of actions one can perform with the materials. Creative Commons (CC) (Creativecommons.org, 2002) license is one of the most frequently used license which can be divided into 6 different licenses, include:

- CC-BY requires the user to give the proper credit to the original works with the permit to be used for commercialization.

- CC-BY-SA requires the user to give the proper credit to the original works and indicate if the changes had been made with the permit to be used for commercialization. Redistribution of the new version of material under the same license.
- CC-BY-ND requires the user to give the proper credit to the original works and indicate if the changes had been made. The materials are allowed to be used for commercialization. However, users are not allowed to redistribute the modified version of the works.
- CC-BY-NC requires the user to give the proper credit to the original works and indicate if the changes had been made. However, users are not allowed to redistribute the modified version of the works.
- CC-BY-NC requires the user to give the proper credit to the original works and indicate if the changes had been made. However, this material or modified version is not allowed to be used for commercial purposed.
- CC-BY-NC-SA requires the user to give the proper credit to the original works and indicate if the changes had been made with the restriction not to be used for commercialization. Redistribution of the new version of material under the same license.
- CC-BY-NC-ND requires the user to give the proper credit to the original works and indicate if the changes had been made. However, commercialization and redistribution of modified version are not permitted.

OER is playing a significant role in current education (Li Yuan, Sheila Maeill (2008), Wilbert Kraan, Jan Hylén (2006)). It surpasses and overcomes the limitation of traditional learning style by offering asynchronous access to the information regardless of place and time. It offers variety of resources, fast accessing and effective search engine. The clear statement of license also assisting in finding the original copy of the works. With this license, it could maintain the accuracy of information. Moreover, it also highlights the ethical perspective in researching to prevent other people to use that particular material for other undesirable purposed.

2.4 The Conceptual Framework

Based on literature review, it showed that the development of OER based on Connectivism theory should endorse the 4R's principle identified by Wiley (2009). Knowledge sharing is

playing a critical path and acting as a driven factor for any OER based on Connectivism to be successful. The challenge in enhancing the OER system are to create the connectivity between OER in two countries, Thailand and Malaysia, introduce the compromised activity for Thai and Malaysian learners in order to promote the knowledge sharing from different sources between 2 parties. This could also open an opportunity to collaboratively working together, promote the interactivity and further strengthen the relationship between two countries. The following figure illustrates the proposed model based on Connectivism with the aim to promote knowledge sharing in an OER system.

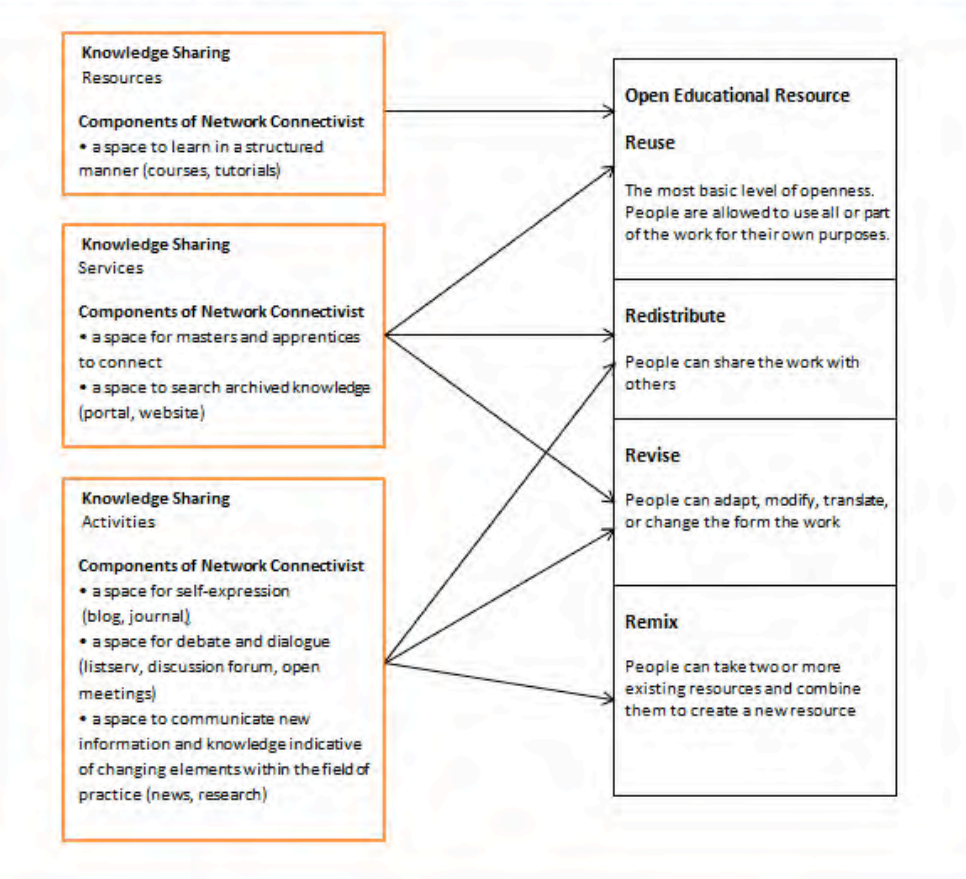

Figure 1. Conceptual Framework

This figure emphasize on the learning tools which could support knowledge sharing. In each tools the component of network connectivist proposed by Siemens (2005) are aimed to support the characteristics identified as 4R's of the OER system proposed by Wiley (2009).

3. Methodology

The methodology used in this research begins with critically review and analyse the related literature on OER and theories that currently be used to support the development of OER.

Connectivism encompasses with knowledge sharing shows significant role to enhance the OER system. As a result of this stage the table is used to clearly state the related components. Using OER in Thailand and Malaysia as a case study later uses this finding to formulate the proposed model with the objective to enhance the knowledge sharing in OER system. This research is expected to be evaluated by 5 experts in the area of OER in term of overall OER system, learning and teaching in the OER, tools used in OER and the usage of OER.

4. Analysis & Discussion

4.1 Based on the analysis, the Model of Open Educational Resources (OER) based on Connectivism theory to enhance knowledge sharing between Thai OER and Malaysian OER

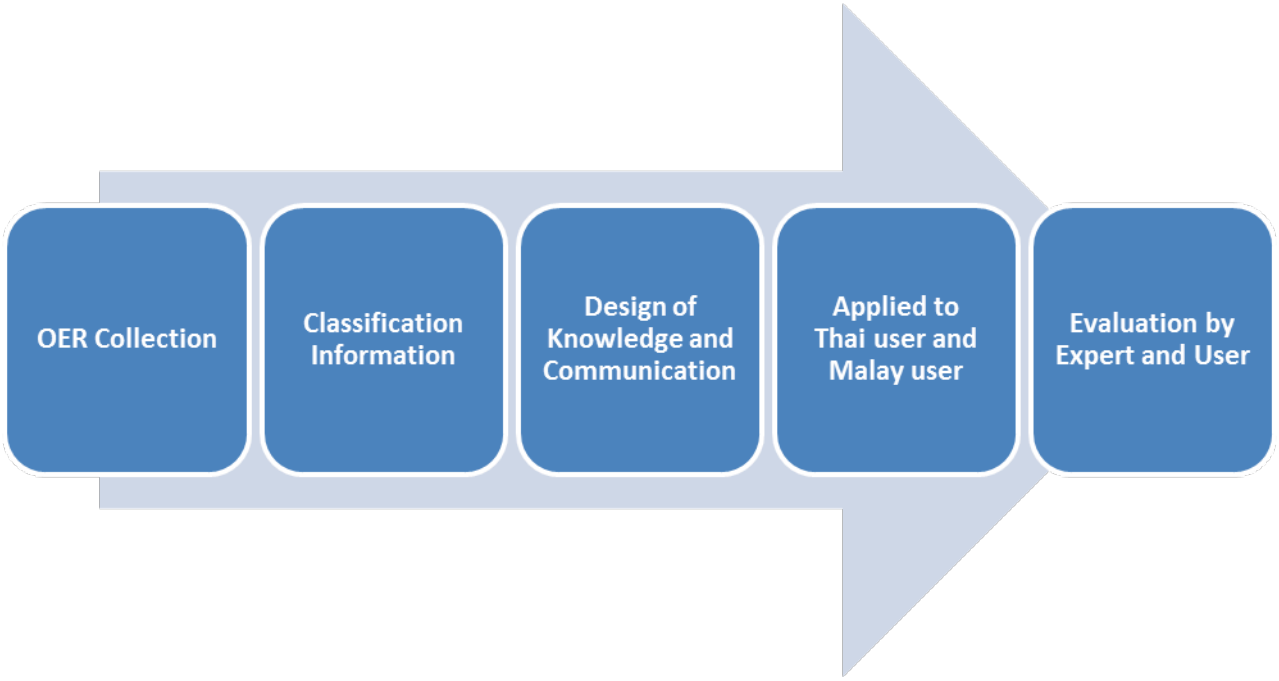

Figure 2. Model of Open Educational Resources (OER) based on Connectivism theory to enhance knowledge sharing between Thai OER and Malaysian OER

4.2. Model Explanation

Table 1. Model Explanation

Step Model	*Explanation*
1. OER Collection	1. Collaboratively identify the topic of interest and objectives of learning by both teacher and learners from two countries by brainstorming using available channel such as web-board. 2. Discuss and exchange ideas on the identified topic. 3. Gathering the open learning material related to the identified topic. 4. Update the progress through web-board or forum.
2. Classification Information	1. Categorize the Open Learning Material systematically according to the objectives identified in Phase 1: OER Collection 2. Present the categorization through web-board or forum. 3. Collaboratively evaluation the categorization of opens learning material, discussion and shares the idea if there are any concerns through web-board or forum.
3. Design of Knowledge and Communication	1. Design learning content and structure. Teachers should instruct and advice on the learning structure and step taken in learning. Usually, it should begin from the most basic concept to deeper and more complicated matter. Meanwhile, learners should also provide feedback based on their perspective as students. 2. Design learning activity which could collaboratively interact by both students from Thailand and Malaysia - Clearly identify objectives of learning - Clearly state the class's duration - Precisely state the required activity for the purposed class - Clearly identify the evaluation and assessment method for the course The learning activities as designed by teacher should promote the sharing of knowledge and ideas from learners. Learners can refer to the available information as categorized in OER system. It is important to promote the sharing and discussion on the learning subject. This is because the ideas shared by students from different countries could be impacted by the different of culture and society they lived in. Therefore, students could view the same issues from totally different angles and different perspectives. The teacher could assess the performance of student from their end product and from the sharing and discussion of learners through the digital trails they left behind in the web-board, forum or any available discussion platform. Using "food" as an example subject, the discussion might be in a topic of how Thai students feel and taste about Malaysian food. Students from two different countries could therefore present their ideas in web-board, forum, live chat between two parties or any discussion platform. The idea could be presented using "infographic", text, and Slide presentation, Chart etc. Teacher could evaluate the performance afterward based on the numbers and quality of discussion, participation in the discussion or even the material students created to present their ideas. 3. Develop the learning tools based on the proposed model. The tools will later be licensing with the Creative Common (CC) License.
4. Applied to Thai user and Malay user	Demonstrate and apply with Thai and Malaysian students
5. Evaluation by Expert and User	The assessment can be divided into 2 parts: 1. Assess by expert on the OER itself, mainly on the resources and activity in within OER 2. Assess by learners on the satisfaction and user experience in using the OER.

5. Conclusion

OER based on Connectivism theory underlie the rapid change of technology in digital age. The lifetime of knowledge has become quickly obsolete due to the fast development of technology, high demand and volume of technology usage, which resulted in vast amount of data. Knowledge could be formulated quicker than it was previously in the past century. Education should adapt to this changes. Connectivism theory takes into account the manner of rapid change in information and knowledge of the digital age. Learning is no longer compulsory to be in formal face-to-face classroom or learning through books any more. Various of online, distance learning courses is available worldwide. Teacher can organize more creative courses and introduce more on knowledge sharing from diversity of resources. Moreover, students can also be connected to their peer of interest from all over the world. Learning new things and knowledge become easily and more accessibly.

This paper presents the proposed model of OER based on Connectivism theory with the aim to enhance knowledge sharing between Thai and Malaysian students. The proposed model comprised of 5 main stages which are OER (1) Collection, (2) Information classification, (3) Design of knowledge and communication, (4) Apply in Thai and Malaysian OER, (5) Evaluation. The earliest stage begins with OER Collection, which aims to collaboratively identify subjects and objective of online course, which can be done through the discussion on web board or forum, made decision on the discussion. Later, the information regarding the subject defined earlier will begin to be collected. The progress of information collection should be update constantly through available communication channel such as web-board or forum. Second stage is aim to classify the information into its corresponding objectives. These categorizations will later be presented through online learning tools. The progress of information collection should be update constantly through available communication channel such as web-board or forum or any other flexible available channel. Both teachers and students are requested to evaluate if the material and information were classified accordingly as well as provide feedbacks on this. In the third stage, the content and learning structure will be designed. Teachers are responsible to provide instruction on how to design the course. The course should begin from the basic concepts toward more complicated topics. Design the collaborative learning activity between Thai and Malaysian students by identify co-objectives, duration of the course, procedures use in the activity and assessment approach. The activity should be corresponding with the identified objectives and it also should promote the collaboration and sharing of information. After that the learning tools will be developed and

licensed. The fourth stage will focus on the application of proposed tools and model in the course for both Thai and Malaysian students. Finally, both expert and students will evaluate the proposed model in term of usability and satisfaction.

Open Educational Resources will be useless if there is no connection between blaze of resources and sharing of information and knowledge by learners. The connection and knowledge sharing are considered as a core concept of any OER systems both nationally and internationally. The collaboration between organizations to support the OER is required because it can motivate learners from different community to work together, share the information. This could create the lifelong learning. Furthermore, learners can also receive update information regarding the subject of interest. This information can be beneficial in their education and it can also be applied in daily life activities.

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Utilization of Online Radio for Learning Media. Case study at Universitas Terbuka

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Abstract

Technology has created a revolution in the various sectors such as health, trade, government, and education as well. In educational sector, the use of educational technology will improve the quality of education, the amount of enrolment, and the ease of learners to follow the whole process of learning. Faced with the geographical conditions of the area which consists of various islands and diverse terrain textures, Indonesia requires innovation in the educational process. A qualitative research was conducted at Universitas Terbuka to explore a format design of online radio as one of learning media that can be followed by the students all over Indonesia. Collecting data using interviews with IT experts, Instructional design expert, literature studies and other supporting documents. The results showed that online radio has a highly flexible medium for students as well as tutors. The tutor has a chance to improve their learning material by sharing and discussing with another tutor based on their learning experiences. The students have a chance to learn a learning material from various learning materials given by another tutor from another tutorial classes, so that they can improve their understanding about their course materials. The students also has a chance to choose the tutorial class they like. Besides, they can communicate well with the UT's students all over Indonesia.

Keyword : online radio, learning media, disseminating of learning materials

1. Introduction

Advances in technology have revolutionized the systems and procedures of the transaction in all aspects of life. Technology through a variety of social activities, such as communication, information exchange faster scrolling. Similarly, transactions work faster and more efficiently. The advent of new communication technologies also creates changes in media, print media originally ranks first in the consumption of news / publications but is currently experiencing a shift in the print media quantity, community prefers electronic media / digital to enjoy a wide range of information including news.

In the world of education, technological advances also affect the organization of learning. Originally providing education that runs in the conventional, classroom-based and face-to-face has changed, that the transfer of science can do electronic / digital. The phenomenon of learning systems like this have been done on the various levels of education from primary school to university.

The Open University as a college long distance currently have implemented the concept of digital learning system, in which various materials learning materials accessible to students online.

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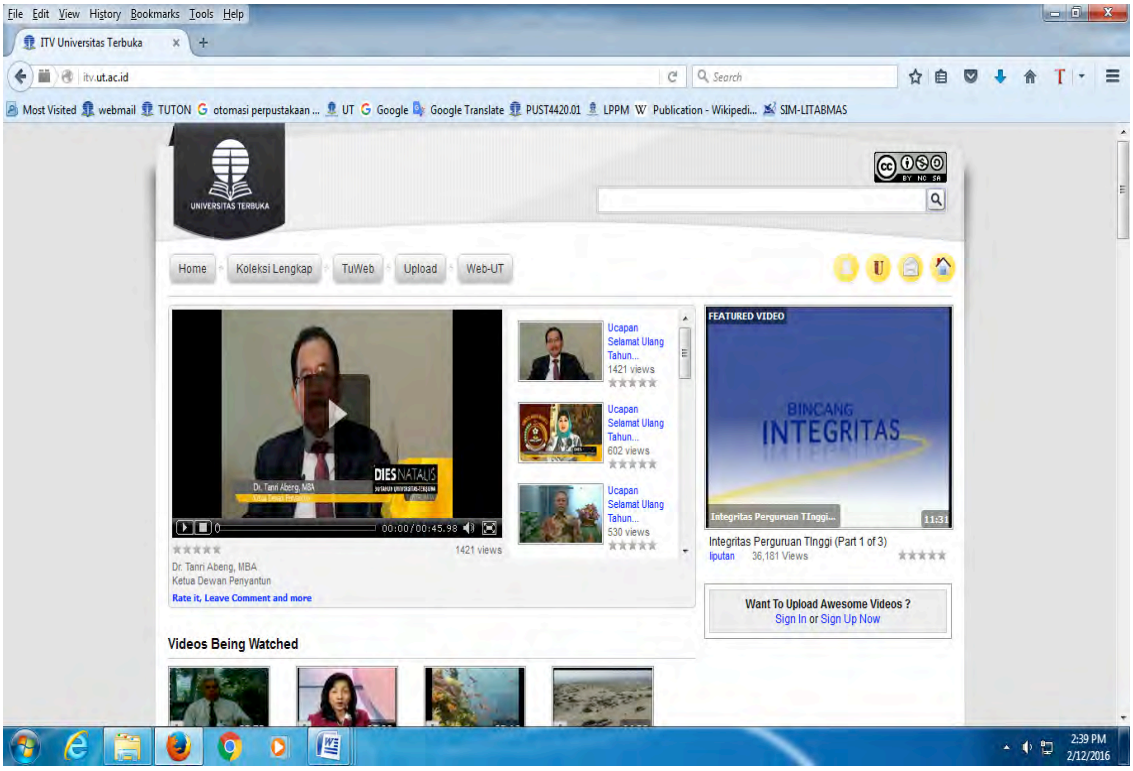
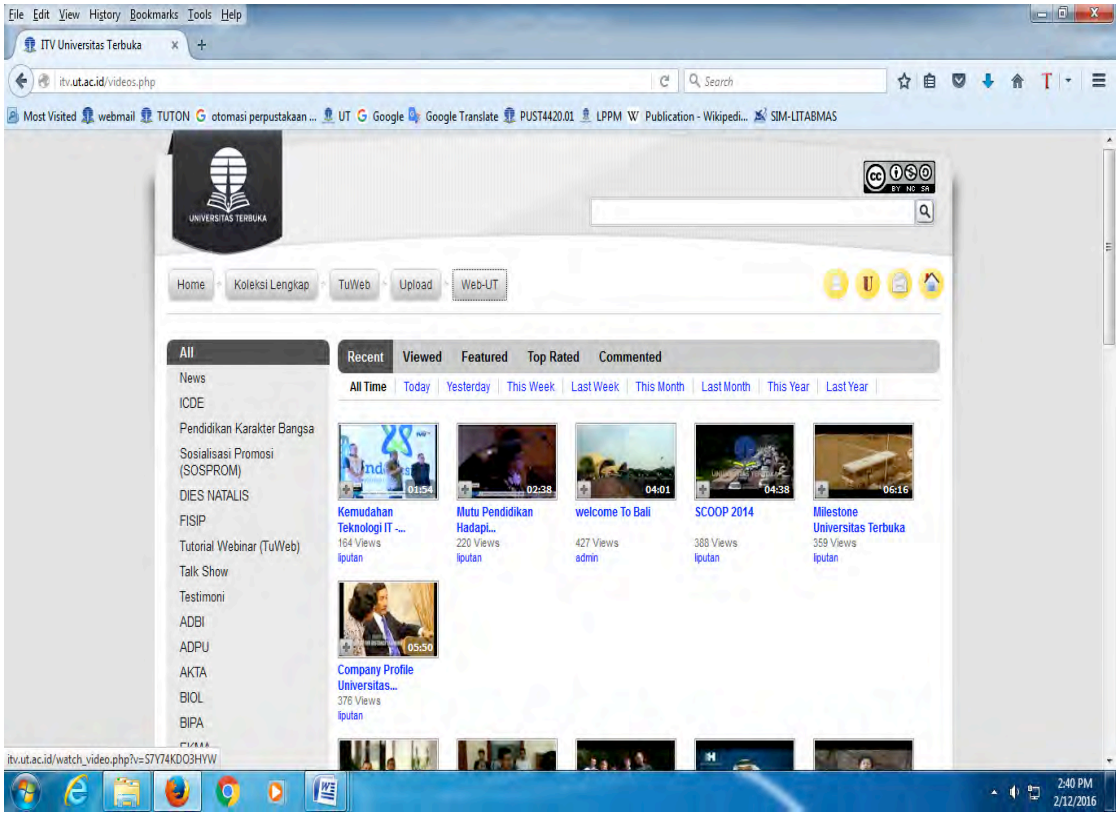
Implementation of online learning base include online tutorials, lab cleaning. For an online tutorial activity students receive learning materials from teachers, complete the quiz, independent exercises and discussions. From the results of the survey on-line tutorial activities identified that 75% of the classes provided active student.

Distance education system used by UT using the duality system means that most systems use procedures manual, such as the implementation of tutorial-face organized only at regional offices (UPBJJ), registration for students who use the package curriculum that must be present for register at regional offices, the implementation of new student orientation, and other academic activities that can not be accommodated digitally. On the other hand academic activities are also conducted electronically as an online tutorial that applies to all of the courses that can be attended by students wherever they are, access to material the modules are packaged in a digital format that can be enjoyed on the menu in virtual reading room, teaching materials non-print consisting of multimedia-based material, dry lab, feature video, radio feature, CAI (computer assisted instruction).

Along with the development of technology, protocols for access to course materials is also changing, UT students can access the course materials more flexible. Printed teaching materials which also includes content-based audio, video, multimedia contained in the Open Source Learning (SUAKA-UT) shows that digital-based lecture material has pretty much been developed by UT and its presence is helping students understand the learning materials.

Here is the user interface facility non-print instructional materials contained video based on open learning resources (SUAKA-UT).





Facilities online learning resources that are listed in the portal UT (http://www.ut.ac.id) do not use a base-line radio / internet radio. In fact, from the media, radio has the advantage among others, (1) the coverage area, (2) the material can be repeated, (3) media prices relatively affordable, (4) for this type

of online radio is very flexible broadcast material can be adapted to the needs local students. (5) Radio as a medium has the ability to realize the education equity for the community.

Online radio or internet radio is one of the latest technological advances which have not been utilized by the UT as a medium to provide assistance to students in an effort to minimize the difficulty of accessing the learning materials contained in the portal UT UT-based video. This online radio is one of the flexible strategy can be used by UT students. The material adapted to the needs of students, as well as to directly interact with teachers.

With the characteristics of UT students are scattered bring understanding and accessing information about the concepts learned at UT are not the same. For students who are in urban areas easier access through electronic media and minimal barriers, a visit to the office of UT (Central, UPBJJ) too easily. On the other hand also found minimal UT students access to information from the UT both of side media information and location of residence to the office UT (Central, UPBJJ) far enough. Such a condition is affecting success in their learning process.

Through the medium of radio as one means of communication UT students can receive academic and administrative information. They can find out the schedule, which was held at UT's academic, administrative matters such as registration procedures, and materials are delivered via radio tutorial.

2. Research Purpose

The purpose of this study was to identify the learning radio profile and online radio design as a means of learning support for students Open University. In this paper has been prepared material to build the online radio.

3. Method

Research will be conducted with several approaches, which aspects need to easily receive distance learning material system, aspects of the availability of online radio as a means of distance learning and online aspects of the procedure for the use of radio communication media distance learning materials.

For the needs of input materials research study will be conducted the data collection to identify management especially learning material information required by UT students, characteristics and radio profiles, operating system oline radio, online radio performance and management.

Analysis in this study will be conducted using qualitative methods, to get the output in the form of recommendations online radio utilization as a resource that can be used to support distance learning system.

Research case study online radio use media as a means of learning at the Open University in view of the efforts that need to be done in order to provide equitable learning aid that is fair to all students of

UT. Outcomes of this research is the design of radio-online according to the characteristics of UT students.

4. Problems Formulation

1. What opportunities for the utilization of online radio for distance learning media?
2. How could the use of radio as a means of helping online learning for students?

5. Discussion

5.1. Function Digital Media For Higher Education Distance

Distance education has the characteristics:

- The separation of students by faculty
- The use of media as a means of student aid
- Students have the freedom to determine the course pursued
- Having a learning time flexibility

The Open University as a higher education distance very rely heavily on media as a means of giving learning aid for students. Open University (UT) media as an aid student learning consists of print media: material teaching materials (BMP) or modules, and teaching materials based electronics include teaching material non-print: lecture material-based multimedia, dray lab (virtual lab), the video feature , radio feature, cai (computer assisted instruction). This electronic-based -materi material gathered in an open learning resource database (SUAKA-UT). The source-source learning accessible to students free of charge. Meanwhile, to increase students' knowledge library reference or UT also provide learning resources that can be accessed internet technologies such as journals, research collection, -UT modules packaged electronics that can be enjoyed through the virtual reading room facility (RBV).

The use of technology in distance education has a very big role especially in the current era of technology, allows each student to learn at any time.

Research conducted by Safitri, heni and Herawati (2011) regarding the students 'perception of the use of virtual laboratory that focuses on the material practice on virtual laboratoium shown that with the use of technology that is in manifest into a virtual laboratory is able to cultivate students' interest and avoid saturation. This is because students require things that are interesting, new, and can be enjoyed when the students are learning.

Based on interviews with information technology experts, instructional design experts and student can be obtained the results as the table below.

Table 1. Interests of different stake holders

Responden	*Subject*	*Opinion*
Students	Barriers to learning	restricted access
	Needs access to learning materials	Have many choices facilities / access in the learning process
Information technology expert	Long distance lerning fasilities	UT-based learning resources in Multimedia. Among others: Internet TV, Drylab, CAI. This facility felt still less to help students in learning
	Recomendation	Radio online presence is required to provide access to learning materials selection facilities.
Instructional design experts	The advantages of online radio	Radio online delivery of material can be repeated, and learning materials can be customized needs of local students

Here is a matter of learning resources that are used by the UT to assist students in the learning process

Table 2. Learning resources used by UT to assist students learning process

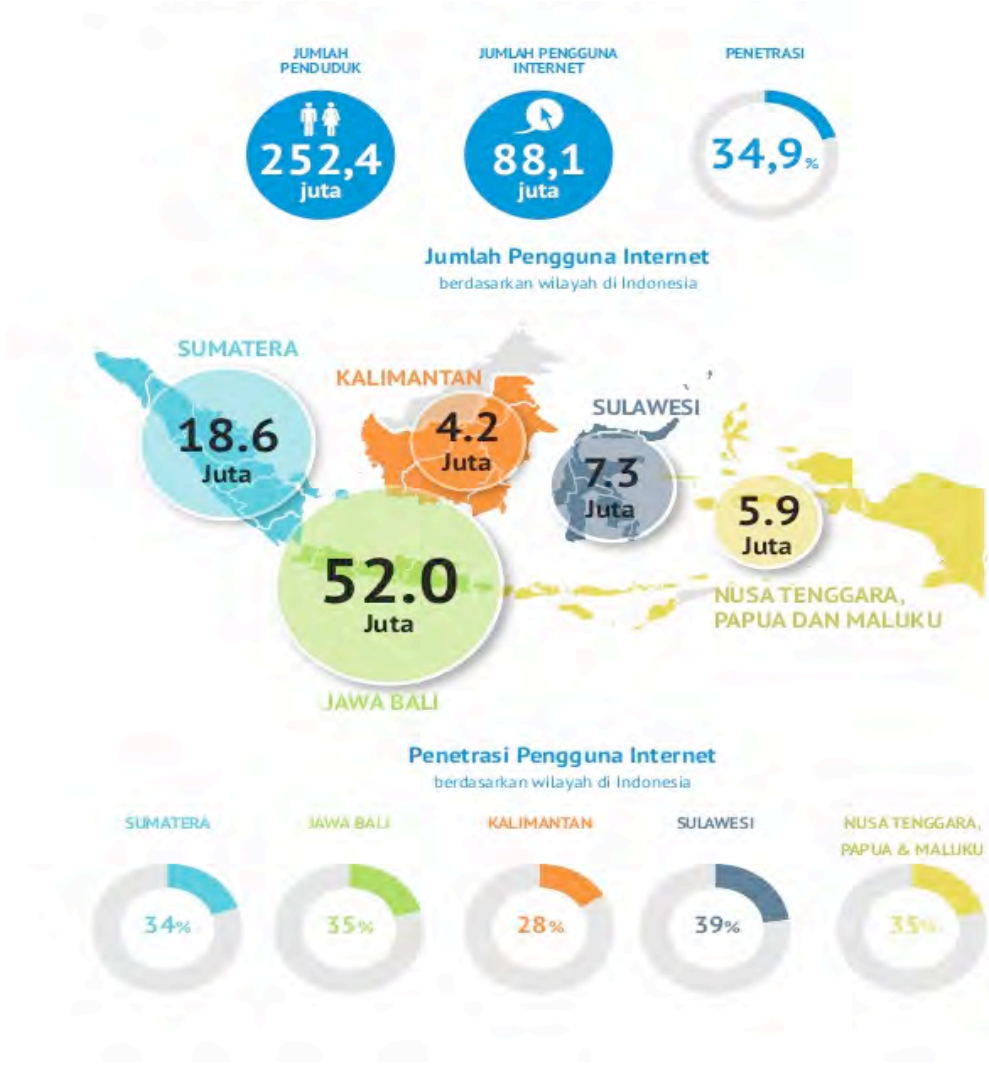
Learning Aid	*Media Format*	*Material information*	*Design*	*Facility providers*
Digital library	Html	e-Jurnal e-book virtual reading room Research	Students access the library collection ut anytime	Library
Tutorial online	Hypertext Audio–video	Audio Video Audio Video Learning materials in the first half	Question and answer Discussion Case study	Online tutorials
ITV /internet tv	Audio-video	Lecture materials	Learning materials	Open Education resources (SUAKA)-UT
Material enrichment courses	Audio-video	Lecture materials	Learning materials	Open Education resources (SUAKA)-UT

From a number of learning support materials for students of the majority of text-based and multimedia. The aid of learning resources based in audio which is operated via radio online / internet radio has not been performed by the UT. Even though the internet radio is the way

students learn more fleksibal. Because in addition to learning materials can be repeated with the construction of streaming radio in various areas will help each student a UT to select content that is needed. The following is a mapping 39 office units of distance learning programs / regional offices (UPBJJ) - UT in the regions.

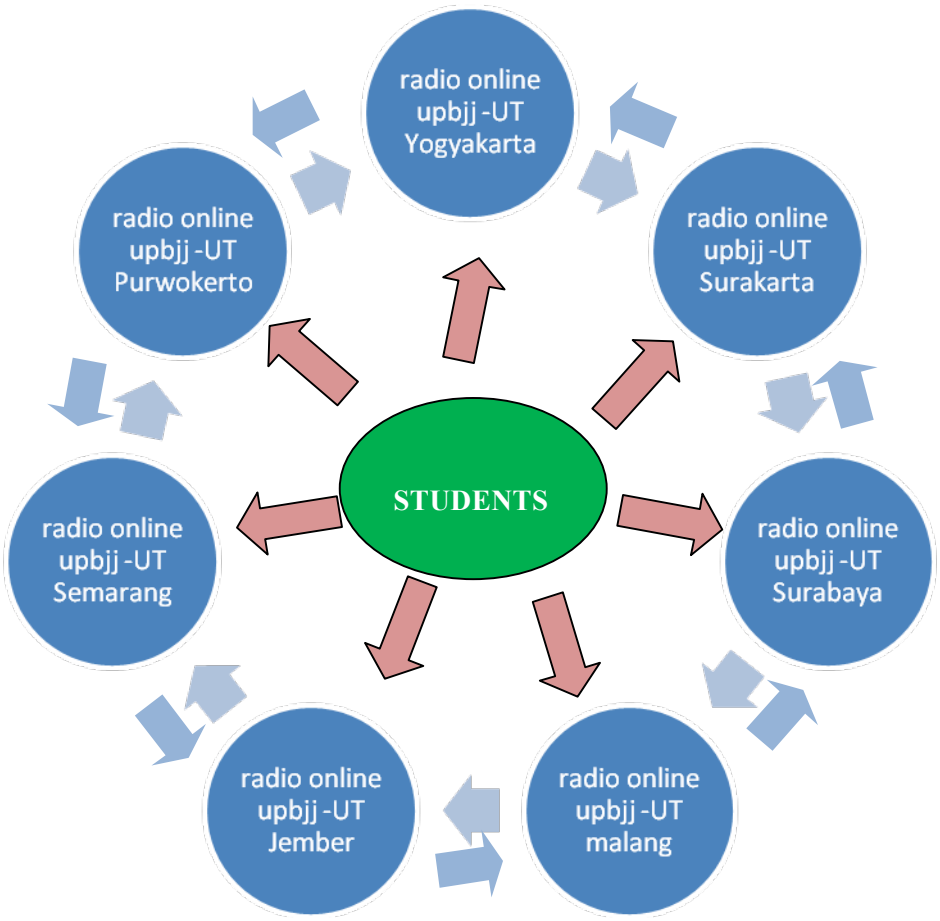
Given the very broad range of both in Indonesia and abroad, the study aid for students of UT is required. Radio online presence not only help the learning of students in the Indonesian territory, but also UT students who are outside the country such as Malaysia, Singapore, Hongkong, Taiwan, south korea, country-states in the region such as the Middle East, Saudi Arabian, Iran, Egypt ,

Indonesia has a range of internet that allows each UPBJJ make online radio accessible by UT students. Here's reach of the Internet in Indonesia. (Source APJII) Indonesian Internet Service Provider Association) - The Association of Indonesian Internet service providers (APJII) disclose the number of Internet users in Indonesia years to reach 88 million people by the end of 2014. Based on population, the highest number of Internet users is the province of West Java as much as 16.4 million, followed by 12.1 million users eastern Java and central Java 10.7 million users.



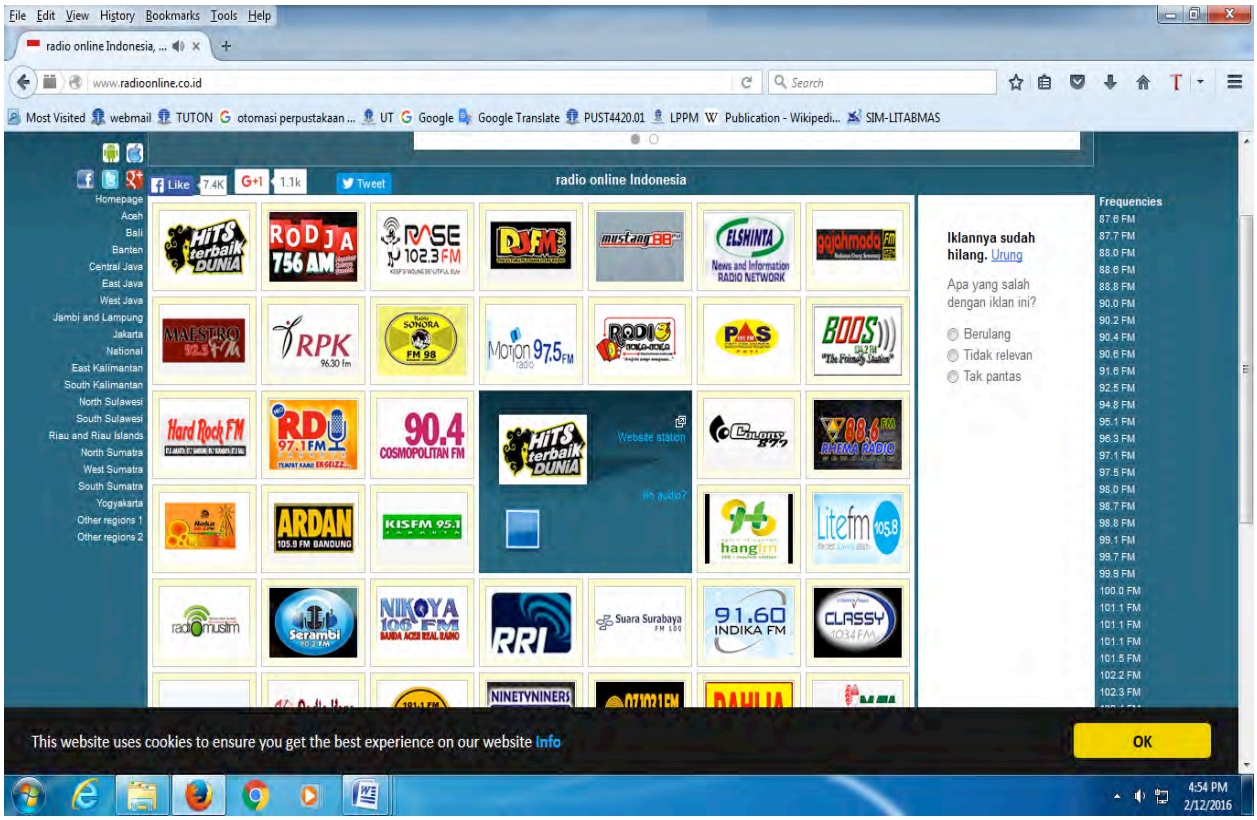
With the wide reach of the Internet allows any area containing UT students can communicate with each other. The existence of radio as a medium of communication will help students learn the material in lecture materials.

The following illustration of the interaction of online radio communications built in each UPBJJ-UT / regional offices.



This position will allow many options for UT students learn through any online radio in accordance with the necessary learning materials.

Analogous to: http://www.radioonline.co.id



By synchronizing these two models online radio UT will be provide an alternative for students to determine the hours of study, necessary learning materials.

5. 2. Online radio / streaming radio / internet radio

Radio as a medium of mass communication has many advantages including cost price, the coverage is quite extensive and can accommodate participation in significant amounts. Online radio / Internet radio is a medium that is very flexible. If each of the regional offices are online radio / radio streaming will have the opportunity for students to exchange information on the lecture material.

Besides the radio can be broadcast over the participation of various parties is possible. With these advantages is strategic radio media are used as a means of disseminating information. For streaming radio has a very wide range of broadcast coverage can be said to reach the whole world.

A. Basic Law of Broadcasting

The legal basis which can be used as a foothold on radio broadcasts are:

1. Law No. 36 Year 1999 on Telecommunication (State Gazette 1999 No. 154, Supplement to State Gazette No. 3881);
2. Government Regulation No. 52 Year 2000 on the Provision of Telecommunication (State Gazette No. 107 of 2000, Supplement to State Gazette No. 3980);

3. Government Regulation No. 53 of 2000 on the Use of Radio Frequency Spectrum and Satellite Orbit (State Gazette No. 108, Supplement to State Gazette No. 3981);

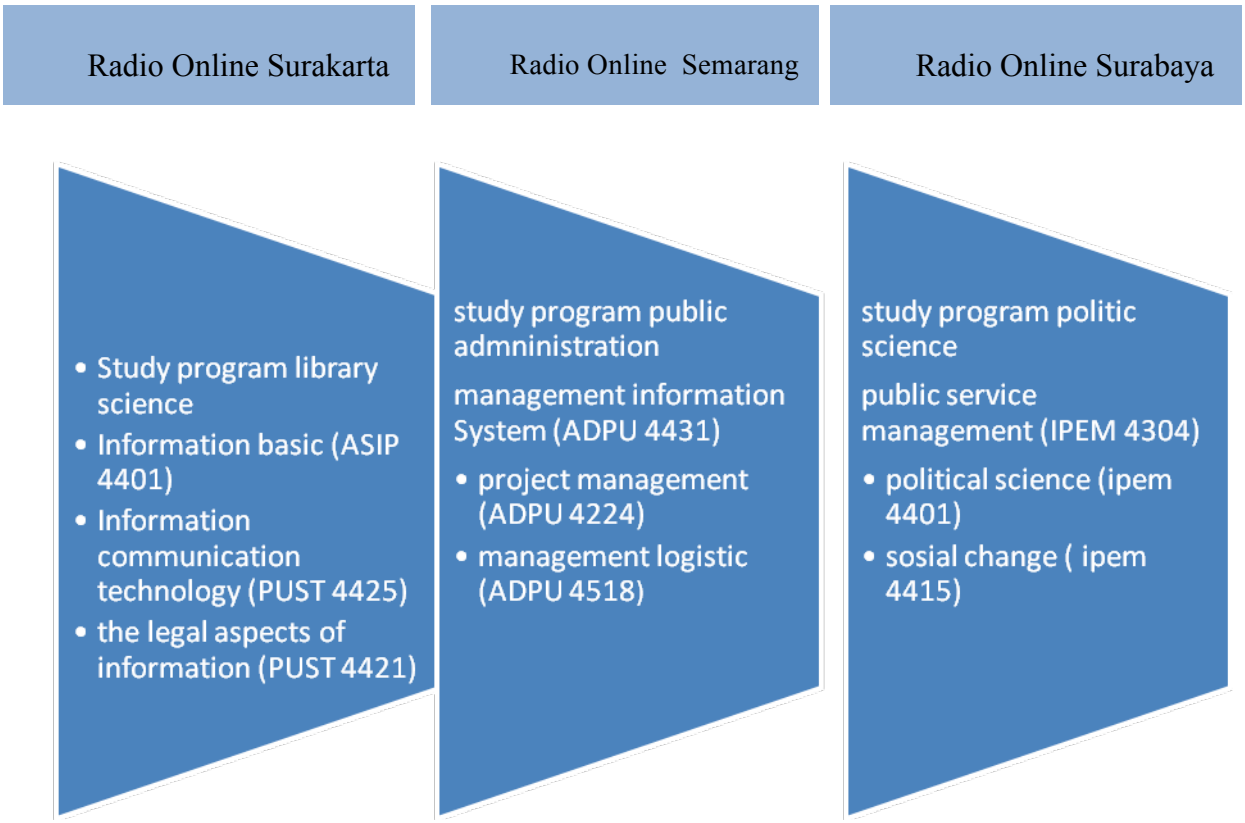
The legal basis of the above position the radio spectrum given radio frequency as the natural resources are limited, so its use should be regulated by a separate Act. As natural resources are limited radio frequencies need to be utilized optimally.

The existence of streaming radio is quite popular in the community, it can be seen from the increasing number accompanies number of conventional radio. This means that the majority of conventional radio facilitate its media streaming. The number of streaming radio in Indonesia reaches approximately 91 radio.

B. Design material online radio UT

UT online radio is designed as a means of UT students help in learning who is able to feed that choice for UT students to choose, to communicate between the existing online radio.

Here's designs on online radio



Based on the above picture looks online radio broadcast in Surakarta UPBJJ tutorial library studies program, with course the basics of information, communications and information technology, and legal aspects of information. Meanwhile in UPBJJ Semarang online radio broadcast tutorial program

with courses of study Public Administration Management Information System, Project Management and Logistic Management,. While UPBJJ Surabaya radio broadcast tutorial Political Sciences program, with courses Introduction to Political Science, management of public services and social changes. The illustration above shows that each UPBJJ can broadcast radio content online in accordance local students. With online radio performance characteristics, the UT students can do online radio options according to their needs.

6. Conclusion

The existence of online radio plays an important role to provide learning assistance to students. With regional offices / UPBJJ that exist throughout Indonesia has the potential to provide equitable access to learning resources for students. With online radio presence in every regional office / UPBJJ provide an option for students to participate in academic information such as tutorials, discussions according to their needs. This is because every region has a diverse student karakteirstik. To build a presence online radio needs to be prepared

1. Content-based learning can be formatted audio
2. Identify the subjects that will be used as the material tutorial

7. Recommendation

Setting up adequate bandwidth so that the Internet as a media / online radio broadcasting frequencies

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Undang-undang Nomor 36 Tahun 1999 tentang Telekomunikasi (Lembaran Negara Tahun 1999 Nomor 154, Tambahan Lembaran Negara Nomor 3881);

Peraturan Pemerintah Nomor 52 Tahun 2000 tentang Penyelenggaraan Telekomunikasi (Lembaran Negara Tahun 2000 Nomor 107, Tambahan Lembaran Negara Nomor 3980);

Peraturan Pemerintah Nomor 53 Tahun 2000 tentang Penggunaan Spektrum Frekuensi Radio dan Orbit Satelit (Lembaran Negara Nomor 108, Tambahan Lembaran Negara Nomor 3981);

Design and adoption factors of an m-learning application to support self-exploratory guide visits

Hai-Ning Liang[30], *Jessica Sewell*[31], *Steven Davey*[32], *Rebecca Kiddle*[33], *Sophie Sturup*[34]

Abstract

We have been witnessing rapid development of mobile technologies, such as smartphones, which are reaching into nearly all aspects of society and people's lives. An increasingly number of people are now willing and prefer to use mobile devices to do a wider plethora of activities such as web browsing, social communication/networking, map navigation and learning. This research has a twofold aim: (1) to develop an understanding of the features of a map-based application to support outside class tour explorations; and (2) to investigate what factors will impact its acceptance and use of these types of learning tools by students. Such apps are particularly useful to support architecture and urban planning students' learning as they are often asked to do outside explorations of building and city sites. To do this, we have followed a two stage process. We first conducted an exploratory study to understand better what properties students found useful in current popular map applications for mobile devices. From this study we extrapolated features that would be useful to the design of our m-learning application. After the app was implemented, we ran a number of focus groups with participants working with it to assess what factors are important for these students if they were to use the app to support their learning. The data collected allowed us to test a number of hypotheses based on the technology acceptance model (TAM). The results show promise for the map app, with regression analysis of the data indicating what factors have the most significant impact in the future adoption of the app by students.

Keywords: m-learning; technology acceptance model; university education; technology-guided tours.

1. Introduction

Mobile devices are indispensable tools in our daily life, as can be observed in their rapid adoption. Kukulska-Hulme and Traxler (2005) have pointed out that, to some extent, new opportunities are being provided by mobile devices for users to acquire knowledge, help individual learners to improve their performances and improve the efficiency of managing courses. Oulasvirta et al. (2011) stated that the development of mobile applications equipped with similar computational power as a standard PC with the evolution of global positioning sensors, wireless connectivity, photo/video capabilities and so on accelerate the popularity of mobile devices. Similarly, Pereira and Rodrigues (2013) also demonstrated that to enhance the properties of mobile devices, extra utilities and functionalities which augment mobile devices' utilitarian and recreation functions are being provided by mobile

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applications, so such applications are playing a significant part in users' daily life. For students' learning experience, especially for those attending university, educational applications, which now occupy a big commercial, market section given their number of downloads, are of increasing importance (Pereira & Rodrigues, 2013). Therefore, there is a trend that educational applications on mobile devices (or m-learning for short) will play a significant and ever-growing role as learning tools (Kukulska-Hulme & Traxler, 2005).

There are a number of situations where m-learning tools to support outdoor guided exploratory visits can be very useful. Given space constraints, we will provide only two such situations. First, students who are majoring in practice-based disciplines—for instance, Urban Planning and Design and Architecture—have difficulties to link the theory which they learn from the class lectures to the reality without incurring large expense like physical site visits. If a study topic is about European Architecture, it will be difficult for students to transfer the knowledge from books or class notes into real life because they might not have enough time to tour Europe nor the expense for universities to organize such expensive students' activities. Second, for some travel fans, the meaning of traveling is not only experiencing the beauty of the site but also learning more knowledge about the specific place. Current map applications, which are based on complex geographic information, provide basic functions such as location, searching, and maybe points of interest (like restaurants). As such travellers may not be able to find relevant, useful information about the sites they visit from a more historical, exploratory perspective. For both situations, current maps do not meet their needs but m-learning application designed properly can support exploratory, learning, and other activities students and visitors may find meaningful.

Inspired by the lack of applications addressing the issues just mentioned, the perspective of this research is to develop a map-based educational application to test how well the map technology can enhance mobile learning so as to complement formal lectures and teaching activities. Thus, the first step of this project was to investigate the disadvantages and advantages among current popular map apps on mobile devices. Then, suggestions from the investigation would be used to develop the map-based application. Later on, we would test how well the app can support learning and exploratory activities. The app was specifically designed to meet the needs of explorers of specific sites and was expected to minimize the gap between theory and the reality for practice-based disciplines, such as Architecture and Urban/City Planning. Its aim was to also satisfy travellers who would want to know more details about specific aspects of sites they would like to tour.

2. Background

A number of researchers emphasize the importance of m-learning. M-learning is an impetus in learning to assist with the improvement of literacy, numeracy and life skills (Attewell & Savill-Smith, 2004). Sharples, Taylor and Vavoula (2005), for example, pointed out that m-learning provides a new

environment for learning using technology which can mediate learning by knowledge acquisition using it as an instrument for productive enquiry. Manuguerra and Petocz (2011) indicated the importance of mobile devices on tertiary education to transform our ways of teaching and learning, bringing constructivist and collaborative approaches to learning, and also enabling efficient and flexible ways to teaching. Kearney et al. (2012) also noted that it is obvious that m-learning, as a new learning method, has numerous chances as well as challenges in education because of the infusive multimedia, social networking, communication and geo-location capabilities of the portable and convenient devices.

Most research about m-learning is focused on the convenience that characterizes mobile devices. Sharples et al. (2010) stated that mobile learning applications should not only focus on the characteristics of "anytime, everywhere" but should also take the mobile learning as an intervention on the basis of guiding what the learner is constructing and exploring. How to scheme an available m-learning mode and analyze learners' behavioral patterns based on a specific informal learning activity is still worth exploring, especially when it comes to the exploration on portable devices assisting informal learning. More importantly, the design and the development of mobile learning applications are still important activities, which demand the aid of related people's initiative and insights such as educators, learners, and practitioners.

Considering the limited quantity of nevertheless consequential research, this project sets the first blueprint to extend previous research and infuse more contributions into the development of m-learning. As there have already been several main types of educational applications in Mobile App Store, such as English learning or E-book reading applications, this project aims to design a different application to increase the diversity of educational applications for mobile devices.

Nowadays, the greatest problem among students is that they lack sufficient conditions to link theories they have learnt in class to practice, especially those students who study practice-based disciplines such as Geology, Architecture or Urban Planning and Design (Meredith and Burkle, 2008). For example, an Urban Planning Design program needs a large amount of tours, which may be inconvenient and expensive. Therefore, there is a gap between theories and the real world for UPD students. Besides, for travelling fans, map applications they refer to for guides during the trip are complex, geographic-based. The complexity inherent in map applications may reduce user satisfaction as they need to spend more time on searching information on the limited screen—and often not finding anything useful. After a thorough investigation of educational applications on portable devices, we can see only few researchers who have focused on this area of map-based applications for mobile devices. Also, there are only few applications attempting to minimize this gap for practice-based disciplines students. We aim to fill this gap with our research.

3. Theoretical basis and the research model

3.1 Technology Acceptance Model

The technology acceptance model (TAM) was proposed by Davis (1989) to investigate technology acceptance with two cognitive measures: perceived ease of use and perceived usefulness. Perceived ease of use refers to the degree to which adopting the new technology or method is free of effort for users. Perceived usefulness refers to the degree to which individuals' performance can be enhanced by using a particular system or technology. Although TAM has been widely evaluated and accepted, it is still not a perfect model. It does not for example explain the acceptance level of all types of technology, such the app that we have developed. Based on the different application areas and technologies, more or different variables need to be added to extend the initial model to make sure that the development of technology can be guided in the right direction (Mathieson, 1991, Li et al., 2008). Li et al. (2008) also pointed out that the conventional TAM still has limitations as TAM is forcefully based on the theory of reasoned action (TRA) which suggests that if a person intends to act strongly, he can realize his/her intent without any restrictions.

Venkatesh and Davis (1996) found in a certain environment, in addition to perceived ease of use and perceived usefulness, computer self-efficacy is also a significant variable and both of the initial variables have a positive relationship with the computer self-efficacy. In the context of mobile learning and on the basis of technology, there are some factors such as computer self-efficacy, which need to be considered when it is being evaluated by TAM. Besides, based on the nature of mobile devices, which provide anytime and anywhere access to information and content, the variable of collaboration among students when they attempt to adopt the m-learning technologies during their learning process should also be relevant and be integrated into the model. Another factor that may be useful for m-learning applications is personal innovativeness and as such we plan to include it to extend the scope of TAM for m-learning technologies.

3.2 Computer Self-Efficacy

Bandura (1997) defined self-efficacy as the belief that one has the capability to complete a specific task. Correspondingly, computer self-efficacy refers to a belief of one's capability to use computers to achieve some expected results (Compeau & Higgins, 1995). Brosnan (1998) stated that higher computer self-efficacy could enhance users' persistence in learning computing; in other words, higher computer self-efficacy could positively influence users' intentions to adopting a particular technology (Ariff et al., 2012). Zhang and Espinoza (1998) also pointed out that self-efficacy and computer self-efficacy were found to be positively related to the students' attendance for computer courses and their plans for taking more computer-related courses were influenced positively by their belief in their computer self-efficacy. However, Chau (2001) found that there are small, indirect and negative

impacts of computer self-efficacy for perceived usefulness and ease of use. Ramayah and Asfaqi (2004) conducted a survey about the impact of computer self-efficacy and cognitive beliefs on the adoption of e-library services and pointed out that perceived usefulness and perceived ease of use can be directly and significantly affected by computer self-efficacy.

Based on this research, we present the following hypotheses:

H1: Computer self-efficacy (COMPU) positively influences Perceived Ease of Use (PEOU)

H2: COMPU positively influences Perceived Near-Term Usefulness (PNTU)[35]

H3: COMPU positively influences Behavioral Intentions (BI)

3.3 Personal Innovativeness

Personal innovativeness, which is derived from the innovation diffusion theory, is an inherent character which people possess (Jackson et al., 2013). In the context of technology, personal innovativeness refers to the willingness to adopt new technology (Jackson, Mun & Park, 2013; Agarwal & Prasad, 1998). Much research in information systems (IS) has stated that personal innovativeness is a significant factor when it comes to understanding the new IS/IT and its future spread and usage intention (Liu, Li & Carlsson, 2010). Rosen (2005) also indicated that when using personal innovativeness in technology matters as a predictor, it can be considered as an antecedent to other variables. Besides, for computer self-efficacy (Kishore et al, 2001), perceived ease of use and perceived usefulness (Kishore et al. 2011, Lu et al. 2003), and intention to use technology (Thatcher, 2004), personal innovativeness has a positively influence on these predictors.

Based on previous research, the following further hypotheses are proposed of mobile learning:

H4: Personal Innovativeness (PI) positively influences COMPU

H5: PI positively influences Perceived Long-Term Usefulness (PLTU)

H6: PI positively influences PEOU

H7: PI positively influences BI

3.4 Perceived Ease of Use

Ease of use is considered an important factor that has an effect on the adoption of mobile learning (Liu, Li & Carlsson, 2010). From the technical viewpoint, there are many restrictions such as small screen, low resolution, input limitation, the limitations of access to the internet, lack of standardization and compatibility and so on, which affect heavily the use of m-learning tools in different settings (Shudong & Higgins, 2005). The limitations of mobile devices, which can reduce users' willingness when they attempt to adopt the m-learning tools, have a negative impact on the ease of use (Shudong & Higgins, 2005). Tong et al. (2004) stated that users will find the new technology useful as the

[35] This will be explained further down.

system or technology is easy and convenient to use. There is also some previous research (Amin, 2007; Lallmahamood, 2007) that proved the perceived usefulness can be positively affected by the perceived ease of use. Perceived near-term usefulness can be seen as improved job performance or satisfaction through adopting the new system or technology. Perceived ease of use can significantly influence the near-term usefulness. Thus, considering both TAM and the mobile learning literature, the following hypotheses are proposed:

H8: Perceived ease of use positively relates to Perceived Near-Term Usefulness

H9: Perceived ease of use positively relates to Behavioral Intentions

3.5 Perceived usefulness

Perceived usefulness refers to the degree to which people find a new technology useful and this perception can affect their willingness to adopt it (Davis, 1989; Liu, Li & Carlsson, 2009). Chau (1996) distinguished long-term usefulness and near-term usefulness, and found that the two components of perceived usefulness have significant impacts on the adoption of a new technology or system. Long-term usefulness can be seen as the improvement of one's career goals or social reputation; while near-term usefulness is the job performance achievement or the sense of pride in goals achieved. Previous research on this area stated that both long-term usefulness and near-term usefulness have a positive impact on users' intention to adopt the new technology or system. Besides, once users set their long-term goal by adopting the new technology, the near-term usefulness should be satisfied as users are persistent and willing to use the system for a long time to achieve their long-term satisfaction. Thus, we have identified three more hypotheses for m-learning applications:

H3: Perceived Long-Term Usefulness positively influences Near-Term Usefulness

H4: Perceived Long-Term Usefulness positively influences the Behavioral Intentions

H5: Perceived Near-Term Usefulness positively influences the Behavioral Intentions

We thus have a total of 12 hypotheses:

H1: Computer self-efficacy (COMPU) positively influences Perceived Ease of use (PEOU)

H2: COMPU positively influences Perceived Near-Term Usefulness (PNTU)

H3: COMPU positively influences Behavioral Intentions (BI)

H4: Personal innovativeness (PI) positively influences COMPU

H5: PI positively influences Perceived Long Term Usefulness (PLTU)

H6: PI positively influences PEOU

H7: PI positively influences BI

H8: PEOU positively influences PNTU

H9: PEOU positively influences BI

H10: PNTU positively influences BI

H11: PLTU positively influences PNTU

H12: PLTU positively influences BI

Based on the above factors and hypotheses, our proposed modified TAM for mobile learning technologies is presented in Figure 1.

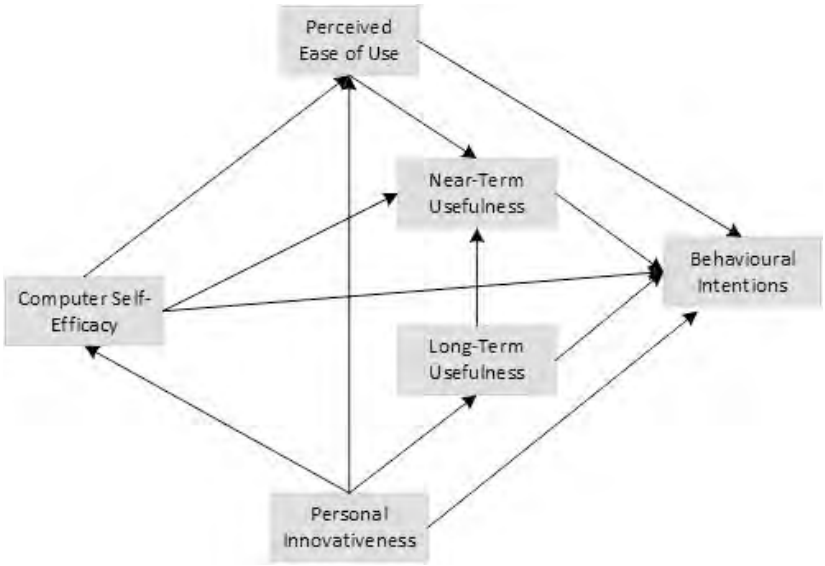

Figure 1. Proposed modified technology acceptance model for map-based m-learning applications to support guided tour visits. The direction of arrows indicate positive effect from one factor to the other.

We next describe our methodology and approach to test the hypotheses and the above model.

4. Methodology

4.1 Pre-Test: Survey of current maps and users' subjective feedback on features

In this research, we initially conducted an exploratory study with 77 students at an international, predominantly English-language University located in China. The aim of this study was to find out the useful functions and less user-friendly ones of frequently-used map applications. The data collected would serve as the foundations to develop a new map application by adopting useful functions and improving the less-satisfactory ones to increase user experience. Thus, this first study was composed of two aspects which are multiple-choice questions and more exploratory discussions. For the former part, questions were designed to figure out the frequently-used popular map applications installed on participants' mobile devices. To achieve this goal, questions sought details like what type of mobile devices were often used by the participants, which map applications were popular among users, what the patterns of use of various map applications are among the participants, and so on. As for the later part, questions were focused on the advantages and disadvantages of their frequently-used map

applications on the mobile devices.

4.2 Data evaluation of pre-test data

The result generated from the pre-test was used to develop the new map application on mobile devices. Because of space limitations, we only provide the table below with some general information of the use of maps in mobile devices.

Table 1. General Patterns of Usage of Interactive Maps in Mobile Devices (n=77). Because of space limitations we have omitted other data.

	Frequency	*Percent (%)*
Use of interactive maps		
Yes	70	91
No	7	9
Frequency of using interactive maps		
Always (everyday)	10	13
Often (once or twice a week)	24	32
Sometimes (once or twice a month)	33	43
Hardly (once a year)	5	6
Never	5	6
Use of maps on mobile devices		
Yes	75	97
No	2	3

Information collected reveals some interesting patterns of use of map apps. The results indicated that current maps serve general functions such as location, finding routes information and so on. However, the limited size and complex icons made the information provided by map applications ambiguous and cumbersome to follow. As a result, if m-learning applications were to follow the same approach of current apps, it would not be inviting for students to use, thereby creating a negative impression of these tools

Based on the analysis of the data, the new map app would have to avoid the limitation participants pointed out and instead on realizing the recommendations presented by students. As such and in a much summarized manner, the new app will develop from the several aspects: (1) simple and clear layout; (2) enough and specific information; and (3) less icon functions, functionalities, and interaction complexities. Some screenshots of the app are presented below.

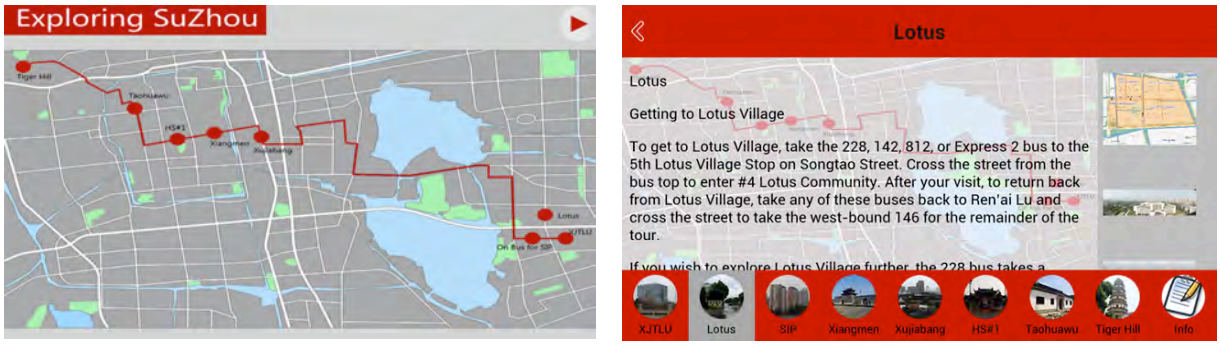

Figure 2. Screenshots of the map application. (L) Main navigation page; (R) detail view of one site of interest with text description, pictures, videos to give users historical, geographic, and other contextual information. Our application has 8 sites.

4.3 Post-Test: Students' subjective perception of m-learning technologies

The post test was conducted with 30 students attending the same local English language university. Participants needed to fill a short questionnaire to collect demographic data including basic demographic information of students and their learning approaches. Afterwards, participants were free to use the app for about 30 to 45 minutes in groups. They could interact and discuss with each other. After this interaction, to test how well they learnt information from the new app or, in other words, how well learning was enhanced by the presence of the new app, participants needed to complete a second questionnaire about their perception of the app and how it affected (or would affect) their learning process.

4.4 Data evaluation of post-test data

The average age of our 30 participants was 22 and all were doing their bachelor's degree. Twelve of them would normally attend lectures (60-80%) and half of them had their average grade between 60-70%. Nearly all participants (27) would prefer to use mobile devices to assist their learning activities. Students, however, were not willing to take their mobile devices as their learning assistants because of their small screen size and of being tempted to play with their devices due to the presence of games and social network apps.

We have tested our hypotheses using multiple linear regression in SPSS. Our preliminary results suggest that *Perceived Near-Term Usefulness*, *Perceived Long-Term Usefulness*, and *Personal Innovativeness* were the most significant factors in the model shown in Figure 1. Some interesting conclusions could be drawn from the results, which will be provided in the future.

5. Summary and preliminary conclusions

As the mobile devices have become indispensable tools in people's daily life, there are various ways for mobile technology to assist people to do a variety of activities. As a positive aspect of mobile devices, students can adopt the technology to check the dictionary, have social interaction with friends using social network applications, use map applications when they are traveling, and rely on language applications to learn a new language. Maps are useful tools in people's life especially for students who are majoring in geographic-based information or for traveling fans. In this project we designed a new app according to advantages and disadvantages of participants' frequently-used map-based apps to test how mobile learning could enhance students' learning processes. The whole process was divided into three parts: (1) pre-test, aimed to find out the advantages and disadvantages of students' frequently-used map apps, (2) the development of new app based on the results obtained from the pre-test, and (3) the investigation of what factors affect the mobile-learning process through the user experience study of the new map app. Our preliminary results suggest *Perceived Near-Term Usefulness*, *Perceived Long-Term Usefulness*, and *Personal Innovativeness* are the most significant factors in an adapted technology acceptance model for our m-learning tool.

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The Impact and Benefits of Internet Usage in Presidential Election Campaign

(A Case Study on the 2014 Indonesian Presidential Election)

Meita Istianda[36]

Abstract

The emergence of technology, in this particular case internet, has affected the dynamics of politics in Indonesia. Internet has been used as a medium in achieving political power, for instance in presidential, members of the legislature, or district head election campaign. In the said campaigns, many efforts have been attempted, both negative and black campaigns. Unfortunately, even though the campaign period has ended, the competition between both parties is still yet to come to an end. This paper aims to discuss the positive and negative impacts of internet usage as a campaign medium and how to overcome its negative impacts. To elaborate and answer the questions, the author of this study did a literature study regarding the use of internet in 2014 presidential election campaign. The results found that, despite its negative impacts, internet is an effective medium of campaign. The efforts in resolving the negative impacts shall include building an improved structure of political communication based on political ethics.

Keywords: *internet, campaign*

1. Introduction

The usage of internet nowadays is getting massive. Internet is not only utilized to share thoughts, but also to influence political power. Internet user in Indonesia reached 83.7 million people in 2014, compared to a total population of 245.862.034 people.[37] The number depicts just how big the number of internet user in Indonesia, that the country even took place as the 6th biggest in the world.

Considering the rapid development of internet user, a study regarding the matter becomes more interesting as the development itself is hugely influencing every aspect of the Indonesian society, including the political aspect. From the political aspect, internet has been employed to increase coverage, speed, and efficiency in political communication, therefore it may be expected to increase and strengthen the quality of democracy (Towner, 2013).

The utilization of internet in Indonesia's political process started not long before the fall of Soeharto's regime. Krisna Sen and David suggested that within the last two years of Soeharto's order, the internet was widely used by middle-class groups to plan movements and measure international support to

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[37] *See: http://www.sinarharapan.co/news/read/140916057/mendagri-pastikan-jumlah-penduduk-254-juta-span-span*

overthrow Soeharto's authoritarian regime.[38] After the dethronement of Soeharto, the usage of internet intensified with increasing variety of communication channels such as Facebook, Twitter, Youtube, Blog, Blackberry messenger, Whatsapp, and others. Society utilizes the internet to carry out political pressure and mobilize public opinion. For instance, the pressure to solve the Century Bank scandal, and the mobilization of public opinion on POLRI vs KPK case, or Prita Mulyasari's case.

In the case of KPK (The Indonesian Corruption Eradication Commission) vs POLRI (The Indonesian National Police), for example, the utilization of internet became phenomenal since it was capable of engaging more than one million facebookers within a relatively short time (less than a month).[39] In this context, as stated by Idy Subandi Ibrahim (2011), the phenomena was a form of cyber democracy, cyber politics, or cyber protest in Indonesia. According to John Hartley, cyber democracy is defined as a virtual community with its own rules who interacts and participates in the issues regarding democracy within the scope of its own or society (John Hartley: 2004). Cyber politics is any activity that is conducted within the scope of internet utilization in political activities. These activities include every form of softwares, including journalism, fundraising, blogging, volunteer recruitment, and organization development. The term cyber-politics itself can be reflected into one sentence; "internet based conflict involving politically motivated attacks on information and the system of information", which means an internet that is underpinned on conflicts that involve attacks motivated by politics on information and information system (Amnestika, 2014). Cyber protest refers to a phenomenon which involves protest movements in the cyberspace.[40]

The forms of cyber democracy, cyber politic, or cyber protest, not only exist in the case of the mobilization of public opinion on some issues that is of society's concern but also in presidential election process (Pilpres), for example the 2014 presidential election in 2014. The tenet of democracy which resounds throughout Indonesia also popularize the utilization of internet in campaigns, whether it is in the context of cyber democracy, cyber politics, or cyber protest.

Ahead of the 2014 presidential election, the cyberspace was livened by internet campaigns conducted by supporters of Prabowo and Jokowi. The campaigns were leading towards negative campaigns and black campaigns. Prabowo was attacked on the issue of humanity, the kidnapping of activists in 1998, his discharge as an active military soldier (TNI) by the honorary board of officers (DKP), and the emergence of Hendro Priyono's statement, who used to be Prabowo's superior-regarding Prabowo's

[38] Salim Alatas, *Media Baru, Partisipasi Politik dan Kualitas Demokrasi*. http://www.academia.edu/6433955/MEDIA_BARU_PARTISIPASI_POLITIK_DAN_KUALITAS_DEMOKRASI

[39] ibid

[40] Meike Lusye Karolus, *Socio-Emotional Content dalam New Media sebagai Solusi Alternatif Terciptanya Media yang Humanis di Indonesia (Studi terhadap Akun Twitter Blood For Life dalam Membangkitkan Kesadaran Kolektif Masyarakat)*, Universitas Gadjah Mada, JURNAL KOMUNIKASI - Vol. 05, No. 1, Mei 2015

mental health, which was suggested to be on the level of great 4, or equivalent to a psychopath.[41]

On the other hand, Jokowi was attacked on being a Chinese descendant, his unidentified parents, being a descendant of ex-PKI andex-Gerwani members, and being surrounded by PKI activists. In addition, Jokowi was also said to be dishonest about his origin, and involved in the corruption of Transjakarta bus procurement. It was also rumored by the presidential special staff on disasters and social assistance, Andi Arief, that Jokowi's son and Luhut Panjaitan colluded in establishing a company. (nasional.inilah.com, 2014).

Prabowo's campaign on social media were centred on social media accounts, particularly twitter, which were directly affiliated to Gerindra, his major supporting party. Several account of Prabowo's supporters include *@Gerindra*, *@FansGerindra*, *@GarudaPrabowo*, *@Fadlizon*, and *@Info_Prabowo*. On the other hand, accounts of Jokowi's supporters were more dispersed and dependent on volunteers. Jokowi's supporters' accounts include: *@Jokowi4Me*, *@PDI_Perjuangan*, *@InfoJKW4P*, *@Jokowi_Ina*, *@Bara_Jokowi*, *@Relawan_Jokowi*, *@Jasmev2014*, *@IwanPiliang*, and *@KartikaDjoemadi*.[42]

According to the description above, it can be suggested that internet has brought significant impacts on the development of Indonesia's democracy. Society is getting more freedom of expression. Internet is able to describe the actual situation regarding the political participation of the people who actively care and aware of the existing public issues. This is suggested by the up-to-date information from the internet prior to the presidential election. The improvement of society's participation is a good thing for democracy. Terri L. Towner (2013) suggested that the usage of internet is a positive predicter in political participation; it also has played a big role in politics. Some analysts boost the role of internet as a tool which may help the process of democracy by exposing the society to political information and accommodating participation.

Within the context of the internet having a big role in political process, this paper aims to discuss the positive and negative impact of the use of internet as a campaign vehicle; how to solve its negative impacts. The case study discussed in this paper is the 2014 presidential election of Indonesia.

[41] http://www.gresnews.com/berita/politik/23046-buntut-kampanye-hitam-dua-kubu-saling-lapor-ke-polisi/0/
[42] http://www.suara.com/news/2014/05/20/105653/3-perbedaan-pendukung-jokowi-dan-prabowo-di-media-sosial

2. Discussion

2.1. Internet as a campaign medium

*In its rel*ation to political activities, the internet has advantages in increasing political participation associated with coverage, speed and efficiency in delivering information to the people. Another advantage of the internet is to have characteristics that are not limited, transparent , global, free , and quick in disseminating information. Meanwhile, conventional campaign medium seems to be more restricted, censored, and limited to space and locality. Within functional orientation, the conventional campaign is putting more emphasis on the elite class and more often than not, ignore the universality of publication; while the internet is more able to penetrate all layers of society with its universal access. Within the context of institution, conventional campaign is more centralized, managed by the owner, requires a big capital; while the internet is more decentralized, flexible, anonymous, and the user is the owner and it is only an intrument for access. In the context of public access, the conventional media, the range is lower and one-way; while internet outreach to various directions, interactive, free and equal. Based on the explanation of its characteristics, Khanisa (2013) argued, internet campaign is believed to be more democratic. The assumption is based on the compatibility of internet and the character of democracy. Democracy reflects equality, tolerance of diversity, freedom, participation, and protection of human rights. All of those aspects were accommodated by the internet, which possesses the chraracteristics of being free, eequal, and independent. The internet has a power which lies in its participative capability, and this participation is the principle which underpins democracy.[43]

Within the context of democracy, Aeron Davis stated that the potentials of internet is hugely affected by the normative values of democracy and public space initiators such as Habermas, Bohman, Putnam, and others (Davis, 2010:746). According to them, information and communication technology offers a more specialized tool which is associated with a more inclusive society participation and deliberative exchange between civilians and political elites. The point is, a more fluid, inclusive, and direct communication between society and political elites will take place through the internet, without barriers of formality.

To be more precise, the usage of internet as a campaign tool will give more chance to campaign participants (candidates) in quickly and effectively approaching constituents and its people, so that they can predict how big is their support and how their constituents' political participation are doing within a short span of time. This means that the internet also has a positive impact on political participation, and is able to quickly and intensely increase society's knowledge and involvement in

[43]Khanisa. (2013). *Dilema Kebebasan Dunia Maya: Kajian dari Sudut Pandang Negara*. Widyariset, Vol. 16 No.1, April 2013: 23. Jakarta: LIPI Press.

their interactions with the candidates. Considering its advantages mentioned before, the usage of internet became a variable of importance, which is expected to change the pattern of political communication between the candidates and its contituents, so that they may become closer. Theoretically, the internet has a potential of revolutionizing and improving the development of democracy.

2.2. Impacts of Negative and Black Campaigns

From the previous explanation, it is a known fact that the internet has a positive impact on the society, as it is able to develop democracy and drawing the relationship between candidates and its constituents closer. Despite its positive impacts, the internet also has several negative impacts.

In campaigns, the behavior of a candidate, the people, the party, or the supporting group aims to support and convincing other people to be willing to vote for them. These efforts were conducted by showing, offering, or promising what will be carried out, what will be done, and what will be fought for. Within that context, the internet is used to conduct political publicity. Political figures or political parties will utilize every potential medium to increase the popularity of the figure or its own party. The internet is also used to solicit supporters, rooters, and colleagues which comes from various layers of society, using the process of political imaging. However, due to the nature of campaign as a battle to fight for power, the function of the internet is parallel to the urge of fighting. The parties fighting are not only using internet as a media of political imaging but also as a medium for fighting, in which each parties will attempt to knock the opponents down through the internet, or more commonly known as a cyber-war.

In Indonesia, on the 2014 presidential election, campaigns of the two candidates, which were Jokowi-JK and Prabowo-Hatta, were conducted. The campaigns, aside from trying to emphasize the image of its candidates, were also inevitable to black campaigns and negative campaigns, aiming to knock each opponents down. Negative campaigns are the disclosure of facts regarding the shortcoming of one candidate which was truthfully, and relevantly delivered. On the other hand, black campaign is a way of campaign which is conducted in a bad or malicious way. In general, a black campaign is characterized by the spread of one politician's disrepute with the aim of him/her being not liked by its friends in the party, its supporters, and general society.

This table represents the examples of negative campaigns and black campaigns in 2014 presidential election.

Table 1. Examples of Negative Campaigns

No.	*Jokowi*	*Prabowo*
1.	If elected, he will be dictated by Megawati Soekarnoputri and foreign countries	Was involved in the abduction of several human rights (HAM) activists in 1998.
2.	Deceitful, as he did not fulfill his promise of completing his position as the governor of DKI Jakarta for five years	Family not getting along well
3.	Involved in the corruption case of Transjakarta corroded bus precurement from China	Temperamental (not able to control his emotion) and prone to using violence
4.	If elected, he will defend minority groups more and not pay attention to the interest of Muslims	Not successful in business as a lot of his companies were bankrupt

Source: Lingkaran Survei Indonesia, as quoted in Suara Pembaruan, Wednesday May 28th 2014.

Table 2. Examples of Black Campaign

No.	*Jokowi-JK*	*Prabowo-Hatta*
1.	Jokowi is accused of being a stooge of Zionist movement	Prabowo was accused of being a citizen of Jordan as he lived in the country for two years
2.	Jokowi-JK will appoint a minister of religion coming from the Syiah Islam group	Prabowo was accused of not paying the salary of Kiani Kertas employees for several months
3.	Jokowi was accused of being a non-muslim and being a person of Chinese ethnicity	The emergence of Prabowo's case of hitting at KPU video
4.	The emergence of grief advertisement stating Jokowi died with the name of Ir. Herbertus Joko Widodo	A twitter account exists on behalf of Abraham Samad, saying that Jokowi needs to be protected from assasination
5.	Jokowi-JK is said to be going to repeal the policy of teacher benefits and certification	

Source: Media Indonesia, Monday, May 26th 2014

In conducting the campaigns above, most of the modus were carried out using the internet. As explained previously, the usage of internet media, with its characteristics of being virtual, interactive, convergent, and global, is effective in raising support, but it also may negatively impact the votes received by a candidate. According to the data from Lembaga Survei Indonesia (LSI – The Indonesian Survey Institute), the negative and black campaigns may have impacts on votes, which may hinder the support from political parties. As a result, the announcement of Jokowi as a presidential candidate by PDIP only increased, more or less, three percent of PDIP's electability from being 18.2 percent on LSI's survey in January/February 2014, to a number of 21.1 percent on a survey by the end of March 2014. The massive advertisements carried out by Gerindra party as the major supporter of Prabowo only increased, more or less, three percent of its party's electability, from being 8.7 percent in the previous survey to 11.1 percent.

Aside from hindering support, the impact of negative and black campaign on 2014 presidential election does not stop on votes, but also until the president was elected, for instance: first, the fight between the two parties as a continuation from the 2014 presidential election resulted in negative reaction from the market. Several business associations and investors stated that the investment

climate in Indonesia is not conducive to carry out business, due to the unstable government. This was proven when the House of Representatives (DPR) for 2014-2019 period was appointed and conducted the first hearing in deciding the head of the House of Representatives, the fight between the two parties were becoming more palpable, that is the fight between Koalisi Merah Putih (KMP) who supports Prabowo and Koalisi Indonesia Hebat (KIH) who supports Jokowo-JK. KMP attempts to slow inhibit KIH in several divisions of government by taking over the parliament. They prepared a revised law concerning MPR, DPR, DPD, DPRD, or UU MD3 by inserting an article which regulates the mechanism of DPR and MPR chairperson election, which is viewed to be benefiting the KMP. The nuance that KMP will continue the fight is highly readable, with a statement coming from vice chairman of the Board of Gerindra, Hashim Djojohadikusumo, which says that KMP does not only want to act as a counterweight, but also to investigate and inhibit Jokowi's governance.[44] Second, KIH responded to KMP attacks in efforts to defend its side by placing their people in important positions without considering feedbacks form the people or Corruption Erradication Commission (KPK); for instance, the appointment of Agung Prastyo as General Attorney, who is coming from Nasdem Party; their coalition. Forming Wantimpres where six out of its nine members were people coming from its supporting parties. The appointment of Budi Gunawan as National Police Chief (Kapolri), despite KPK's statement of his indications of being involved in corruption. After the case of Budi Gunawan was processed by KPK, Jokowi appointed Badroidin Haiti as the National Police Chief.

The fight between the two sides finally has its own implication on the stability of governance. This was proven by the first cabinet re-shuffle. Not even a year after being appointed, the working cabinet formed by Jokowi was re-shuffled on August 12th 2015. As 2016 enters, Jokowi also received pressure to realize the second cabinet re-shuffle.

Regarding the instability of governance within the context of internet usage, member of the press council, Nezar Patria, in "Dialog Demokrasi dalam 140 Karakter" discussion at Sari Pan Pacific Hotel, Menteng, Central Jakarta, thinks that social media influences public's perception and preference in 2014 presidential election.[45] If the elected candidate is assuming the power in the executive branch, then the negative side of the internet is that it is able to weaken the legitimacy of governance. On the internet, political issues could develop into something more dramatical due to the biases in reporting which is mixed with reviews, opinions, or information whose source is unidentifiable. Therefore, although the internet is easing the process of political communication, its impact of destabilizing the government should come to consideration, rather than the high cost of government instability.

[44] Edward Febriyatri Kusuma, *Sejauh Mana Peran Twitter dalam Politik Indonesia, Retrieved from* http://news.detik.com/berita/2943818/sejauh-mana-peran-twitter-dalam-politik-indonesia
[45] ibid

3. Overcoming the Impacts of Negative Campaign and Black Campaign

To overcome the impacts of negative campaign and black campaign is to try building an improved communication structure by: first, making an inventory of the currently-developing negative issues and develop a chronological map of those issues. Secong, develop a clarification map. If there exists a spreading of negative issue in society, quickly spread clarification and flood the targets with the prepared clarification. Third, take control of social media. Builld a good communication with mass media which are using neutral and non-provocative language. Be calm and keep building a positive image. Fourth, make use of influential community leaders, as an intermediary, in explaining the issues. Fifth, form a loyal and trustworthy team to monitor and clarify attacks from political opponents.

4. Conclusion

Regarding its association with political activities, the internet can be used to increase coverage, speed, and efficiency in communicating with the society; it also has the potential of strengthening and improving the quality of democracy. With its nature of being virtual, interactive, convergent, and global, the internet came as a broader, more accessible public space to accommodate aspirations from the people. However, the internet also has its negative impacts when it is used to knock other political opponents down through negative campaign or black campaign. To solve the shortcomings of irresponsible internet usage in political campaign, the government should establish regulations which may control and sanction campaign participants, so that they will abide the rules in implementing a more ethical ways of conducting campaign, and develop structured communication channels so that it will be able to monitor its use.

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FESTIVAL SCIENTIFIC, ACADEMIC AND PRACTICAL THEMES

IMLF2017 will explore concepts, practices and issues that provide pathways for effective integration of mobile and emerging learning technologies in education at all levels and environments such as, open, self-directed and flexible learning, e-learning, blended learning, flipped learning, MOOCs, and socially-networked learning. We will explore four key elements of an effective learning design: Resources, Activity, Support and Evaluation, and engage in examination of enabling conditions and articulation of coherent strategies for advancement of mobile and emerging learning design.

Mobile and Emerging Learning Resources

- Analysis and design of digital resources for learning
- Educational Apps
- E-books and digital publishing in education
- Learning objects
- Open-access resources
- Theory driven approaches to educational interface and interaction design
- Authoring systems for development of mobile resources for learning
- Social media resources
- Cloud-based resources
- Learning resources and integration with Big Data
- Emerging forms of learning resources and interactivity, virtual and augmented reality, holographic technology, interactive toys, 3D printing, and wearable devices.

Mobile and Emerging Learning Support

- Social networking and emerging forms of communication tools for learning
- Emerging devices, context awareness, and connectivity of learners
- Connected communities and culture of support
- Development of life-long/independent learning through support strategies

Mobile and Emerging Learning Activities

- Learning outcomes and mobile learning activities
- Inquiry-based learning, problem-based learning, design-based learning and other contemporary approaches to learning activity
- Innovative approaches and activities
- Digital storytelling
- Student engagement
- Gamification of a learning activity
- Case studies of mobile learning activities
- Impact of mobile learning tools and activities
- Design of mobile learning environments for blended, open, flexible, distance, distributed and classroom learning

Mobile and Emerging Evaluation and Assessment approaches

- E-portfolio Assessment
- Learning Analytics and educational data mining
- Mobile learning and assessment methodologies
- Assessment of new literacies
- Assessment of creativity and other emerging generic skills
- Feedback strategies

Building on our standard format, which includes keynote speakers, invited speakers, paper presenters and industry representations, IMLF2017 will introduce Doctoral Consortiums and Virtual Presentations.

In addition to a special issue of a top journal in the field, we plan to write the 2nd volume of the Mobile Learning Theories and Applications book to be published by Springer.

Submit your proposal, papers and nominations for speakers by 15 November, 2016.
We look forward to seeing you in Hong Kong in June 2017.

IMPORTANT DATES

Abstract/Full Paper Submission Deadline:
15 November, 2016

Early Bird Registration Deadline:
15 January, 2017

Conference Date: **8-10 June, 2017**

ACADEMIC SUPPORT

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