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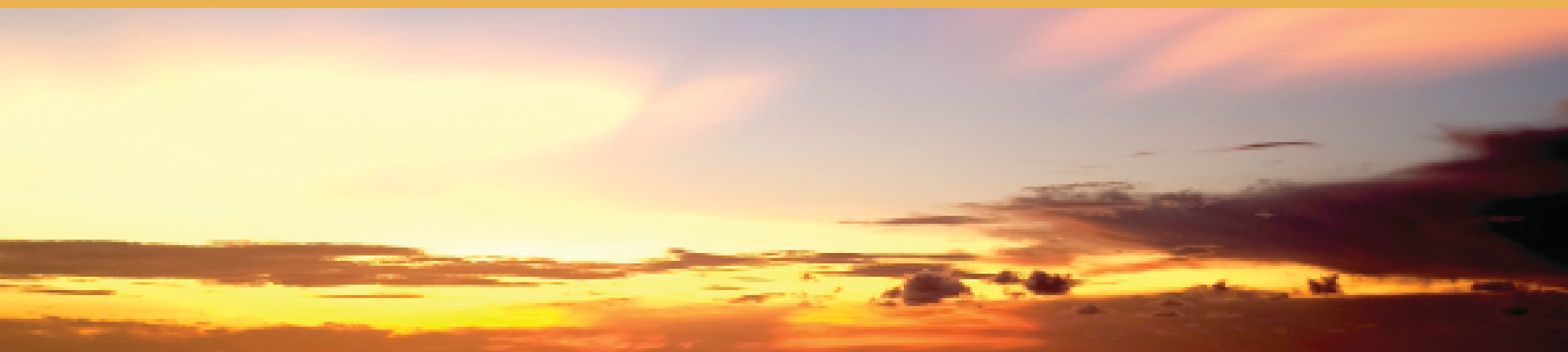

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Contents

Four Cases of a Sociocultural Approach to Mobile Learning in La Clase Mágica, An Afterschool Technology Club

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This paper presents four projects in which mobile devices are used to support authentic learning in an afterschool technology club, *La Clase Mágica* (LCM@UTSA), designed to motivate underrepresented elementary school children in science, technology, engineering, and mathematics (STEM). The implementation of mobile devices into LCM@UTSA is based on a sociocultural approach to mobile learning in which we use mobile devices to bridge school and home lives in order to make learning authentic and meaningful. This approach uses mobile devices to facilitate generative themes, multiple contexts, and culturally responsive practices. This paper describes four iPad-based projects in LCM@UTSA since 2012, which follow this sociocultural approach to mobile learning.

Keywords: mobile learning; informal learning environments; instructional technology

Introduction

La Clase Mágica (LCM) is an afterschool club that provides an enriching learning space for children from diverse backgrounds (Vásquez, 2003). Established in 2009, *La Clase Mágica* at the University of Texas at San Antonio (LCM@UTSA) is a university-school partnership between UTSA and Los Árboles Elementary in a predominantly Latino/a working-class area of San Antonio, Texas. Most of the children attending this school ranged from 5 to 12 years of age and are from Spanish speaking homes. In LCM@UTSA, elementary school children participate in science, technology, engineering, and mathematics (STEM) activities within an informal learning environment guided by university mentors, who are UTSA Spanish/English bilingual education teacher candidates. The club is designed and administered by the university faculty at Los Árboles. This afterschool club meets for two hours on a weekly basis for approximately ten weeks a semester.

Sociocultural theories of learning and development guide the pedagogical design of LCM@UTSA. Our goal is to address the social and cultural factors that shape and influence the educational experiences of culturally and linguistically diverse populations. Thus, all participants in the clubs must respect and value the cultural funds of knowledge (González, Moll, & Amanti, 2005) that children bring from their home and community lives. An important aspect of LCM@UTSA is the authentic learning and development of both Spanish/English bilingual education elementary school students and Spanish/English bilingual education teacher candidates. This program engages children of marginalized communities in meaningful and enjoyable learning experiences as they interact with adult mentors. As a general rule, LCM@UTSA projects and activities adhere to guiding principles against which UTSA faculty judge appropriateness in design and the activities in which the children participate. Two of these principles indicate that "the activity must be a mixture of play and education" and that "learning is an active process that is fostered by norms of intergenerational interaction in which adults work alongside with children as co-participants and not as directors" (Gallego, 2001, pp. 316-317).

The integration of technology as a system of meaning making in LCM@UTSA is purposeful and deliberate. Although LCM@UTSA has evolved since 2009 in various ways with an increased focus on STEM and the use of newer technologies including iPads—the goals of the program remain the same: to address the U.S. digital divide by providing access to technology to Latino/a students; to develop teacher candidates' and children's bilingualism and biliteracy; and to provide access to rich learning experiences to children and families who are underserved by public schools. All children and mentors are given iPads to use during the LCM@UTSA activities.

The authors contend that the integration of iPads into the LCM@UTSA curriculum provides a sociocultural approach to mobile learning that respects the cultural and linguistic diversity of its participants while also bridging the school and home lives resulting in authentic learning. This paper will present LCM@UTSA's sociocultural approach to mobile learning followed by the discussion of four projects exemplifying this theoretical framework, our findings, discussion, and implications from this work.

A Sociocultural Approach to Mobile Learning

Sociocultural perspectives and learning theories stress a learner-centered collaborative learning approach. More emphasis is placed on the impacts of cultural practices, social relations, and community on the learner and the learning process (Wang, 2007). Sociocultural theories regard learning as a meaning making endeavor mediated through social interaction with others and artifacts (Vyogtsky, 1978; Mahn, 1999). Thus, sociocultural pedagogical perspectives, such as those involved in the design and implementation of LCM@UTSA, recognize and value the children's learning processes that occur before the children arrive at and participate in the afterschool program (Mahn, 1999).

By incorporating project-based activities that highlight "learning that emerge naturally in the course of cultural practice" (Bereiter, 1994, p. 21), we recognize home and community funds of knowledge as central "social and cultural factors in learning and development" (Mahn, 1999, p. 341). The inclusion of UTSA teacher candidates as mentors who facilitate the children's learning process through the use of mobile devices is also an example of how the afterschool program shapes the "thinking, learning, and development through social interaction" (Moore, 1998 as cited in Wang, 2007, p. 151). The university mentors provide the children with sufficient scaffolds for higher order operations as in accordance with Vygotsky's (1978) concept of the zone of proximal development. Thus, our projects align with Wang's findings that, "sociocultural learning theories provide us with a framework to understand how students learn" (p. 152), in our case, specifically how the children participating in LCM@UTSA learn through the use of mobile devices.

A sociocultural approach to mobile learning promotes meaningful uses of mobile devices within formal and informal learning settings in order to bridge students' school and class lives. According to Drotner, Jensen, and Schroder (2008), "school no longer holds a monopoly as a site for learning experiences that are deemed relevant by learners" (p. 2). Such sites are commonly referred to as informal learning environments (ILEs) and typically described as "out-of-school learning environments [that] strive to create contexts where youth can engage in technology-infused activities not supported in the community's schools" (Rebmann, 2013, p. 240). In the case of LCM@UTSA, the ILEs we describe here is an afterschool technology club, which focuses on developing bilingualism, biliteracy, and STEM-related skills within a low-income Latina/o community.

In our afterschool programs, mobile devices are the mediators between children's home and school lives. The sociocultural approach to mobile learning presented here is based on Arreguín-Anderson and Ruiz's (2013) framework of mobile learning within bilingual education settings in which mobile technologies facilitate: 1) students´ exploration and identification of generative themes, 2) navigation between multiple contexts, and 3) culturally responsive practices. In essence, this framework draws from Vygotsky's conceptualization of learning as a socially constructed activity that takes place in in well-defined cultural contexts (Vygotsky, 1978). Therefore, what we know or want to explore in our inquiries and projects is closely shaped by our particular cultural space (Vygotsky, 1978). A critical aspect of this framework is the understanding that students navigate a variety of contexts through out any given day and thrive in pedagogical environments that capitalize or respond to their very specific needs by targeting themes or issues generated from "problems of their own experience" (Shor, 1992, p. 12).

Students' Exploration and Identification of Generative Themes

Generative themes emerge from students' personal and familiar spaces (Freire, 2003). Using mobile technologies, children at LCM captured images (i.e. pictures, videoclips) of daily life that were 'generative' in the double sense that the images connected to themes or topics that inspired them to learn, and by discussing with their adult mentors, students could generate even more complex inquiries or projects. LCM@UTSA mentors are given iPads to use within the club activities. Mentors and children use these devices to captures images, video, and other information about their surroundings, which can include their school, community, and homes. Children can contribute to these generative themes when they are home and using their own or their parents' mobile devices. The iPad-based activities required children to integrate aspects of their home and community lives into the academic content. In LCM@UTSA, the academic content was related to STEM subjects. Authentic learning occurs when children are able to incorporate their home knowledge into the activities. It is essential that children learn to integrate mobile devices into their everyday lives, just as adults generally use their smartphones and tablets to conduct everyday business like texting, picture taking, and browsing the internet.

Navigation Between Multiple Contexts

Generative themes occur across contexts. Sharples, Milrad, Sánchez, and Vavuola (2009) note that mobile learning involves “processes (personal and public) of coming to know through exploration and conversation across multiple contexts, amongst people and interactive technologies” (p. 5). The navigation between multiple contexts is important in authentic learning and culturally responsive practices. That is, mobile learning is not confined to just one context (e.g., school or class); rather, it spans and effects change across contexts. Mobile learning environment should be contextualized to the learner’s environment (Wang, 2004; Sharples et al., 2009; Arreguín-Anderson, 2011) given the personalization and positioning affordances of mobile devices. That context may change and even intersect with other contexts as our program is always integrating children’s home lives into the activities. Be it the classroom, the home, the zoo, the gardens, or at the market, mobile learning should help children navigate with each context while also transcending others. Recent surveys show that most adults and teenagers own cellphones with about half of each demographic with smartphones (Madden, Lenhart, Duggan, Cortesi, & Glaser, 2013). Access to mobile devices is growing among all demographics. The portability of such devices allows children to bring their devices wherever they go allowing for learning anytime and anywhere (Hlodan, 2010). With portability, children can access educational information online anywhere they carry their iPads. Given increasing mobile device ownership among all demographics (Lehart, Purcell, Smith, & Zickuhr, 2010; Madden et al., 2013; Pew Research Center, 2014), the idea of "whose devices do we use" becomes an issue as personalization. Given that students have free access to a wealth of information online, they are able to select and use any resources they want. In the same vain, they can access the same resources on whatever platforms they want including their own personal devices rather than a school or library computer.

Culturally Responsive Practices

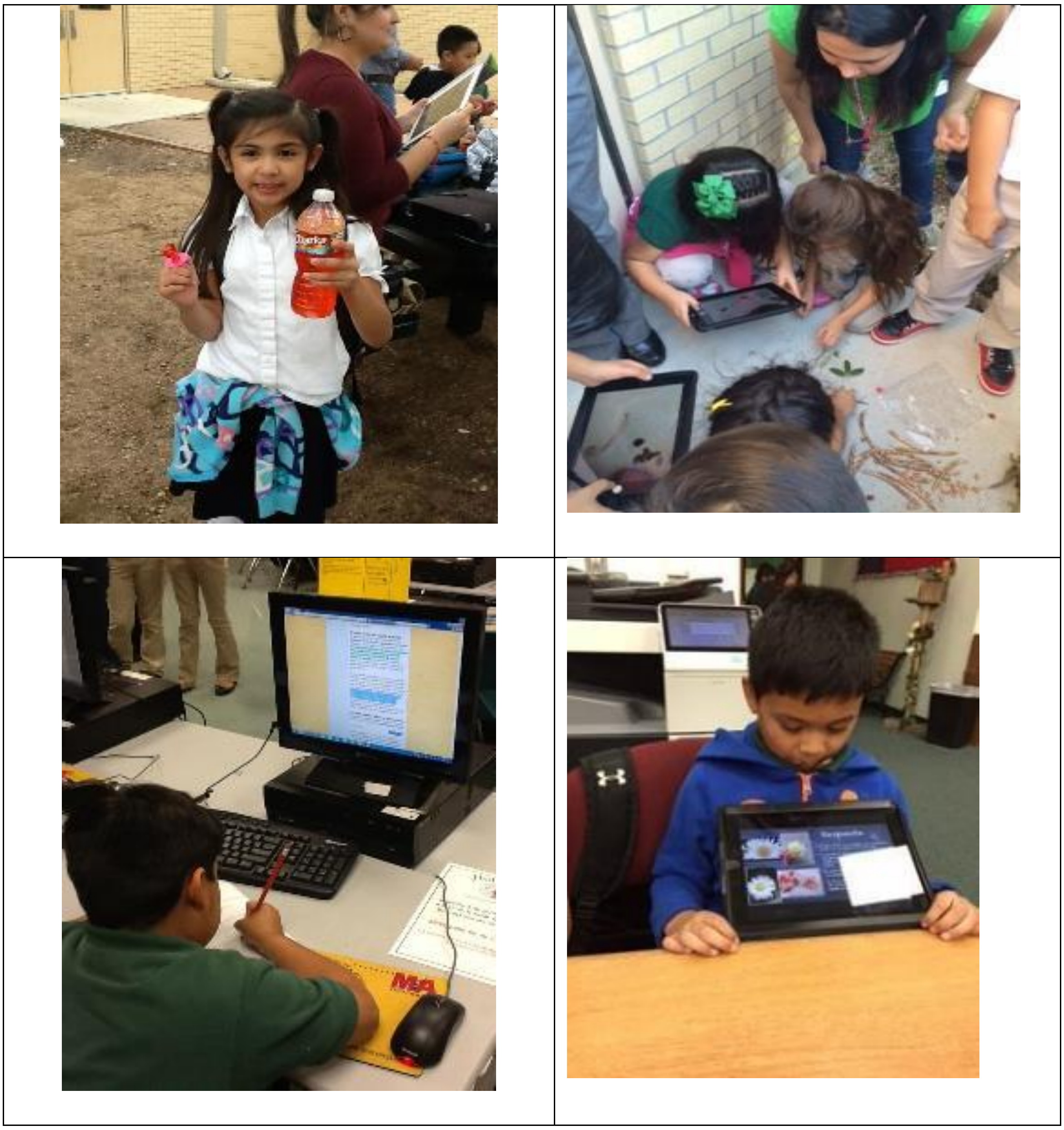
Culturally responsive teaching embraces and respects the cultural and linguistic characteristics of diverse students in order to ensure academic success of all students (Flores, Clark, Claeys, & Villarreal, 2007). The personalization aspect of mobile learning provides a learning space that is culturally responsive to its students/users and it is particularly relevant in linguistically diverse settings such as LCM@UTSA where the use of Spanish is favored, but in which children take advantage of technologies and resources that afford them the opportunity to continuously switch between languages (English and Spanish) as they develop strong academic and digital literacy skills.

An underlying premise of mobile learning is that it promotes 21st Century Learning, also known as digital literacy skills. Digital literacies are usually discussed within the context of using information and communications technologies (ICT) in which users must have core computer and technology skills, an understanding the nature of information, literacies in finding, using, constructing, and evaluating digital and non-digital information, and good digital citizenship (International Society for Technology in Education, 2007; Bawden, 2008; Koltay, 2011). The digital literacies are congruent with learners today, in the 21st Century, who are more likely to be fluent in technology skills; have on-demand access to information from multiple sources, perspectives, and multi-modal representations; are always connected to the web; being an active participant and contributor in online networks (Rodgers, Runyon, Starrett, & Von Holzen, 2006; Bawden, 2008). Digital literacies are important to mobile learning, as mobile devices are often the only ICT that students and their parents have. Further, these 21st Century learners spend their free time engaged in digital environments like games and electronic communications (Rodgers et al., 2006). Sharples, Taylor, and Vavoula (2005) refer to mobile learning as being inherently social constructivist as mobile devices are and support conceptual changes and community building. Though similar, the sociocultural approach to mobile learning presented in this paper focuses on how mobile learning embraces and facilitates learning that is responsive to the cultural and linguistic diversity of students. The projects involving mobile devices (i.e., iPads) in LCM@UTSA followed the sociocultural approach to mobile learning described above. The next sections will present four projects that occurred from 2012 to 2014.

Project 1—Informal Science Learning Using Mobile Devices

In the spring of 2012, children at Los Árboles Elementary engaged in technology-based science activities in collaboration with teacher candidates. Together, they transcended the confines of the science lab in which they met on a weekly basis. That is, children used iPads, smartphones, and laptops to extend their inquiries to informal settings such as their homes, their neighborhoods, and the schoolyard. Congruent with theoretical definitions of mobile learning, children used mobile devices to engage in activities and interactions that span multiple contexts (Sharples et al., 2009; Arreguín-Anderson & Ruiz, 2013). In order to examine how the mobile devices span these multiple contexts, the UTSA faculty investigated the question of: what is the nature of scientific inquiries that pairs of students elect to develop in an informal afterschool setting with the use of mobile technologies? Data was collected from 25 elementary school children in spring of 2012 and 20 elementary school children in fall of 2014 for this investigation (see Figure 1). Twenty-six teacher candidates worked with the children in the spring of 2012 and 16 teacher candidates worked with the children in fall of 2014.

Figure 1. Children using technology to develop science projects.



Description of the Activity

A pre-established plan included open-ended activities for each of the ten weekly meetings. To conduct their scientific inquiries, children generally divided their time investigating amongst different sources and different technologies. Initially, most participants used their desktop to navigate the web to locate information related to their topic and to learn about presentation software such as iMovie and Prezi. Subsequently, they used their iPads and iPhones to take pictures of objects, organisms, and events and record interviews. For example, a child researching the topic of sharks used search engines to locate National Geographic documentaries, YouTube videos, and to locate pictures of the largest and the smallest type of shark. Then, he learned about Prezi, and used the iPad to take pictures of a scale model of a shark's tooth that he constructed. Additionally, he used the video capabilities of the device to interview classmates regarding their perceptions and fears of this beast.

Outcomes

A pattern identified in the spring of 2012 was participants' inclination to take advantage of devices' portability as they seamlessly moved from laptop to tablet to smartphone to collect data, document observations, and complete their final product. A total of 16 children focused their investigations on generative themes related to life science. Additionally, nine children selected other areas of science including objects in the sky, medicine, soccer, and transformation of natural resources. In all cases, participants selected science topics closely related to personal hobbies, favorite sports, or traditional artifacts. Then, they compiled data from a variety of internet websites and books and recorded and stored interviews, text, and video in English and Spanish to build databases from which to draw as they built their final products. LCM's responsive approach was evident as UTSA teacher candidates provided scaffold or support to their child partners during the preparation of and presentation of final products, thus empowering Los Árboles students intellectually, socially, emotionally, and politically by providing opportunities to use “cultural and historical referents to convey knowledge, to impart skills, and to change attitudes” (Ladson-Billings, 2009, p. 13).

Project 2—Bilingual Science Puppet Videos via Mobile Technology

During the fall of 2012, LCM@UTSA students and their mentors produced inquiry-based science videos that featured a skit with homemade sock puppets. These individually designed sock puppets helped illustrate the science content of their short plays, which they wrote and video-recorded collaboratively—as pairs or triads—using mobile technology. Since there were 19 UTSA bilingual teacher candidates working with 21 students at Los Árboles Elementary that semester, the afterschool technology club produced 19 videos—all reflective of children’s cultural knowledge and responsive to their strengths and dominant language: Spanish.

The final videos covered generative themes such as: the life cycle of a plant or animal; the three states of matter; laboratory precautions; petroleum formation; sharks, marine turtles, frogs; volcano formation; electricity generation; the scientific method; gravity; hail formation; snow formation; and lunar phases (see Figure 2 for screenshots of some of the final videos). The children prepared the video projects knowing that the videos would be premiered at an end-of-the-semester family night with their parents and families as the audience.

Description of Activity

During this particular semester, LCM@UTSA at Los Árboles Elementary was held for 11 weeks. The following list details the weekly activities the university mentors had to collaboratively achieve with their child partner(s): 1) explore the app, “Sock Puppets,” on your iPad; 2) write a dialogue/script that features two of the puppets, minimum three lines each, and record it in Sock Puppets; 3) select a science question/inquiry you want to answer this semester; remember that you will present your findings in a final video; 4) investigate this inquiry using the Internet and various search engines; 5) write the dialogue/script for your play based on the research you obtain; record this dialogue in Sock Puppets; and upload your dialogue/script into Moodle; 6) plan out and submit a list of all your materials you will need to make your two sock puppets, which will be featured in your science play; 7) make your real-life sock puppets; 8) use the iPad's camera to record your play, based on the script you wrote; 9) use video-making software on your iPad to add a title, trailer, and music to your video; and 10) premiere your video on Family Night to parents, siblings, other relatives.

Figure 2. Screenshots of the children's inquiry-based science puppet videos.

As this was an informal learning environment, the various pairs and triads negotiated how they were to achieve each weekly task. In line with LCM@UTSA's responsive approach in which support or scaffold is provided as necessary, the mentors did not dictate the process and instead acted as a facilitator. The student's science inquiry topic, their artistic choices for the puppets, and their own biliterate practices infused the process and final product.

Outcomes

By using a project-based learning approach (Bell, 2010) to make sock puppet science videos, the elementary school students in LCM@UTSA were able to: 1) examine and try out what they knew; 2) discover what they needed to learn; 3) develop collaboration skills for higher pair/triad performance; 4) improve their communication skills; 5) become more flexible in processing information and meeting obligations; and 6) practice skills they will need for the 21st Century. Project-based learning emphasizes 21st Century learning skills (Bell, 2010), such as the digital literacy skills needed to find and critically consume data on the internet while also using a multi-modal approach to communicating information, which was apparent in this project as pairs synthesized information and gathered data across multiple contexts (Rodgers et al., 2006; Bawden, 2008).

Instead of handing children structured content, the pairs and triads discovered and worked with content they determined to be necessary to solve the problem. UTSA teacher candidates adjusted the process to match students' individualities ensuring that that the children identified a science theme based on their personal interest, subsequently generating a wealth of expressions or science puppets. This project-based learning was mediated by the mobile technology afforded to the afterschool technology club through The Academy for Teacher Excellence. For this particular semester, iPad 2s, were given to each bilingual teacher candidate who was, in turn, responsible for bringing it to the weekly LCM@UTSA meetings at Los Árboles Elementary. The teacher candidates were allowed to keep the iPads after completion of the program. In fact, the springboard for the science puppet video projects came from the app available on mobile devices: Sock Puppets.

Project 3—Digital *Fotonovelas*: Mobile Learning and Biliteracy Development

In the spring of 2013, 22 LCM@UTSA children created a digital *fotonovela* as their digital literacy project with the help of their mentors. As a storytelling form, a *fotonovela* can use the familiar framing devices, sequencing, and text balloons of a traditional comic book with posed or candid photographs (Parlato, Parlato, & Cain, 1980). As a generative theme, *fotonovelas* reminded children of cultural tools often present in their households. At the same time, *fotonovelas* inspired children to take charge of their learning by positioning them as authors of self-generated stories.

Figure 3. Completed digital *fotonovelas*.

Description of the Activity

The children created their digital *fotonovela* using an iPad and the app "Comic Life." The final product was completely personalized as children told their own story, in the language of their choice, and in their own voice. The digital *fotonovela* project required the children to play many roles, including photographer, writer, actor, and researcher. They used different backgrounds for their digital *fotonovelas*; photographed all or more than half of their digital images themselves; added a variety of callouts, such as speech, thought, and exclamation bubbles; added captions placed correctly, either at the top or at the bottom of the frame; were able to digitally manipulate their photographs; the digital photograph images and text worked together to create meaning; and they used proofing tools to edit and revise Spanish/English bilingual text in order to express answers in written form. Figure 3 provides four examples of completed *fotonovelas.*

Outcomes

In addition, the participants learned how to digitally manipulate iPads and the app Comic Life. It is important to mention that, in order to create a digital *fotonovela* on Comic Life, the children needed to perform several meticulous steps. For example, in order to access the app Comic Life, children needed to know how to use an iPad. Then, they went to "Create a comic" and chose a template from the options provided. They also needed to download the digital photographs from their digital camera to the iPad, for which they learned how to use an iPad adapter. Moreover, as each photo needed to fit on the template frame, it had to be manipulated. This project connected children social and academic spaces as they manipulated mobile technologies and documented personal stories that emerged in multiple familiar contexts, such as their home, their classroom and their neighborhood.

Project 4—Exploring Health Related Issues with Mobile Technology

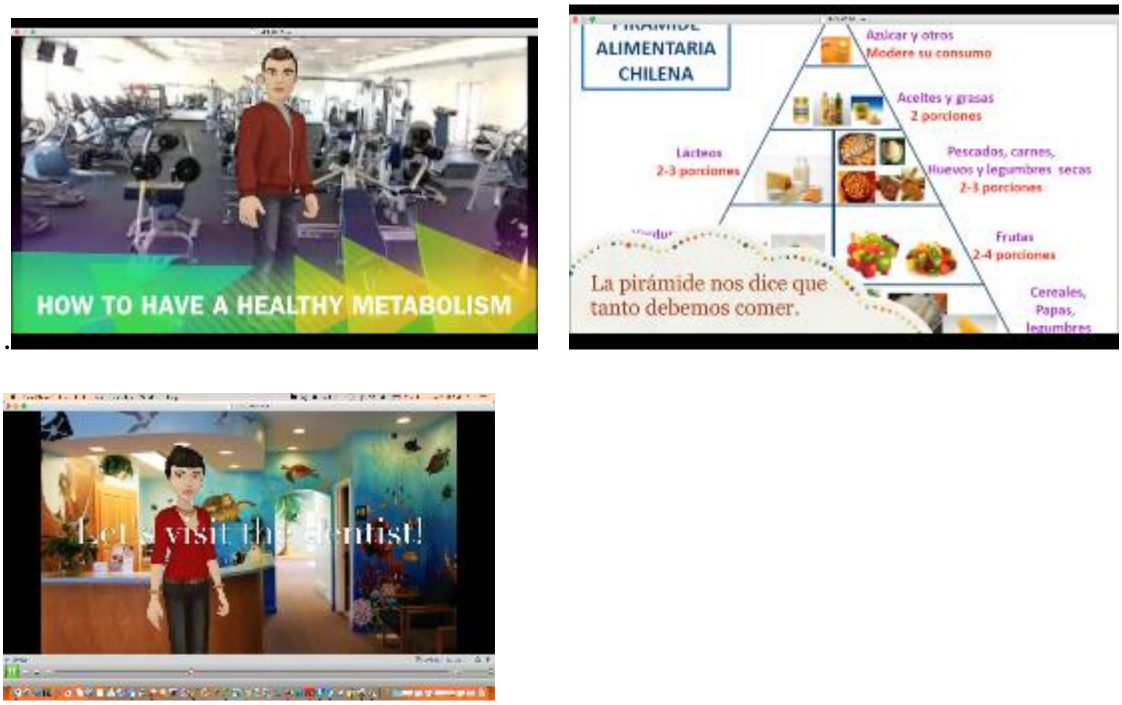
Because generative themes "express problematic conditions in daily life" (Shor, 1992, p. 55) during Spring of 2014 LCM@UTSA students and their child partners at Los Árboles Elementary produced inquiry-based virtual reality (VR) videos on health and hygiene issues affecting their local community. García-Murillo and MacInne (2014) in citing Franklin, Peat and Lewis (2003) found that many computer games allow students to realize and react to the consequences of their (and their peers') decisions" (p. 2). Therefore, providing the LCM@UTSA students and their child partners the possibility of creating simulated scenes inspired in their own lives and examples of ways in which the health issues investigated affect their community, thus, traveling without moving, ultimately generating authentic explorations into their communities' conditions and encouraging them to eventually seek solutions through critical reflection and playful action. VR activities, such as the ones created through this project, provided opportunities to play, explore, and design imagined worlds (Harter & Chao, 1992).

Jointly, the LCM@UTSA students and their child partners created videos and with the use of an application called "Tellagami" they created virtual people who came on the screen to either, narrate the possible scenes, or tell a story about the health issues investigated. A total of ten VR videos were created with the 20 LCM@UTSA students who took part in the afterschool technology program that semester. Topics chosen included; diabetes, obesity, hypertension, dental care/hygiene, healthy living, and promoting good metabolism.

Description of Activity

The LCM@UTSA afterschool technology program during the spring of 2014 ran for ten weeks. The following are the activities LCM@UTSA students and their child partners completed that led to the creation of their VR health videos: 1) discuss critical health issues affecting their community--students choose a topic to investigate; 2) investigate the topic, examine an issue as it relates to their community, a problem as they see/hear in their community, and possible solutions; 3) learn how to use the VR application Tellagami, includes using with the application to create gami (VR people) in the application interface only, then create different scenes within the Tellagami inter-phase; 4) at around week four learn and practice how to combine system inter-phases by adding a tellagami on to an existing video; 5) write a script after all research is completed on the topic, divide it into scenes, and assign roles to different characters, including the tellagami; 6) discuss the video production process, the role of the gami in the video, and finalize a script for the video; 7) at week six, record and produce the video; 8) at week seven incorporate the tellagami into the existing video; 9) at week eight and nine edit the video; and 10) at week ten present the video at a health fair open to school, family, and community members.

Figure 4. Screenshots of completed Tellagami videos.



Outcomes

Peat and Lewis (2003) have stated that allowing students to use virtual reality computer games allow students realize and react to the consequences of their (and their peers') decisions. In the same way it allows students to play out real scenarios without the consequences of reality. Outcomes of this culturally responsive approach to teaching and learning included: 1) LCM@UTSA students and their child partners learned to use VR technology to discuss and research real life social and health issues affecting their communities; 2) they learned to use VR as way to express and explore ways to problem-solve issues related to their communities; 3) LCM@UTSA students learned to use VR as a learning tool for classroom learning that incorporated language, literacy, technology, and science; and 4) they practiced and developed 21st Century skills for classroom and community utility. In other words, the responsive aspect of mobile learning empowered children and their mentors to engage in critical analysis of their own context through self-generated projects.

General Findings/Synthesis, Evaluation, Results

Socio cultural theory is relevant to the design of mobile learning projects at LCM. Congruent with the Vygotskian premise that learning is always mediated, children at LCM benefited from mediation embodied by mobile technologies and “more knowledgeable others” or adult mentors (Vygotsky, 1978). All four of the iPad-based projects described above incorporated the use of mobile devices to support authentic learning between UTSA university bilingual education teacher candidates and Latina/o students enrolled in a bilingual education program at Los Árboles Elementary School. Through their active participation in LCM@UTSA club and exposure to culturally and linguistically responsive practices, members have gradually appropriated or gained digital literacy skills, such as use of educational applications on smartphones and iPads, use of digital cameras, editing, and transferring of files, and communication via email and web platforms. Moreover, with the use of specific technology terms, such as “memory card,” “download,” “save,” “delete,” and “import”, the students became adept at communicating in a language that is common in this digital era. This new vocabulary was important in the students’ usage of technology tools, including applications such as iMovie, Comic Life, Sock Puppets, or Tellagami. In sum, there were able to internalize and independently perform complex skills that initially required constant scaffold or support through collaborative learning.

Additional digital literacy skills are acquired as they access *El Laberinto*, the Maze, and follow the step-by-step instructional task cards in each digital room within the Maze. Opportunities for authentic learning are expanded as the children are supported in selecting and developing their research topics and uses of mobile technology to complete their projects.

Conclusions

Mobile devices have emerged as culturally sensitive tools that span across multiple contexts and settings (Shuler, 2009). This platform is critical at a time when representation of ethnic groups in the STEM fields in the United States continues to lag. Through participation in authentic science activities that mimic what scientists do in real life, students in this afterschool technology club have crossed disciplinary barriers by integrating all academic subjects in meaningful ways.

Mobile learning highlights the importance of examining informal learning contexts, and particularly an afterschool technology club, as a means of empowering children and promoting their biliteracy and digital literacy development. The LCM@UTSA participants clearly made significant progress in their personal, academic, and creative development, which allowed them access to mobile technology while providing continued opportunities to excel academically and socially in Spanish and English.

Mobility in physical and social space (Sharples, et al., 2009) refers to the ability to learn in different locations and with different people. Physical and social mobility was crucial in the ability children had to document knowledge generated in their own homes (González et al., 2005). Children were asked to share their projects with their parents on a weekly basis and to request their input. Additionally, children explored their other non-traditional learning spaces as they investigated the research questions that guided their inquiries. In a representative science project produced by a first-grade child, the use of chamomile or *manzanilla*—as it is known in Spanish—brought together the knowledge he captured from his mother, along with documented exploration of plants in the school.

A new technology—that featured an old-time craft, the Sock Puppets app, —became the impetus of an authentic learning experience for bilingual children and mentors at LCM@UTSA. In addition, having an authentic audience to whom the videos were shown also served as strong motivation for the partners in this project-based learning project. Classroom-based teachers should feel confident in infusing their instruction with more mobile technology that can successfully be paired with project-based learning because the results and benefits far outweigh any perceived lack of rigor or fear of "too much" fun/play on a tablet. The digital *fotonovela* activity, for example, demonstrated the importance of providing the children time and space for sharing their views about themselves--a Latina/o child living in an increasingly diverse Texas and US population.

Schools in today's mobile era are in a critical position of adopting pedagogies that draw on students' natural inclination to generate their own interest-based projects, many of which will originate in non-traditional spaces. In this sense, mobile devices emerge as tools that open space in which children of diverse cultures and languages are empowered to take charge of their own learning.

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Project ENGRID: A Quasi-Experiment Using Mobile Instant Messenger to Support Second Language Learning

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Immersion is an acclaimed method for second language acquisition (SLA), but is not available to most students. The idea of this study is to create Mobile Immersion on smartphone using Instant Messenger. 45 Form-1 (7th Grade) students participated in a 3-month experiment in 2014. They were divided into two big groups: one with Mobile Immersion (Mobile Group) and the other without (Control Group). A vocabulary list of 200 high-frequency English verbs was the main learning material. Net Gain in vocabulary score between pre-test and post-test was the measurement of learning progress. The statistics showed no significant difference between the two groups' means. However, within Mobile Group, there was significant correlation between individual's chat frequency and vocabulary gain. Furthermore, chat histories of participants revealed a theme that has implications for researchers and educators.

Keywords: MALL, Mobile Learning, SLA, ESL, Immersion, Instant Messenger

Introduction

The motivating problem of this study is that the "communicative" part of second language learning is very inadequate in many mainstream schools. Specifically, this problem has been long standing in learning English as a Second Language (ESL) by Chinese students in local schools of Hong Kong. Outside of school, for most local students, communicative exposure to English in the society is limited because English in Hong Kong only has a negligible social role (Evans, 1996). Possibility for students to practice English at home is also low. According to Census 2012, the proportion of Hong Kong's population which uses English as the main language at home is only 3.5%. In comparison, the figure in Singapore, another former British colony, was 48% in 2010 (Yeung, 2013). In a nutshell, for most local students, the communicative learning component is not easily accessible in school, in the society, or at home.

The general lack of second language communicative exposure may partly account for the sub-optimal efficiency of learning. This may be reflected in the perceived phenomenon that many students in Hong Kong cannot master a practical level of English even after twelve years of formal study (from Primary 1 to Secondary 6). According to the reports published by the Hong Kong Examinations & Assessment Authority, in the 2013 Hong Kong Diploma of Secondary Education (HKDSE) examination, only 48.6% of candidates attained Grade 3 or above in the subject of English Language (HKEAA, 2014). Grade 3 is regarded as only a basic ability to communicate and study in the language, which is a minimum requirement for entering a subsidized local university. In other words, over half of Hong Kong students fall short of this standard. This study is to examine a new solution leveraging mobile technology to provide the lacking communicative component:

Mobile Immersion.

Traditionally, immersion is a learning method where learners put themselves in an environment where they can interact in the second language with others, usually face-to-face with peers or some experts such as teachers or native speakers. Ideally, immersion should happen in a place where the target language is actually spoken, such as in a foreign country or in an international school. Obviously, this may be too costly and not accessible to the majority of learners. With the advances in technology, it is hoped that the essence of immersion can be replicated with mobile devices.

A Theory of Change: the intervention in this experiment, Mobile Immersion, is basically formatted like this: Teams of three participants are put into a chat group with some online tutors. Participants are asked to use English in their daily lives to chat with their teammates in written text. If their texts have any errors, the online tutors will provide edit or feedback to guide them to the correct form of the language. To encourage active chatting, the online tutors would sometimes also participate in the conversations.

Research Question: Does Mobile Immersion enhance second language learning, specifically vocabulary building?

To find the answer, a quasi-experiment was set up. A 3-month after-school programme was arranged for 45 Form-1 students from different classes of the same school. They formed teams of three on their own. The 15 teams were split into two big groups: one had the Mobile Immersion (Mobile Group), and the other did not (Control Group). Everyone was given the same learning materials at the beginning, which is a vocabulary list of 200 high-frequency English verbs. Every Monday, all participants had a gathering in a function room of their school to have some team game activities. During the research period, all participants went through the same programme and presumably similar schooling. The only different intervention was the Mobile Immersion for Mobile Group. At the end of the 3-month programme, the vocabulary test results of Mobile Group and Control Group were compared. The actual chat histories of individual participants were also reviewed to analyse their online behaviours.

This paper will report the findings in the research, draw insights from it, and discuss possible implications for the education field. Further research will be suggested for this new learning model to benefit more schools and more learners.

Literature Review

Two main bodies of knowledge inform this study: (1) Interactionist Theory of second language acquisition (SLA), and (2) the principles for mobile-assisted language learning (MALL).

'Immersion' in the framework of Interactionist Theory

Two major perspectives or approaches to second language acquisition (SLA) prevail in the literature over the last few decades, namely cognitive (psycholinguistics) and socio-cultural (sociolinguistics). Interactionist Theory, while sitting under cognitive, appears to be also related to the social perspective. According to Blake (2013), the Interactionist Theory can be broken down into four main hypotheses in the learning process: -

- the Input hypothesis (Krashen, 1985)
- the Interaction hypothesis (Long, 1983, 1990)
- the Output hypothesis (Swain, 1985)
- the Noticing hypothesis (Schmidt, 1990)

Based on these hypotheses, why 'immersion' is an effective learning method is analysed here. As per Interactionist Theory, interaction between students is considered to be the main mechanism by which languages are learnt (Randall, 2007). Whereas Krashen's (1985) Input Hypothesis argued that acquisition follows comprehensible input alone, others such as Swain (1985) argued that output was also necessary for second language acquisition. The Output Hypothesis emphasises the role of comprehensible output (language production), through which the learner's interlanguage can be stretched (Swain, 1985). Immersion as a learning method requires learners to try their best to express themselves in the target language and to be understood. Therefore, producing comprehensible output is the duty of each participant. The Interaction Hypothesis (Long, 1983) argues that a second language will be acquired through communicative encounters and negotiation of meaning. With immersion, despite diversity in language proficiencies, learners continuously experiment with their language when they try to interact. Communicative urge during these interactions will supposedly lead to the learners adjusting their language to be understood and to overcome any non-communication. Long (1996) further on places more emphasis on the importance of feedback on form. He incorporates Schmidt's (1990) concept of 'noticing' and suggests that 'post-modified input' (i.e. correction or recast) is a superior learning material than 'pre-modified input' (i.e. models of the correct forms). The power of corrective feedback is that learners can 'notice the gap' (Swain, 1998) and adjust their language accordingly. The insight for this study is that, in an ideal mode of immersion, if an expert (such as an online tutor) can provide timely and explicit feedback on learners' language forms, it can make the 'noticing' even more effective.

The above analysis shows that immersion can capture the essence of the Interactionist Theory. The problem is that most learners do not have access to such an environment to immerse in. So, can immersion be successfully replicated by mobile technology and become more accessible?

Mobile Immersion (with Instant Messenger) as a form of MALL

Despite the rapidly changing mobile technology, there are some evolving principles of designing effective mobile-assisted language learning (MALL) platforms, such as the set proposed by Stockwell and Hubbard (2013). Mobile Instant Messenger appears to be an attractive tool for MALL for a few reasons. The language used on Instant Messenger can be described as between oral and written genres. It has good potential for creating a conversational environment even by texting. From a technology perspective, it provides new affordances. While by nature it is an asynchronous communication tool (no need for immediate responses), people often use it in a synchronous mode (real time chats). So it carries the benefits of both worlds. From a pedagogical perspective, chatting among peers naturally requires content authenticity, and comprehensible input, which is the crucial element leading to second language acquisition (Krashen, 1985).

According to a literature review conducted by Viberg and Grönlund (2012), the result of a stock-taking exercise on researches published between 2007 and 2012 indicates that "there is a lack of empirical studies providing concrete evidence on how the mobile technology use can enhance individual's language learning results" (p.15). Mobile Instant Messenger, being one of the dominant modes of everyday communication now, is a relatively new technology, not to mention as an educational tool. There seems to be a knowledge gap in the literature.

In summary, drawing upon Interactionist Theory, immersion is an effective method of second language acquisition. Mobile technology, particularly Instant Messenger, holds promises of enabling Mobile Immersion. The purpose of this study is to examine it empirically.

Research Method

The methodology of this study is to use a quasi-experiment to test whether the Mobile Immersion has any significant effects on learning outcomes. Vocabulary test scores are used as a measurement and a proxy to the learning progress, complemented by studying the chat histories as transcripts.

The intervention

From the literature review, it appears that immersion is an attractive method for second language acquisition, and mobile technologies do have potential to replicate the benefits of traditional face-to-face immersion. So, the assumed theory of change is: if students immerse themselves in a second language environment with Instant Messenger, they will show a desirable outcome of enhanced learning, specifically, growing their vocabulary of high-frequency verbs more effectively.

Key components in the methodology

- A special 3-month After School Programme
- 45 participants divided into two groups: Mobile Group and Control Group
- A list of 200 high frequency English verbs as the core learning material
- Post-test vs. Pre-test to measure net gain in vocabulary test scores
- Statistical analysis on test scores and chat frequencies
- Analysis on chat histories

Rationales of methodological decisions

Choice of technology

Hardware: smartphone. The adoption rate of smartphone in Hong Kong is among the highest in the world. It is penetrating quickly even among school children. It is an important factor for the research because the technology must be readily accessible to most of target participants. Software: Instant Messenger (WhatsApp TM). This mobile app has been one of the most popular in Hong Kong. Most local people are already using it.

This means less technical barrier and training needs for this study. In this research, written text is the mode of chatting.

Choice of school

Under the educational policies of Hong Kong, local secondary schools are put into three 'bands', reflecting the average academic performance of a school's students. Band 1 is the highest; Band 2 in the middle; Band 3 being the lowest. The participating school is in Band 3. The significance to the research is that, if the new learning method is successfully implemented in this school, the probability of it being also successful in other schools (in the same or higher bands) should be reasonably high because theoretically their students' motivation and ability to adopt new learning methods should not be lower than a Band-3 school.

A team size of three

Group dynamics are often affected by team size. If the team is too big, it is often more difficult to have deep exchanges. So having a small chat group would increase the likelihood of enjoyable chatting. An even smaller team size of two is not preferred, because when they have real needs to communicate, a direct 1-to-1 phone call will be a more natural communication mode. Balancing all factors, the choice is to go for three people each team.

Group assignment: Mobile Group vs. Control Group

The purpose is to create a controlled experiment with Mobile Immersion as the only different intervention. The guiding principle is that when assigning teams to Mobile Group, priority will be given to the teams of more existing smartphone users. The rationale is to minimise the technological hurdle for users. The judgement is that it should not jeopardise the research integrity and validity.

Inclusion of outside tutors but no school teacher in chat groups

Researches on Computer Moderated Communication (CMC) have suggested that students prefer the presence of a moderator to support successful online interaction (Zhang, 2012). However, Nickel (2002) believes that the teacher should not play too much of a role in the online discussion, otherwise there is a risk of impeding student exchanges. Balancing the opposing concerns, the arrangement is to have online tutors (outsiders) act as the 'experts' for giving feedback; the school teacher is not in the groups.

Data Collection

45 Form-1 students were recruited as teams of three each to participate in a three-month After-School Programme with weekly meetings of 1.5 hours. Eight teams were assigned to use Mobile Immersion, the Mobile Group. The other seven teams were the Control Group. The activities and sequence of the programme are summarized in the following table: -

Table 1. Key activities of the 3-month programme: Mobile Group vs. Control Group.

	Mobile Group (8 teams, 24 people)	**Control Group** (7 teams, 21 people)
Stage 1		
Pre-Test	Yes	Yes
Learning material distribution	Yes	Yes
Stage 2		
Weekly meetings (all 45 people together) for team games and exercises	Yes	Yes
Mobile Immersion on smartphone (on weekdays after school)	Yes	**No**

Stage 3		
Post-Test	Yes	Yes

As seen in the above table, both Mobile Group and Control Group went through the same activities except the Mobile Immersion component. All participants also had the same curriculum in their normal schooling. A list of 200 high frequency English verbs was distributed at the beginning of the experiment. Mobile Group members were encouraged to practice using the new vocabulary in their daily lives to chat with their teammates on the mobile app. If there were any errors in their writings, some online tutors would provide timely edit or feedback. Online tutors were available after school 15:30 to 18:00 Monday to Friday except holidays. Vocabulary tests were given to every participant at the beginning and the end of the three-month programme in a classroom setting. The Pre-test and Post-test scores were the principle measurements to quantify learning. Mobile chat histories were automatically recorded in the system.

Findings

Finding 1: Mobile Group vs. Control Group: No significant difference between their mean gains in test scores

The learning outcome was measured by the net gain in vocabulary test score between the pre-test and post- test. At the beginning of the programme, a list of 200 frequently used verbs was distributed. A subset of them was tested among all participants individually. The vocabulary test format is like this: The Chinese meaning of each verb was given. Each student had to write the equivalent English word. The first letter of each answer was given as a hint. Then, at the end of the 3-month programme, a sample of the pre-tested words was tested again. It is worth emphasising that the timing and scope of the post-test were not announced beforehand. The purpose of it was to have a more accurate measurement of what each student had learned and retained, instead of what some students might have crammed into short-term memory by last-minute revision right before test.

The two sets of test scores were adjusted to a common denominator (100) for comparison. The net gains (Post-test minus Pre-test) were analysed with T-Test in SPSS. Five out of 24 participants in Mobile Group were absent for the Post-test, so the sample size N became only 19. Control Group members were all present, so the sample size was 21. The summary of the results is as follows:

Table 2: Vocabulary Test Scores and Net Gains of Mobile Group and Control Group

Group Statistics

	Grouping	N	Mean	Std. Deviation	Std. Error Mean
Pre_Vocab_Score	Mobile	24	44.2667	22.33466	4.55904
	Control	21	36.3952	10.38597	2.26641
Post_Vocab_Score	Mobile	19	54.4737	26.42572	6.06248
	Control	21	43.9286	16.25137	3.54634
Vocab_Gain	Mobile	19	7.7526	9.06859	2.08048
	Control	21	7.5333	10.49220	2.28959

Table 3: T-Test to compare means of Vocab_Gain: Mobile Group vs. Control Group

Independent Samples Test

	Levene's Test for Equality of Variances		t-test for Equality of Means				
	F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference

Vocab_Gain	Equal variances assumed	.222	.640	.070	38	.944	.21930	3.11670
	Equal variances not assumed			.071	37.930	.944	.21930	3.09364

Hypothesis Testing

Null Hypothesis H_0 : Mobile Immersion has no effect on learning progress

(i.e. The mean Gains of Mobile Group & Control Group have no difference.)

Research Hypothesis H_1: Mobile Immersion enhances learning progress

(i.e. Mobile Group's mean Gain is higher than Control Group's.)

T-Test Result: t-score $t(38) = .070$, $p > .05$

Therefore, the Research Hypothesis (H_1) is rejected.

(i.e. No significant difference between the mean Gains of the two Groups.)

When the Gain (i.e. Post-Test minus Pre-Test) is measured, Mobile Group's mean (7.75) is close to that of Control Group (7.53). Mobile Group's standard deviation (9.07) is lower than Control Group's (10.49). However, when the scores in Pre-Test and Post-Test are analysed separately, the picture is more complex. Firstly, the mean score of Mobile Group, no matter in Pre-Test or Post-Test, is notably higher than that of Control Group (Pre-test score difference 7.87 percentage points; Post-test score difference 10.55 percentage points). Secondly, the standard deviation of Mobile Group, no matter in Pre-Test or Post-Test, is also notably higher than that of the Control Group (Pre-Test: Mobile 22.33 > Control 10.39; Post-test: Mobile 26.43 > Control 16.25). In other words, within Mobile Group, the scores actually varied a lot more among individual participants. These observations may tell a more interesting story. A question evolved: Is there a relationship between test performance and the usage frequency of the Mobile Immersion? With this insight, further analyses were done on the individual participants' scores, gains and individual mobile chat histories. This led to the discovery in the second finding reported next.

Finding 2: Significant Correlation between individual Vocab_Gain and Chat_Frequency

All chat histories are automatically logged and stored in the Instant Messenger system. In a sense, it is like a full transcript of the conversations of each team during the whole research. Each chat entry carries the useful information of who made that input and the time-stamp. The records of each team's chat group were downloaded as text files for further processing. The number of chat entries, Chat_Count, by each individual was counted, with the following condition. On Instant Messenger, users tend to use a lot of emoticons and graphical icons, as well as single-word conversation fillers such as 'hi', 'k', etc. If all these utterances are counted, the statistics might be distorted. The researcher judged them as noise and made the decision to count them out in individuals' Chat_Count. The assumption of this analysis was that, if mobile immersion was effective, then the more a participant used it, the more gain he/she would make in the vocabulary tests. So, the individual gain in score and the number of chat entries are put to a Correlation test in SPSS. The result is as follows: **($r = .497$, $p < .05$) (2-tailed)**.

Table 4: Significant Correlation between Vocab_Gain and Chat_Count

Correlations

	Vocab_Gain	Chat_Count

Vocab_Gain	Pearson Correlation	1	.497*
	Sig. (2-tailed)		.030
	N	40	19
Chat_Count	Pearson Correlation	.497*	1
	Sig. (2-tailed)	.030	
	N	19	24

*. Correlation is significant at the 0.05 level (2-tailed).

Individual chat count appears to be significantly correlated with vocabulary gain. It should be emphasized that this correlation does not imply causality. In other words, up to this stage, there is no evidence whether higher gain is caused by more usage of mobile immersion. The above analysis uses Chat_Count to gauge usage. In terms of methodology, one risk is outlier data points. For example, if someone made a lot of entries just on one day but remained inactive most of the other days, that one spike might distort the picture in analysis. To contain this risk, another yardstick to measure usage is applied. Instead of no. of chat entries, this time the number of days a participant was active (i.e. made at least one valid entry, again discarding the invalid entries with only emoticons, etc.) is counted. Of course, using Chat_Days alone as measurement also has similar methodological risk. For instance, one participant might be 'active' on many days but just made very few entries each day. Therefore, the researcher needs to be aware of the limitations and look at the bigger picture. Anyway, SPSS is run again with Chat_Days. The correlation is even more significant: ($r = .549$, $p < .05$) (2-tailed).

Table 5: Even more significant Correlation between Vocab_Gain and Chat_Days

Correlations

		Vocab_Gain	Chat_Days
Vocab_Gain	Pearson Correlation	1	.549*
	Sig. (2-tailed)		.015
	N	40	19
Chat_Days	Pearson Correlation	.549*	1
	Sig. (2-tailed)	.015	
	N	19	24

*. Correlation is significant at the 0.05 level (2-tailed).

Combining the above two Findings 1 & 2, an insight evolves. Assuming that Mobile Immersion was indeed effective, then why was there no significant difference shown between the two big groups? One possible explanation could be that, within Mobile Group, the inactive users' low scores have heavily off-set the active users' high scores. As a result, Mobile Group's mean was significantly brought down.

Discussion

In this study, an experiment was implemented to examine the Research Question: Does Mobile Immersion enhance second language learning, specifically vocabulary building? In practical terms, like testing any new educational solution, the questions we want answered are: Is it useful? And, will people actually use it?

Is Mobile Immersion useful?

On the face of it, according to statistics of the data from the experiment, the initial answer to the first question is: not significant. However, this very much depends on how the parameters are applied to define active usage. When designing the research method, a major challenge was the difficulty in controlling the quantity and quality of chats by each team and each participant. In terms of task design, if 'free-chatting' is viewed as a learning task, it is probably not the conventional type. Traditionally, MALL learning tasks are supposed to be more structured with scaffolding (Stockwell & Hubbard, 2013). In contrast, by nature of free-chatting, participants cannot be forced into chatting if they do not want to. The online tutors in the experiment could only encourage chatting by engaging with the participants. As observed in the actual chat histories, some participants were comfortable chatting along, but some were not as ready. This diversity in online behaviours could impact the results fundamentally. As it turned out, the anticipated challenge did happen and the individuals' raw data had to be analysed, which led the researcher to discover even more interesting stories behind the data.

By digging into individual scores and detailed chat histories, important themes were uncovered. When Mobile Group and Control Group are compared, on the surface there seems to be no significant difference. But was Mobile Group fully 'Mobile' in the first place if part of them were not active at all? As reported in the Findings section, if Chat_Count or Chat_Days was taken into account to define the 'true' Mobile Group, the comparison of means between Mobile Group and Control Group could well be more significant. As such, the answer to the research question may be: Mobile Immersion is possibly useful when learners actually embrace it.

Will students actually use it?

Is there any pattern behind the difference between active and inactive participants? One easy and obvious explanation could be the natural diversity in students' diligence, which is possibly a normal distribution. Another possible reason could be in personal styles: some are just more vocal than others. However, a deeper look at the chat histories reveals another theme. Numbers of chat entries are closely related to how participants make use of the platform. If participants treat the platform as an electronic form of homework, they would make entries only when necessary or being asked to. This passive mode of learning is similar to the paper-and-pencil exercises they are familiar with. As a result, reflected in their chat histories will be lower counts of chat entries. In contrast, if participants treat the platform as a social environment, they really try to use the second language in their daily lives. Naturally, they will chat in topics of their own interests. The topics typically are related to their school life such as homework and school activities. Other topics include hobbies such as sports, food, travel, music and other pop cultures. When they chat, other teammates will give feedback, and they respond. This way, there are a lot more turns in the conversation and naturally the chat counts will show higher numbers. Another factor is the group dynamics in the chat group. Similar to other social circles in real life, if there is an out-going and vocal person in a group, the group would tend to be more active. This will reflect in more chat counts and chat days. The insight from this observation is that, a key factor in promoting active usage of the Mobile Immersion is, fundamentally, how learners treat the tool. By extension, if active usage will enhance learning outcome, learners should be guided to the right mentality of second language learning, i.e. to live the language instead of passively doing exercises. Whether a student is motivated to really 'live the language' in the virtual mobile environment also depends on the group dynamics. Researchers have shown more interests in the global phenomenon of virtual social networks enabled by information technology. Concepts of 'relatedness' and 'dwelling' are applied from sociology and anthropology to understand the sociocultural dynamics (O'Hara, Massimi, Harper, Rubens & Morris, 2014). Learner mentality and group dynamics could be an important area that motivates or demotivates a student to use Mobile Immersion as a habit. It warrants educators' careful management.

Limitations of this study

Unable to establish causality. The findings from this study focus mostly on the correlation between use of Mobile Immersion and Gain in learning. Based on Interactionist Theory, there are hypotheses on the mechanisms of Input, Output, Interaction, and Noticing in the learning process. But this research was not designed to test or prove the mechanisms. Significant correlation is a good sign, but one might challenge the causality. Whether higher usage of Mobile Immersion leads to better performance or higher performers tend to use Mobile Immersion more frequently is subject to debate. The implication is, for educators, Mobile Immersion is a tool of good potential; for researchers, it is worthwhile to further examine any causality and mechanisms.

Unable to reflect the quality of chats and behaviors of silent observers. In the analysis, the primary measurement is frequency of chats. The measurement was not able to reflect the quality of chats or learning moments in Mobile Immersion. Besides, silent participants in a chat group might be totally inactive, or might actually be 'active observers'. It was not clear whether they actually paid attention to the texts from tutors or their teammates. Theoretically, these silent observers could also learn from others, but this possible factor was not reflected in this study.

Implications

This study showed significant correlation between chat frequency and learning progress. Chances are, Mobile Immersion does have its value in second language learning. For educators, the question would then be how the programme should be structured so that students will readily use the second language to chat in their daily lives. Insights from this study point to a possible new pedagogy: Use Mobile Immersion as the communicative component in second language education. The focus of teachers could be to motivate active use and provide individualised support. As discussed previously, the key to encouraging active use may be a change in students' mentality towards second language learning: to live the language rather than passively doing exercises and treating the language as an examination subject.

In terms of implication for the academic literature, the 'learner mentality' factor is so important and fundamental that, the researcher believes, it could be used to enrich the theoretical framework adopted in this study. The interaction on social network is not a simple simulation of traditional interaction. The concepts of 'relatedness' and "everyday dwelling" (O'Hara, Massimi, Harper, Rubens & Morris, 2014) could be incorporated in the theory of second language acquisition. Further research is suggested: (i) A longitudinal study on the fuller effects of Mobile Immersion. More thorough measurements could include vocabulary, grammar knowledge, or even attitudes towards learning and confidence in communicating in English. (ii) A study on the causality between Mobile Immersion and learning outcomes, or the detailed mechanism of how it happens, drawing on theories of second language acquisition.

Conclusion

This study was motivated by a long-standing problem in second language education -- the lack of communicative learning opportunity hinders the progress of many school students. With advancement of mobile technology, it is believed that some effective form of educational innovation will help address this problem. Admittedly, the available time for this study was quite limited for the intervention to show its effects more visibly. Nevertheless, the learning is valuable. The research journey has led the researcher to a rather unexpected destination: a possible new direction for educators might have evolved. The critical success factor of Mobile Immersion may be, fundamentally, how a student treats the second language and their learning. If students just passively respond to teachers' questions on smartphone, they are just using another medium to conduct traditional paper-and-pencil exercises, and not much will be gained. In contrast, if students actually try to use the second language in daily life, they could better reap the benefits of immersion as suggested by Interactionist Theory. Their learning outcomes would be significantly enhanced. If this theory is substantiated, the implication for educators is that their energy could be directed to guiding students to adjust their mentality: live the second language, and not just treat it as an examination subject. Mobile technology can create a communicative environment but a new mindset is also needed.

To realize the proposition above, further research is suggested. A longitudinal study of a similar format would be helpful in examining the fuller effects of Mobile Immersion. Research into the causality and mechanisms in the learning process would substantiate the theory. Studying learner psychology and social behaviors in mobile media would help researchers and practitioners in motivating learners to embrace the new learning environment. It is hoped that this study could stimulate further research and contribute to the knowledge bases of second language acquisition (SLA) and mobile-assisted language learning (MALL).

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Making the Connection: Strategies for Supporting Technology-Enabled Learning and Organisational Change

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Along with demands on infrastructure and systems, enabling greater capacity for more mobile, networked learning in the 21st century university also requires a paradigm shift in academic teaching practices, as well as new institutional approaches to support that transformation. This paper presents a case study of strategies that have successfully encouraged increased adoption of mobile and technology-enhanced learning at an Australian university. It examines ways in which concepts of digital literacy, connectivism, and informal learning have been useful in designing communications, professional learning and organisational change management initiatives, and in guiding the technical development of online learning and teaching and administrative systems. In particular, as the rapid pace of change has the potential to cause a disconnect between the emerging generation of learners and traditional teaching methods, strategies that foster capability-building and a connected community amongst staff are increasingly vital. This paper also outlines future challenges that underscore the need for sound pedagogical approaches.

Keywords: technology-enabled learning; organisational change; mobile learning; moodle; digital literacy; professional learning

Introduction

If traditional, top-down ideas about learning are no longer sufficient to shape university teaching, why should they be adequate models for institutional approaches to supporting, communicating and enhancing teaching practice? In order to fully understand the changes in learning and teaching enabled by technology, along with pedagogies and technologies, there is also need to analyse the role of organisational change, including strategic and cultural aspects (Marshall, 2010). This paper considers one Australian university's efforts to foster staff engagement with professional learning, technology and strategic initiatives in learning and teaching, in a way that utilises some of the "anywhere, anytime", informal and collaborative approaches that are emerging from the mobile, networked learning environment of the 21st century. It is an attempt to make the connection between current learning theories and the workplace context in which they operate in higher education; to apply them to institutional support and development strategies that, it is hoped, might then in turn contribute to the uptake and improvement of technology enhanced learning within the institution.

Background

Macquarie University is a research-intensive Australian institution, with a history grounded in increasing access to and flexibility of education for its now 38,000 students. The university's five faculties all encourage a blended learning approach, expecting an online presence for all teaching units on the Learning Management System (LMS). In 2012, Macquarie implemented the open-source Moodle platform as its LMS university-wide; a significant undertaking that was successful in its overall objectives of transforming the online learning environment through enhancing practice and building the capability of academic staff (McNeill, 2012). The change management program was carried out by the Learning and Teaching Centre (LTC), a central support unit. As well as supporting the learning and teaching technology platform, the LTC plays a developmental role in working with the university's 1380 full-time equivalent academics to enhance practice, pedagogy and curriculum design, and provide leadership in the use of technology in teaching. Thus the unit occupies a multifaceted space that touches on internal communications as well as training, educational design and development, professional learning and technical system support and development.

With a marked increase in the proportion of teaching units utilising various online elements as a result of the Moodle project, the university is now showing signs of being in the mature implementation and growth phase of blended learning, according to the framework identified by Graham, Woodfield and Harrison (2012), in terms of institutional strategies, structures and support. In this phase, there is a well-defined concept of blended learning with broad, active support throughout the university; well established training and support processes, and a robust structure for policy and decision-making about blended learning.

Macquarie has carried forward a number of the strategies that were successful elements of the Moodle implementation into everyday practice. More recently, it has also initiated some new tactics in line with the increasingly mobile, media-rich and socially-networked environment of higher education. This shift and expansion of approaches grows more relevant and urgent, as the university is currently formalising its strategic intent in the area of mobile and technology enhanced learning. Under the banner of a 'Connected Learning Community', the university's new strategic vision centres on learning and teaching designed for the digital age, with an "individual-led approach to technology adoption for staff and students, (Bring your Own/Choose your own and Mobile Devices, platform independence) to inform learning technology decisions" (Macquarie University, 2015, p.16). The strategy also signals a new-found institutional recognition of the importance of supporting and developing the "digital fluency" of students and staff, and the idea that "teaching with technology is inherently different from learning with it" (Macquarie University, 2015, p.16).

Conceptual approach

The successful training and change management program supporting Macquarie University's Moodle implementation in 2012 was underpinned by principles of self-determination theory (McNeill, 2012). These principles included competence, or capability-building amongst academics, with a continual focus on the 'why' as well as the 'how to' of using technology in teaching, in order to inspire academic confidence in navigating and utilising the online environment. Another principle was to empower academics with the autonomy to take greater individual ownership of the management of their teaching units, and departments to take greater ownership of the administration and organisation of learning and teaching. The final principle was relatedness; building a culture of peer learning between academics through initiatives that included creating example units to support authentic professional learning (Huber, 2013).

The proliferation of web-based technologies and the ubiquity of personalised devices is leading to a seismic shift in the environment for learning and teaching in higher education, and new thinking about how to ensure learning outcomes for students. The rapid pace of change has the potential to cause a disconnect between the emerging generation of learners and traditional teaching methods. In order to keep pace, institutions may benefit by applying contemporary learning theories to communications, professional learning, and even the technical development of systems, in the learning and teaching sphere. Consequently, the self-determination principles outlined above have been supplemented at Macquarie since 2012 by new strategies that draw on elements of connectivism, informal learning and digital literacy.

Siemens (2008) identifies four different models for educators in a connectivist paradigm - master artist, network administrator, concierge, curator - all with the common attribute of "blending the concept of educator expertise with learner constructions" and the common goal of helping to facilitate the acquisition of knowledge through the networks (p.17). Siemens argues that these four connectivist models could equally be applied to educational design staff, whose traditional role in learning design will continue to be important, but will need to place greater emphasis on "addressing knowledge as existing in networks and learning as developing and forming diverse, multi-faceted networks" (Siemens, 2008 p.19). In contrast with the more hierarchical and formal traditional values of higher education, the strategies to facilitate this may well need to draw on the value sets which are at the core of Web 2.0, including peer collaboration, a bottom-up approach, user-generated content, interactive and group communication and informal learning (Serrat and Rubio, 2012).

The concept of informal learning is very much entwined with connectivist ideas. Informal learning can occur irrespective of location, often exhibiting a high level of personal relevance to and control by the learner, and with a learning goal that is defined by the learner (Jones, 2013). As Kukulska-Hume notes, the proliferation of social media and mobile technologies is not only transforming personal life, but is also "at work within the walls of the academy - physical walls or virtual...breaking down traditional barriers separating academic research from teaching, work-based learning and informal learning." (2011, pp.247-8). This sea change is equally applicable and relevant to the work of the university in supporting and developing academic practices such as teaching, which must now take account of the immense potential and capacity of informal learning. The mobile, networked environment of the contemporary university requires a reconceptualisation of professional learning in order to situate learning within the context of practice, personalise it to suit academics' own needs, link it to communities of professional practice, and build it around social collaboration (Mitchell, 2013).

Digital literacy almost amounts to a precondition for the effective adoption of connectivist, informal learning approaches in institutions in the digital age. The term can be defined in multiple ways, often drawing on aspects of media and information literacy, and its use will often depend on context and purpose. Earlier, more restrictive functional notions of digital literacy concentrate on the idea of a convergence of contemporary technologies and new media, focusing on an individual's skills in using technology (Murray & Perez, 2014; Eshet-Alkalai, 2004). If one knew the technology and how it was used in line with new media, one would be digitally literate. But digital literacy also implies a social aspect, involving the ability to construct and share meaning, to decipher, produce and consume digital texts, and to actively participate in networks individually and collaboratively (Hobbs, 2011; Hinrichsen & Coombs, 2013). In the current context, digital literacy of academic staff is therefore likely to encompass an appreciation of the pedagogical soundness of web-based technologies for use in learning and teaching, and their potential for use by students as meaning-making tools. Waycott (2010) found that the barriers to academic staff integration of technology in their teaching include the perception that technology is often introduced for its own sake, prioritised over pedagogy, and implemented in a top-down fashion. Waycott suggests that the notion of a gap between digital native and digital immigrant is overly simplistic and that, "university teaching staff choose to integrate technologies into their teaching if and when they see educational value in doing so" (Waycott, 2010 p.1203). This highlights the kind of role professional learning and institutional support strategies should look to play in helping to build the digital literacy of academics.

Case studies

Macquarie University has continued to apply the self-determination principles of competence, autonomy and relatedness in the business of managing and improving technology and learning. Additionally, there are several examples, as outlined below, of initiatives that are also applying some new strategies which extend these ideas to encompass connectivism, informal learning and digital literacy-centred approaches. While all of these overlap and impact on each other to some degree, the case studies have each been framed so as to highlight one concept in particular. These approaches are all showing indicators of success in encouraging the increased adoption and effective use of technology-enhanced learning.

Connectivism and Professional Learning

Faculty Partnership Program

Due to the demands, constraints and diversity of academic work in the current environment, as well as the new digital landscape, "practices which position one-to-one assistance and face-to-face training as principal strategies are no longer sustainable or effective in building university wide capability in the use of technologies for teaching." (Taylor and Newton, 2012, p.58). Professional development workshops can often be a very individual experience for the learner, isolated from the teaching context, and with limited potential for making connections and developing networks beyond the boundaries of the session. The university has thus been moving from a training and workshop-based professional learning strategy for technology enhanced teaching, to a model based on collaborative, team-based, situated learning to build capability among academic staff. A major initiative in this space is the Faculty Partnership Program (FPP). Professional learning takes place over the course of six months via a collaborative design and development process, whereby a team of designers and developers from the LTC work in partnership with an academic lead on redevelopment of a unit or program. This process possesses the advantage that academics no longer have to be physically located somewhere or at a specific time to attend a structured session (Carter, 2013) and also allows for a far more connected and context-driven experience. The collaborative approach also draws on the connectivist concept of the new role of the educational designer in facilitating the convergence of educator knowledge with learner-generated constructions and networks (Siemens, 2008). For example, one 2014 project brought together a team of four academics to work with design and development staff to build shared online content modules for multiple uses in blended, flipped or fully online modes, across a Teacher Education Program (Macquarie University, 2014). The project design included an in-built peer review process, as well as pilots to gather student feedback that would inform further design and development - none of which would have been possible with traditional professional learning models. The FPP program thus embodies some of the Web 2.0 values of peer and inter-group evaluation, collaborative learning, participation, and creation (Serrat & Rubio, 2012).

More than thirty FPP projects have now been completed across the university under this active, participatory model. Current areas of project focus include student collaboration on multimedia texts in sociology, the development of a networked and social learning environment for journalism students using Wordpress, and several Flipped Classroom developments. The outcomes of projects are designed to be reusable and are shared with other academics in the department, faculty and broader university community via electronic and face-to-face means, contributing to the building of a connected teaching community amongst staff, something that is often more effective than top-down institutional strategies (Cousins & Bisar, 2012). In 2014, the FPP program was recognised with an international best practice award for ‘Smart Partnerships’, an acknowledgement of its success in developing meaningful and productive collaborations between the LTC and academic partners in the faculties (Arthur, 2014).

Exchange sessions

The LTC has also established monthly ‘Exchange Sessions’, which allow academics to share with one another innovative and efficient ways they have found to use technology in their teaching. When originally established as part of the LMS implementation, the sessions were conceived primarily as a chance for academics to hear about technical developments and to have a chance to have input into proposed enhancements to system design. More recently, however, greater engagement and much higher attendance has been noticeable with a changed emphasis to be more about peer sharing, and localising the sessions for a specific faculty context. The sessions emphasise the value the academics put on sharing between teaching colleagues as professional learning, rather than centralised dissemination, and reflect the role of the educational development staff as facilitators of knowledge through the networks, rather than the sole experts (Siemens, 2008). Anecdotal evidence indicates that academics having seen what peers have tried and produced, has encouraged them to explore new approaches and utilise the potential of technology enhanced learning more readily. This approach nurtures a community, building a network of academics and professionals interested in learning and teaching with technology.

Informal Learning and Communications

Teche Blog

Recent communications efforts in the learning and teaching space have focused on the creation and development of a community blog, which goes beyond the boundaries of a simple ‘communication tool’ to play an important role in facilitating knowledge transfer and supporting informal learning by academic staff. Teche: Macquarie University's Learning and Teaching Blog (http://teche.ltc.mq.edu.au) was launched in 2014 on the mobile-friendly Wordpress platform. The blog was designed to transform traditional one-way internal communication models, such as a bi-monthly newsletter in PDF format, into a more mobile and dynamic network between academic and professional staff involved with learning and teaching. The use of Wordpress-generated e-newsletters enables the central support units and the faculties to transmit their own messages, but the blog also creates the capacity for "always on" two-way engagement: commenting, interaction, and sharing on social media networks. A distributed authorship model enables anyone in the university to log in and contribute content, including reflections, experiences of practice and innovations. In short, Teche exemplifies what Serrat and Rubio call "Attitude 2.0" in higher education, built around user-generated content, interactive communication and control shifting towards the participants rather than the institution (2012, pp.295-6).

Teche is as also beginning to play a role in building a culture of informal, self-determined professional learning. The blog allows training and development staff to 'chunk' training materials and learning and teaching resources, repackaging them as quick and engaging blog posts that can then be shared on social media. Workshops or Exchange sessions on technology topics have also been turned into blog posts, circulated to participants as a resource, and shared with staff who were not able to attend, as well as the wider learning and teaching community via e-newsletters and social media. Additionally, links and tags within the site not only add to the richness of the user experience, but also enhance the potential for informal learning. A reader might click on content that visually appeals or seems immediately useful (for example, information about the new Moodle theme) but then be drawn through tags, links or images to click on another more pedagogically-focused post (such as a post about game-based learning). Colloquially, this has been termed the “spoonful of sugar” approach.

The keys to success in the development of Teche have been to allow the community to develop organically, without promoting the platform as a mandatory tool or implying a top-down approach. While operating in partnership with and leveraging ‘official’ university communications channels when appropriate, the blog deliberately positions itself differently. It employs a conversational, personal tone, designed to encourage the feeling of community and reflect the ‘quick read’ style more common on other blogs and social networking sites, rather than in more formal university communications. This style, combined with a visually appealing, “not too corporate” WordPress theme, was deliberately selected to avoid the feel of “yet another bureaucratic system”. This informality has been helpful in generating engagement from the university community, as content is not didactic, solicits staff opinion and showcases work in an accessible way. Teche is not heavily promoted via links on the University’s main website, and readership data indicates that visitation is generated largely by Google searches, newsletters, social media and other “viral” sources such as email. The emphasis on search engine optimization (SEO) of all content has therefore been a success factor in increasing readership. This has been achieved by including an SEO plug-in enhancement, and by using Twitter as a profile-raising and community outreach strategy.

Digital Literacy and System Development

Moodle LMS

Internet self-efficacy is a concept which involves how easy individuals perceive technology is to use and their belief in their mastery of the domain (Buchanan, 2013). Buchanan (2013, p.10) argues that while increased competence on the part of academics can contribute toward increasing adoption of technology enabled learning, structural issues also play a part, leading to the conclusion that "adequate investments must be made in technical infrastructure and support for those activities." To this end, Macquarie University has invested in design improvements to its supported learning technology platform that are ultimately geared towards improving the student experience, but also contribute instrumentally towards increasing self-efficacy of academics, their sense of competence and autonomy, and ultimately digital literacy.

Although the university enlisted external web designers for its new Moodle theme and LMS system enhancement project in 2014, technical and educational development staff from the LTC were fully involved throughout the process to represent the needs of academic staff and students. They also took ownership of the user testing process, as they were better positioned to predict issues that would be raised by academics. The design strategy to increase staff competence included making the design of the LMS reflect more common website standards, as this would aid intuitive ability through familiarity with elements users were likely to already be adept at using. This included simple changes such as positioning the user name and log out buttons at the top right of the screen, similar to Gmail (the university's email provider). The tools and administration menus, previously docked on the right side of the screen, were also relocated to the top, the more usual place for navigation in a modern website. A quite comprehensive footer now sits at the bottom of each unit, a position commonly expected for those looking for quick links. The university has also built a context-sensitive help function into the Moodle LMS, which allows staff and students to view FAQs according to what they are doing in the system at that time, and also to suggest and contribute to them, reinforcing self-help behaviour as well as adding to the knowledge bank.

Naturally, the above strategies and other initiatives towards greater mobility in the university would be undermined if the LMS was not mobile-friendly. A survey of Macquarie's students and staff in 2013 indicated that most seldom accessed the university's LMS via smartphones or tablets, relying rather on desktop or laptop computers, and that there was a clear demand from students in particular for a mobile-friendly interface and more integration with apps (Cahir, 2014). Creating mobile responsiveness was therefore prioritised in system development, with the university building a customised version of the Twitter-developed bootstrap framework. While data on uptake of LMS and technology use by mobile devices is not yet available, this is expected to have increased significantly due to the introduction of the mobile-friendly interface.

Administrative Systems

The university has also prioritised mobility in the design of the administrative systems which support learning and teaching. In 2014, the University integrated its provisioning system for online units on the LMS with its unit guide creation and curriculum mapping tool. As survey data indicated that the predecessor systems had been very unintuitive from a user experience perspective, negatively affecting staff confidence with using the systems (Cahir, 2014), the key objective was therefore to redesign the user interface and streamline processes in order to increase satisfaction and academic usage. Additionally, iTeach was used as a vehicle to implement a cultural and business change: to reflect the organisational structure of delegated authority, and building autonomy amongst the system's users.

The new mobile unit guide publication platform which is the public face of iTeach (http://unitguides.mq.edu.au) provides anytime, anywhere access to unit information, such as learning outcomes, readings and assessment tasks, which from a student perspective is paramount. Implementation of the new system has required a significant cultural change amongst academics, moving away from the usual practice of producing a Word document Unit Guide that was locked behind the password-protected LMS, to publishing unit information to a publicly available, searchable information repository. While the standardisation of the unit guide template may initially appear restrictive to academics, it actually helps with consistency of information for students, increases familiarity and provides academics with a significant amount of autonomy in terms of a platform to self-publish their unit guide. Despite some resistance to this change, data shows that since the improvements and integration with iTeach, the system is now being well-used in comparison to the previous system, with a marked increase in compliance with the requirement to publish (up to 97% published in some faculties), and heavy visitation of the website by students and the public. It is hoped that this indicates that the system changes have been successful in increasing the perceived usefulness of the system for academics for learning and teaching, and lessening the perception of technology being implemented for its own sake (Waycott, 2010).

For teaching departments, the iTeach system allows them more control over managing the online aspects of learning and teaching, and relinquishes some of the control from central support areas. Departments can quickly and easily allocate staff to online teaching units and unit guides as well as see overviews of particular status elements, such as published and unpublished unit guides and activated online units. Additionally, with improvements to the automation of student enrolment into Moodle spaces, the failure rate dropped to 0.07% (or 150 student enrolment failures out of 150,000). It is hoped that these improvements have contributed to building more trust amongst academics and a sense of self-efficacy, with less need for administrative support from the central service unit.

Future Directions and Challenges

The newly articulated strategic direction of the university signals the formal adoption of a mobility and digital literacy agenda for the institution. Along with the opportunities this presents, there will also be a number of challenges from an organisational change perspective. For instance, this paper has presented examples of system design which work to build the functional aspects of the digital literacy of staff; however, there is still much to be done to build on the social elements of academics' digital literacy, and their underlying appreciation of the pedagogical soundness of technologies for use in learning and teaching. Steps are being taken here with initiatives such as the Faculty Partnership Program, as well as a formal workshop program that now emphasises social networking, digital media production and blogging, but these initiatives are still quite limited in scale. Furthermore, the university will need to articulate a sound and lucid framework by which to benchmark digital literacy, in order to evaluate the success of its efforts in this area.

A further organisational challenge is the almost inevitable outcome of embracing the possibilities of Web 2.0, mobile and networked learning, which is accepting the greater use by academics and students of technologies and tools outside of the supported learning technologies platform. This necessitates the provision of training and technical support for these technologies, as well as pedagogical advice for how they should be used. Flexible approaches will increasingly be required to cater for this complexity. As Palmer et al (2013) note, the "loosening of institutional control over certain technologies which can be used for effective learning and teaching" is a major challenge for quality management in large institutions, and requires new leadership approaches, as well as sound pedagogies. One example, still in its early stages, is the development of an integration between the supported LMS and a Wordpress multi-site, to provide a blogging and publishing platform for students; in effect opening the door to an institutionally-supported Personal Learning Environment (PLE). The main feature of PLEs is the formal and informal space they provide students to learn (Dabbagh & Kitsantas, 2012;). A suite of planned enhancements to Macquarie's system will allow students to connect their own social network sites with the platform in order to reach out to the wider community. The premise behind the initiative, currently being trialled in a postgraduate creative writing program, is in line with Hicks and Sinkinson (2015), and the notion of giving students more autonomy and choice in establishing their learning and professional learning networks throughout their studies. While institutional support for more open, networked approaches to student learning such as this, opens up many doors, it also underscores the need for new approaches to staff development to ensure that staff are able to cope with this kind of approach - not just using the technical tools, but the understanding of what meaning-making entails in this new digital environment.

The above also relates to another significant challenge: the complexity of the environment in higher education. Despite recent efforts to streamline systems and increase flexibility, there is still a proliferation of university systems for academics to use for learning and teaching and administrative functions, not to mention other systems outside the university's platform, as mentioned above. While supporting diverse approaches by faculties and individuals to managing and teaching can be advantageous, it can also be more challenging to maintain. One strategy to mitigate this going forward, is the university's plan to develop its iTeach system into a more complete dashboard of administrative functions, including an integrated student survey system, and richer reporting and analytics functions for individuals, departments and faculties.

As the university moves to broaden its approach to continuing professional learning, a further task will be to find ways to recognise, reward and utilise learning and knowledge gained by staff through informal networks and social networks (Cowan, 2013; Mitchell, 2013). Accompanying this will be the particular type of conundrum faced by a central support area with responsibility for continuing professional development; how to play a role in facilitating more informal and connected learning, and yet continuing to remain visible (and therefore valued) by the organisation?

Conclusion

In describing a multi-faceted process of strategically "shifting mobile" which has been occurring at Macquarie University in recent times, this paper has begun to build a case for embracing Web 2.0-style approaches to professional learning, communication and developmental support for learning and teaching in universities. By extending out successful strategies grounded in capability-building to digital literacy, relatedness to connectivist approaches, and autonomy to informal learning, some indicators of success are apparent. As an initial exploration, this paper suggests some potential directions for future research, as well as some examples which it is hoped may be useful models for other institutions. If the ultimate goal is the empowerment of academics to utilise contemporary approaches that will ensure better learning outcomes for students in a rapidly transforming digital landscape, it seems reasonable to argue that the chances of this succeeding are improved by also integrating these sorts of approaches into the work of the university in supporting academic practice.

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Design of an eBook Software with Lecturing Function

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In order to provide more digital contents for classroom learning (c-Learning), an eBook software with lecturing function is proposed in the paper. It not only plays role for reading ebooks, but also works for content presentation during lecturing. Both the content edition and content presentation are designed in the software. Therefore, teachers can use the edition function of the software to create their own eBooks, and then they can exploit its content-presentation function to teach the contents of eBooks in classroom under the teacher-led model. The function of the software for the content presentation is implemented according to dual-code or dual-channel learning based on cognitive theory of multimedia learning.

Keywords: eBook, epub, classroom learning, dual-channel learning, multimedia learning, spatial contiguity principle, temporal contiguity principle

Introduction

Currently, many studies show that the most of young students prefer to reading eBooks instead of reading traditional books (Noorhidawat & Forbes, 2009; Ebook; Epub). Reading eBooks is also a good learning way in on-line learning (Brut & Buraga, 2004). Some research results have been to point out that the learning or reading to digital contents can enhance the concept construction. Therefore, reading digital contents is better than reading traditional papers (Erdem, Yilmaz & Oskay, 2009). The contents using in e-Learning contains many digital objects (or formats), which make informative contents easier to be found, accessed, manipulated, and disseminated. They are also extensively discussed with the progress of the Internet and multimedia techniques in recent years (Clark & Mayer, 2011).

Most of readers read eBooks which has been designed by other people (not readers). Nowadays, the traditional eBooks are used to learn the new knowledge, but they are not suitable teaching up to now. The function of the traditional eBooks focuses on the layout presentation and multimedia display so as to attract users for reading. The traditional eBook is simply to present the relevant knowledge. It is not suitable for the purpose for learning. The difference between using traditional eBook for reading and learning is similar to the difference between a magazine and a textbook for learning. The traditional eBook lacks the interaction with the learner during learning. Thus, it is hard to have good learning performance. In fact, the eBook still has many advantages such as quick search, rich multimedia, and convenient carrying. Accordingly, how to integrate the eBook materials into e-Learning activities is an important topic. Some studies seldom focus on using eBooks for teaching. Therefore, it motivates to design an eBook software with lecturing function for teaching. The development of the proposed eBook software is based on Ausubel's meaningful learning theory (Ausubel, 1963b). The eBook software can be applied in the traditional classroom while lecturing.

The proposed eBook software provides the content-edition function to edit an eBook and the content-presentation function for display eBooks. The eBook edition function has many features which allow teachers to design an eBook in a flexible way, such as they can shift the materials into the suitable position through the formwork design, deconstruct the other eBook's page, and use these pages into the current eBook. The function of material management is used to organize the classification of the materials and to find out the specific material quickly. The unlimited hierarchical structure makes a rich design of chapters. Using the drag and drop technique in the development of the software, teachers edit materials easily. The thumbnail of template shows clearly situation of material construction. The pages contains the objects with many various format such as text, audio, animation, image, and video, etc.

Students can read the content of eBook by the content-presentation function of the eBook software. They can mark important pages and read these pages of the cross-reference bookmark at one time. They also can edit the featured books by themselves. In this way, students can integrate the various knowledge so as to have an effective learning.

The rest of the paper is organized as follows. In Section 2, the proposed eBook software is described. In Section 3, the applications of the proposed eBook software in c-Learning is stated. Finally, in section 4, the conclusion is summarized.

The eBook software

The eBook software consists of four main modules, eBook editor, eBook reader, and eBook display for teaching, and bookshelf management. The eBook editor is used for the construction or modification of eBooks. Users employ the eBook reader for eBook reading. The module of eBook display for teaching is exploited in the teaching during lecturing in classroom. The bookshelf management module provides the function of managing eBooks the software creates.

The eBook Editor

Figure 1 displays the prototype interface of the eBook editor. It provides three types of basic pages, image page, video page, and blank page, as well as three types of expansion pages, flash page, java page, and web page.

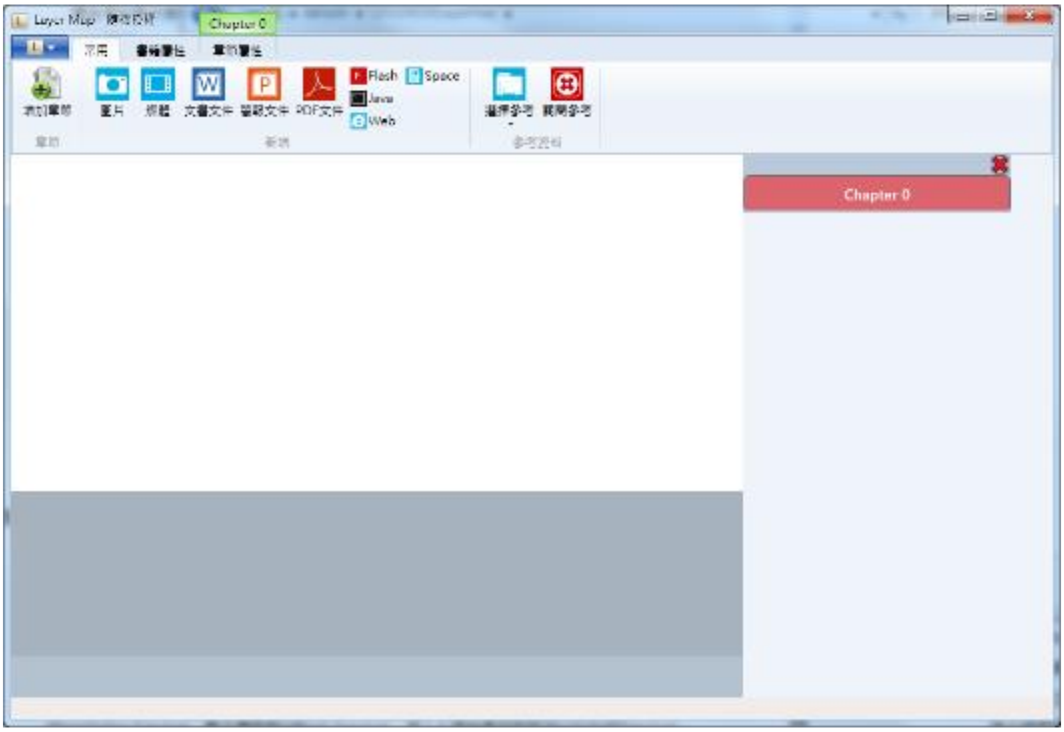


Figure 1. The prototype interface of the eBook editor.

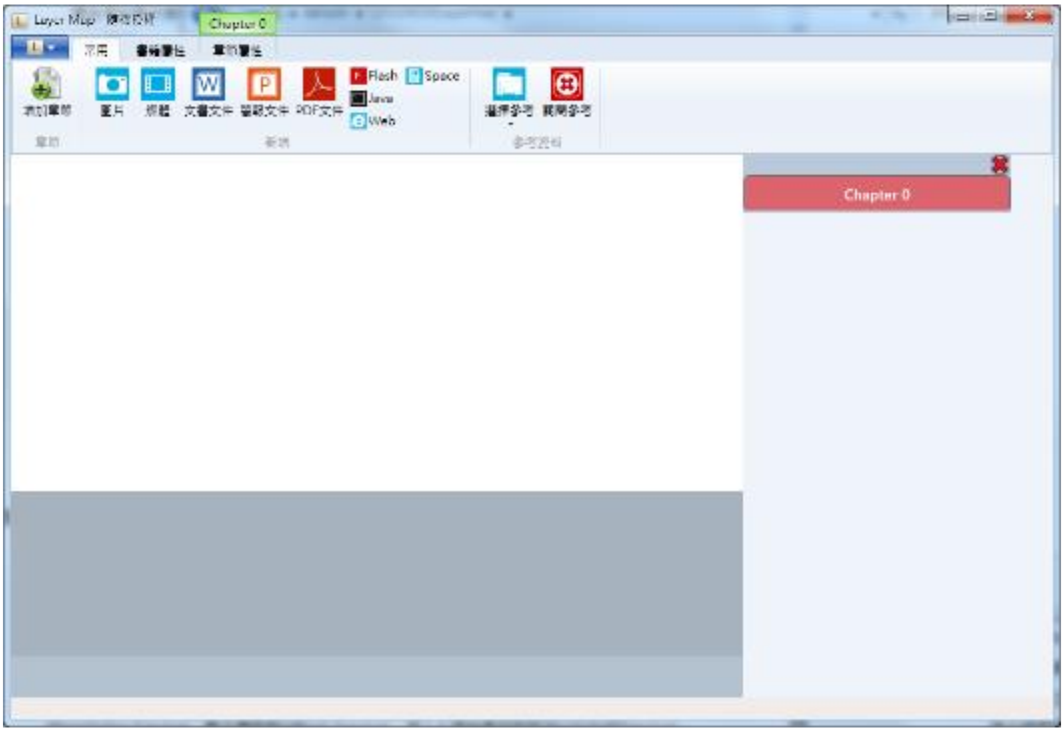


Figure 1. The prototype interface of the eBook editor.

An eBook in the eBook software can contains some types of pages which described as follows.

- Image page

These files such as Word, PowerPoint, PDF, and other types of documents can be converted into the version based on the image format. Each page of an eBook is an image. Therefore, it can save the time when teachers spend time on re-production the teaching materials. In addition, interactive elements such as labels, pictures, sounds, films, and examination questions on the material of images can be added in an eBook.

- Video page

A video can be added in an eBook as a part of the page in teaching process. So, students can watch the video directly in self-reading or teaching case. However, the software does not provide the function to add the interactive components in the video page.

- Blank page

In addition to offer the settings for the page size and background color of the page, the blank page also can be added using interactive components such as labels, pictures, sounds, films, and examination questions. The purpose of designing the blank page is to make typesetting more flexible.

- Flash page

The Flash page belongs to extra expansion type. SWF files can be added in the Flash page and users operate them in the self-reading or teaching cases. Especially, it is suitable for some materials which has been made by Flash type. Extra expansion type means the pages in eBooks cannot be read if they are exported to the epub format. That is, the pages belonging to the extra expansion type can only be read in the proposed eBook software.

- Java page

The Java page belongs to extra expansion type. JAR files can be added in the page and users operate it for the self-reading or the teaching mode. Especially, it is suitable for some materials which are performed with Java. For an instance, the physics course contains simulations with Java.

- Web page

The Web page belongs to extra expansion type. It can be added by URL links and users operate it on self-reading or teaching mode. That is, it downloads all webpages of the web site with URL links. These off-line webpages can be browsed using the Web page.

In Figure 2, the interface of the eBook editor is designed by the Ribbon format which groups the similar types of functions in one group. In addition, files such as DOC, PPT, and PDF is converted to become a set of images.

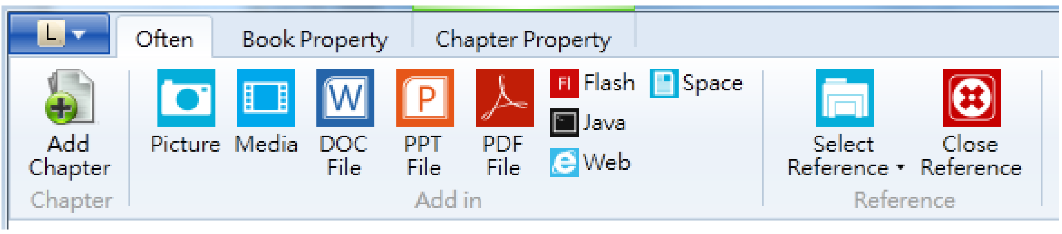


Figure 2. The interface of the eBook editor designed using the Ribbon format.

Image page

The eBook Reader

Self-reading mode is one of basic components of the eBook reader. In general, the conventional eBook players offers two arrangement ways for reading such as interchanging two pages, as shown in Figures 3 and 4. In short, it can switch two pages in one screen. The conventional eBook players also provide single-page and double-pages view modes, as shown in Figures 5 and 6, respectively. The proposed eBook software offers above two kinds of reading modes.

Figure 0. Two pages are displayed in one screen, and Page 2 is on the left of the screen.

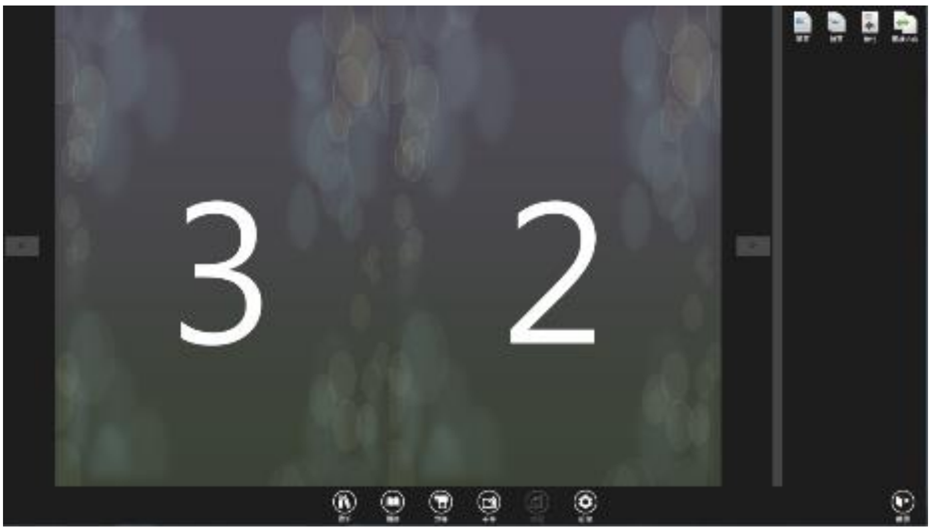


Figure 4. Switch two pages in Figure 3 to form that Page 2 is on the right of the screen.

Figure 5. The single-page view mode.

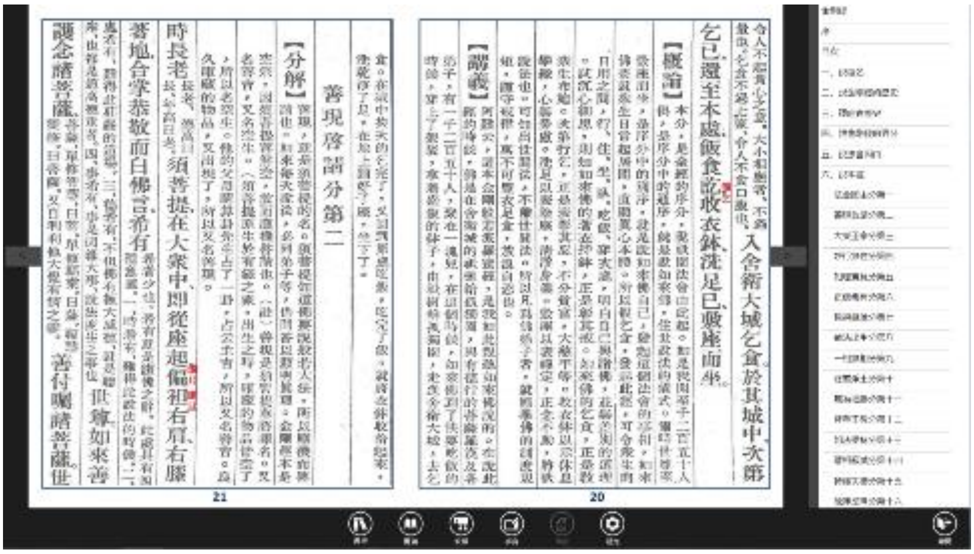


Figure 6. The double-pages view mode.

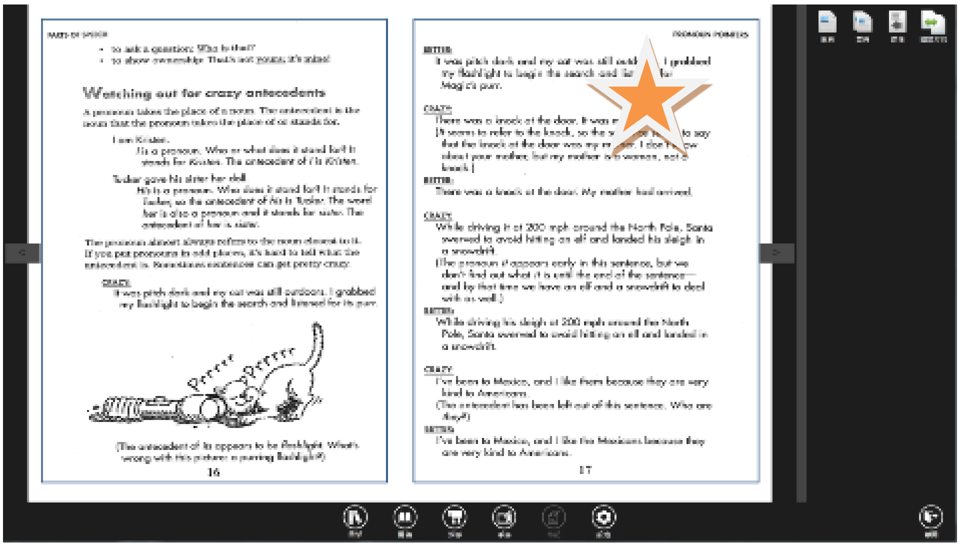


Figure 7. A teacher is lecturing page 17 currently.

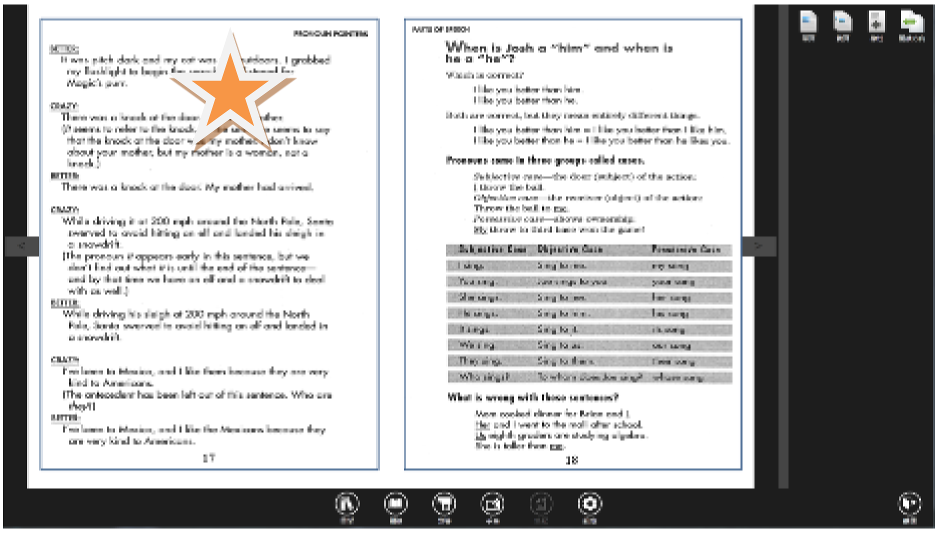


Figure 8. After page 17 was explained, and then page 18 is lecturing currently.

The eBook display while teaching

The proposed eBook software offers the teaching mode which is specifically designed for teaching. It offers the linear-reading mode which can facilitate teaching and reading. The linear-reading mode is similar to the double-page mode. Both of them can display two pages on the screen at a time. The design concept is based on the spatial contiguity principle (students learn better when corresponding words and pictures are presented near rather than far from each other on the page or screen) and temporal contiguity principle (students learn better when corresponding words and pictures are presented simultaneously rather than successively) (Lai, Tsai & Yu, 2011). These two principles are proposed in multimedia learning (Mayer & Anderson, 1991).

A significant difference between the linear-reading mode and the double-pages mode is that the linear-reading mode just shift one page at each time. An example is shown in Figures 7 and 8. The mode helps teachers during lecturing. After the teacher has finished the explanations for page 16, teachers only shift right the pages. Page 16 was disappeared, and the new page 18 are displayed. Teachers can explain the current page, page 17. An advantage of this mode is to offer students to have the opportunity to review and cross-reference the pages.

In the teaching mode, teachers can drag a single page into the central area of the screen. Figure 9 exhibits a teaching scenario. Teachers can select chapters from the directory of an eBook on the right hand side of the screen, and then drag the appropriate pages into the central area of the screen from the bottom track of the page list. The proposed eBook software provides two functions page rotation and zooming. Each page in one screen can be rotated with arbitrary direction and zoomed in or out (Microsoft Surface 2.0 SDK). As shown Figures 3.8 10 and 3.9 11 shows these two functions. Teachers can use these two functions to achieve their presentation purpose.

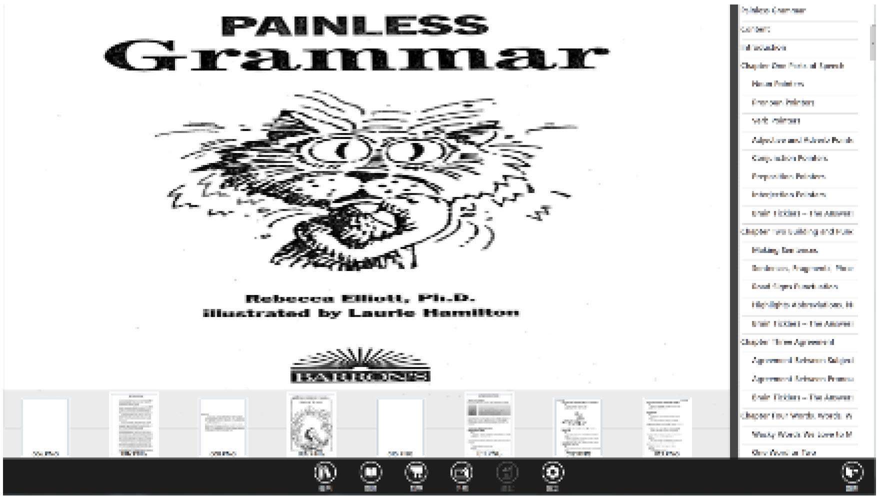


Figure 9. The directory of the eBook is on the right hand side of the screen, and the page list is on the bottom.

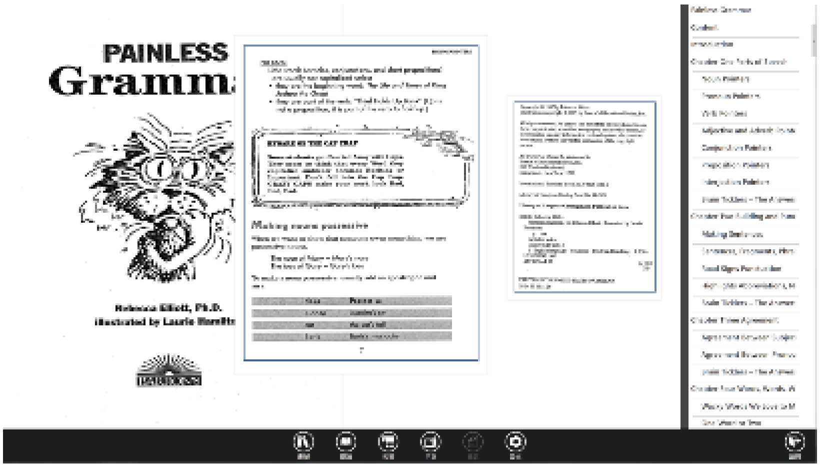


Figure 10. Pages can be zoomed in or out arbitrarily.

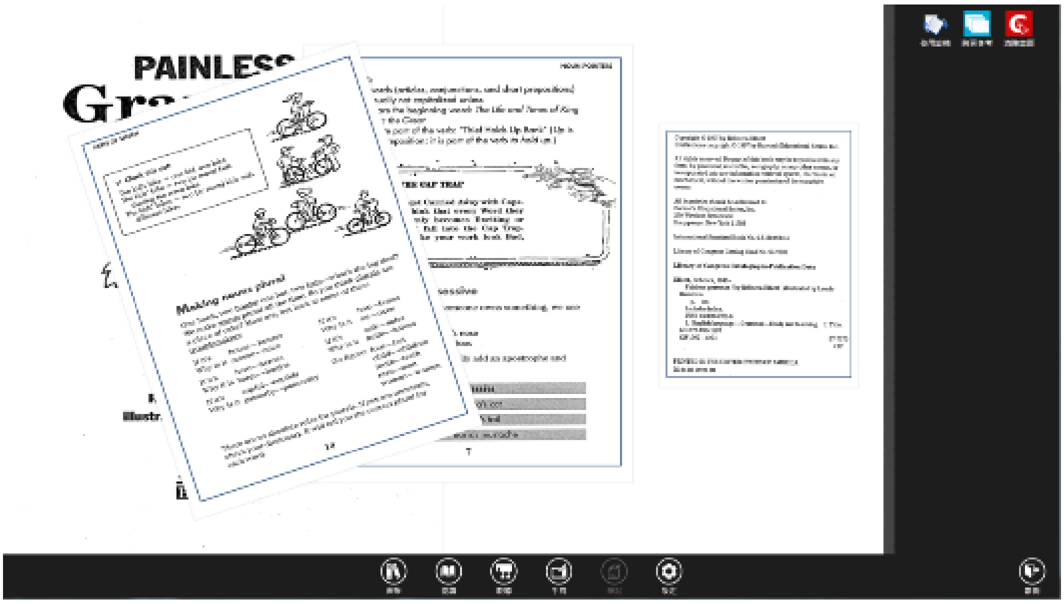


Figure 11. Pages can be rotated arbitrarily.

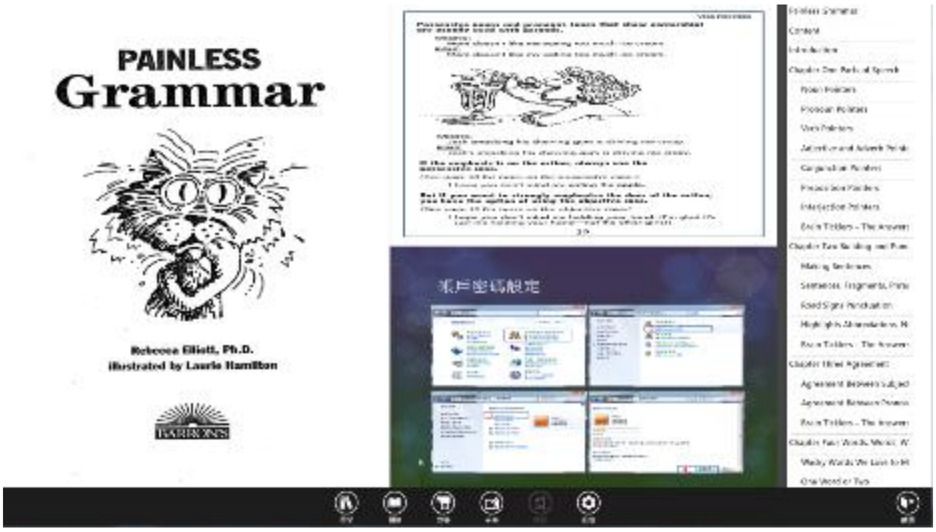
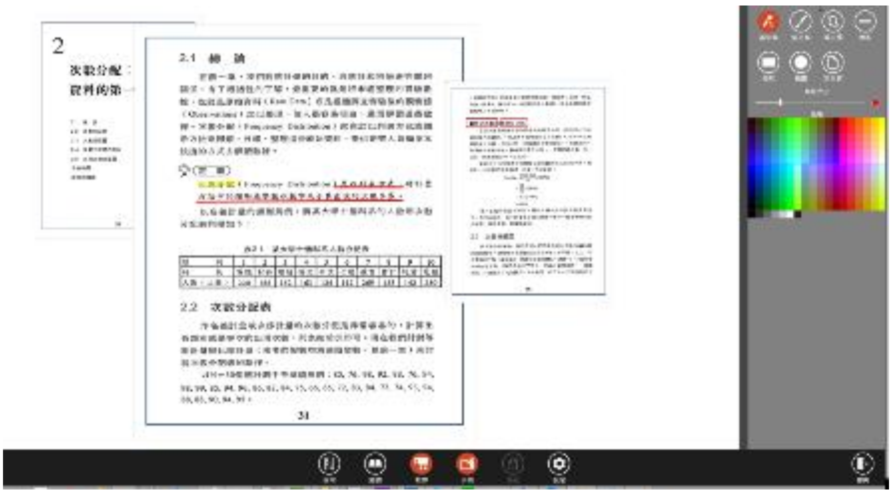
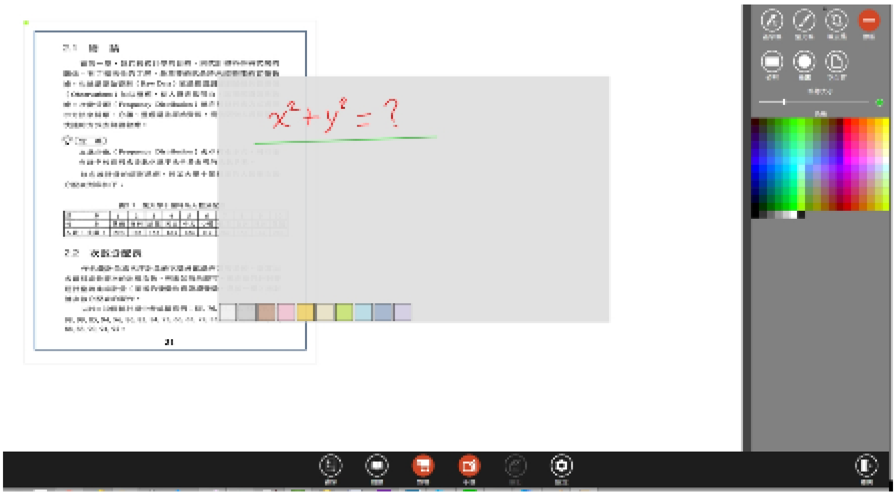


Figure 12. It support user selects other eBook pages to the current eBook.



(a)



(b)

Figure 13. The proposed eBook software provides the handwriting function.

Teachers may require some materials that are not in the current eBook during the teaching process. At this time, teachers can use the function in the cross-page mode, which offers teachers to add new materials in the current page for lecturing. Figure 12 illustrates a teaching scenario. A desktop image of a computer is not in the current eBook. Teacher can add the image quickly in the current page for lecturing. Note that the page in others eBooks is also added in the current page. The proposed eBook software also provide users with the handwriting function. Figure 13 illustrates the results of using the handwriting function on pages during instruction.

Bookshelf management module

The conventional eBook player can keep the reader's handwritings and notes during the reading process. The proposed eBook software not only can store readers' handwritings and notes but also can upload eBooks and associated handwritings and notes to a repository space of the proposed eBook software. Bookshelf management module of the proposed eBook software offers readers to manage their eBooks that are created using the proposed eBook software. Figure 14 displays an interface of using bookshelf management module. It provides the function to manage a set of bookshelves, which includes bookshelf creation, deletion, and modification. All eBooks, which are created in the proposed eBook software, in one bookshelf can be listed, inserted, and removed. Once a bookshelf was removed, all eBooks in the bookshelf will be moved to the default bookshelf automatically. The default bookshelf is unique and read-only. Figure 15 exhibits the feedback-collection function of bookshelf management module.

Figure 14. An interface of Bookshelf management module.

Figure 15. Bookshelf management module offers the feedback-collection function.

Applications in education

The proposed eBook software can be applied in c-learning for teaching. It can support the following five teaching scenarios.

- The eBook software can switch two pages in one screen. Assume that the screen can be projected onto a large screen or an electronic whiteboard in front of classroom. The function helps teachers during lecturing in classroom. Teachers can stand near the current page that they are explaining. Figures 3 and 4 illustrate the teaching scenario. In Figure 3, teachers are explaining page 3 and they stand near page 3. When they work to the other side of the screen (i.e., near page 2), they can utilize the function to switch these pages so that page 3 is also near teachers.

- The design of the linear-reading mode is based on the spatial contiguity and the temporal contiguity principles. The function helps teachers and students to review the previous page teachers just explained due to the previous page still in the screen. This design is based on the spatial contiguity principle. Moreover, the contents of the previous page are relative to those of the current page teachers are explaining. The manner is based on the temporal contiguity principle. According to the results of the proposed article (Lai, Tsai & Yu, 2011), the display method follows these two principles can promote students learning effects. Figures 7 and 8 illustrate an example of the teaching scenario.

- The pages can be performed by rotation and zoom in or out. The function help teachers to highlight the pages. The way may promote students' learning attraction while teaching. Figures 10 and 11 draw the page rotation and zoom out, respectively.

- Supplementary materials not in the current eBook can be also displayed in current page of the screen. Teachers can adopt the function to quickly provide more supplementary readings or learning objects. Figure 12 shows an example of the teaching scenario. Here an image, which is a snapshot of the desktop of a computer, can be added in the page that is currently explaining.

- The proposed eBook software also offers teachers to perform their handwritings on the pages while lecturing or teaching. Figure 13 (a) shows teachers can make highlights on the page, and Figure 13 (b) displays teachers can perform their handwritings on the page they are teaching.

Conclusion

The paper has proposed an eBook software with lecturing function. The eBook software consists of four main modules, eBook editor, eBook reader, and eBook display for teaching, and bookshelf management. Here the proposed eBook software not only has the functions the traditional eBook tools have, but also it provides several modes which are used in teaching process. Here five teaching scenarios are given to state that the proposed eBook software can definitely support teachers during lecturing in classroom. Moreover, it also helps students to promote their learning effects.

Acknowledgements

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iBooks, http://itunes.apple.com/us/app/ibooks/id364709193?mt=8.

FBReader, http://www.fbreader.org/.

Microsoft Surface 2.0 SDK, http://www.microsoft.com/en-us/download/details.aspx?id=26716#overview.

Promotion of E-Learning Regarding University Students' Quality Learning and Its Influences

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Abstract: With the rapid development of technology and quest for continuous learning, network technology is become more commonly and popularized-learning, a new mode for advanced teaching is emerged to give new learning styles and more opportunities for university students' quality learning. Therefore, E-learning differs from other styles of education by supporting modern elements and concepts to university students' quality learning and give universities and institutions education high technical support in order to do reform and enhance the curriculum in extensively. In line with this vision, analysing the properties and benefits of E-learning, this paper discusses the motivation influence on university students' quality learning and puts ahead assumptions in terms of modes for university students' quality learning in the modern network basis.

Keywords: University Students' Quality Learning; Motivation Influence; E-Learning; Education

Introduction

The advancement of information and communication technology with alongside knowledge updating has a tremendously impacted the delivery of education and this is specially in the new devices as a Pc, Laptop, smartphones, etc..., which are owned by millions of users. University students for the time being are slightly turning their methods of access information by only clicking and typing. Students are gaining their information easier and faster than before from different subjects that utilized to be available just to lecturers. The high enhancements and adopting of information technology would be led to make current teaching theory, facing more challenges which under the reform style of teaching and its patterns. E-learning, therefore, as a full modern teaching style to meet and face the standard of university students' quality learning, is play an inclusive role in the contexts of advanced teaching. In the nearest future of teaching reform, the integration of E-learning and university students' quality learning is so apparent to be within the most significant topics in the countless education environments.

Related Content of University Students' Quality Learning and E-Learning

At the beginning, we try to highlight the main components of E-learning and dimensions or sometimes refer to some factors which are represented by Khan's e-learning framework, so each factor represents the category of situations that need to be considered to create and provide successful experiences. As a result, it provides a practical and detailed database to be like a self-assessment tool for various institutions in education environments to assess their learning technology willing or their chances for growth and applicability, figure.1 shows framework components of E-learning from Khan's e-learning framework.

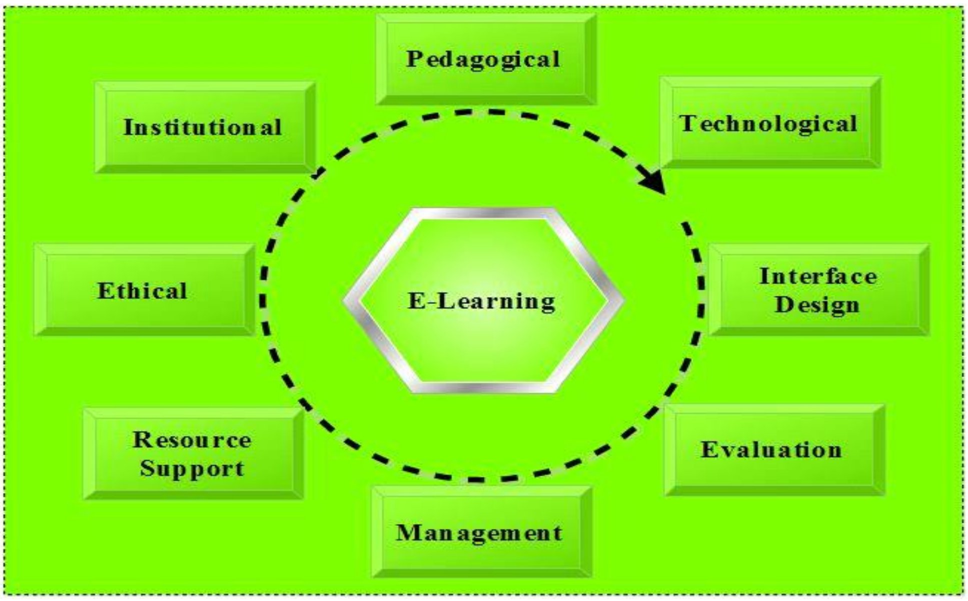

Figure 1: Khan's e-learning framework (Khan, 2005)

Effectiveness of E-learning way towards university students' quality learning

Educators with just blackboards and chalks available to clarification are no longer able to keep up with rapid upgrading and sophisticated knowledge. Nevertheless, multimedia technology and networking open a new area for the development of learning. Regarding 3D and interactive mode for carrying knowledge and its dynamic form have been made the new teaching thrives. The essence of the university students' quality learning in modern era is not to compel all the information on learners. Alternatively, it target at encourage students study and investigate spontaneously. The aim of the E-learning is to establish a good learning atmosphere for university students, in order to enhance their all respects qualities. The properties of E-learning are shown as following:

Plurality sharable learning resources

By transferring through several information, E-learning expands itself by adopting new multimedia technology as animation, image, and sound that can be added and help to support the learning process. Moreover, E-learning is a tool which characterized by an open system in order to allow users of all backgrounds and majors from various schools and areas to do collaborative learning as sharing, discussion, uploading, forums and so on, with the same information simultaneously freely. Consequently, all those advantages have deep influences on different contexts such as forming of individual educational mode, promoting students toward creativeness, converting relations among various learning factors and finally transferring exam-oriented teaching into university students' quality learning.

Disappearance the barriers of place and time with better interactive teaching

By E-learning, the school education makes the students in widely getting their information and sharing with each other. In addition, it also expands the range of educational goals and realizes the important of learning generalization. The role of Lecturers is being the hub of the class while in network environment learners are the centre of teaching. In the same context, students connect with each other by share experiences and information instead of lecturers. The Students are starting education process by choosing the most appropriate learning mode or way, based on their own characteristics and goals. Universities can be, hence, created a sound of E-learning model through benefit of the diverse and rich online information; gather quality teaching resources through information channel with high speed and thereby establishing an open education and dynamic education environment in the same time.

Raising interest

Interest is an important tributary and an important source of wisdom and inspiration; also it is vital to Strengthen consciousness and awareness of self-dependent education. Due to interest and focused in what they study and learn, therefore students in educational environments are more tends to be enthusiastic learners. In technology era, some researchers mentioned that preliminary studies and proactive which is based on accurate information and multi-media studying operation showed that mandatory study without any motivation or interest will led to smother learners' desire and enthusiasm to seek the fact (Abrami, Bernard, Bures, Borokhovski, & Tamim, 2011). In the same vein, teaching tools in E-learning fields are due to the developments in applications of Internet technology are mostly represented as a form of live visualization. As a result, the students are either tend to be attracted by this kind of education or tend to be positive instead of negative ones in terms of learning, which give an easy and fun view for learners to enjoy of learning process. Teaching in modern network environments will be similar to magnet, because this style in education help to attracts students' interest with its abundance in image and sound and liveliness in environments(Meyer, 2014; Sun & Rueda, 2012).

University students' quality learning representing a new learning concept

University students' quality learning is the prevailing trend of teaching reform since 1980s that achieves concept of a modern educational. University students' quality learning is an idea and as well a teaching way which focuses on human development that stresses on the advancement and promoting of comprehensive qualities. University students' quality learning has been derived from realism and real needs of society, it needs the lecturers to respect learner's initiatives and confirm the development of printability, potential and intelligence for students(Brown, Bull, & Pendlebury, 2013; Quinn et al., 2012).

An education for all allowance from education of elite

The old style of traditional teaching is available to a small number of students, as the reason goes back to its methods of choosing students which concentrates extremely on selecting the better whose success is a disadvantage of many plain ones (Huddleston & Unwin, 2013). On the other hand, within development and enhancement process of the all learners' qualities, university students' quality learning links to all the learners with its services to increase their comprehensive potentially with abilities(Astin, 2012) [8].

Learning from all respects instead of an unilateral learning

Further, the old traditional learning has confirmed on intellectual enhancements, but, ignoring enhancements in other different aspects which led to development unbalanced. Some scholars have been remarked in previous studies that "speech basic learning" is promoting talents of trans-century and enhancing the national quality, so that they advise to extensively focus on adopting advance technology in education environments to save many things for learners as well as completely abandoned the one sided examination-oriented learning (Yamada, 2014). Another suggestion, university students' quality learning should be open to all learners, it will help students to obtain the fundamental skills of education, exercising, physical, living and aesthetic appreciation and eventually enable all students to meet the standard of University students' quality learning.

Focusing on possibility of training and mental load

With the revolution of knowledge in this era beside developments in information technology, the old traditional learning aiming at passing on knowledge, but unfortunately cannot live up to the society needs. Consequently, the main focus of university students' quality learning has made dramatically students controlling the skills of possession and updating knowledge. Thus, the previous style teacher-oriented learning must be replaced university students' quality learning whose emphasis is on encouraging students' creativity of discovery and inventiveness.

The Stimulative Influence of E-Learning on University Students' Quality Learning

The high jumps in new applications of information and communication technology and networking have been offered new opportunities and new styles for university students' quality learning that is led to make E-learning which used of multimedia and network resources becomes one of the most important effective means of learning. It not only enhances efficiency of education and improves ability of students teaching, but also it raises students' motivation and interest. In accordance with previous results, we should develop the reform of the education system, promote university students' quality learning in all aspects and pick up the pace of informatization. Moreover, students can learn in different education environments how to keep life-long learners concerning applying information, getting means, sharing information, transmitting and processing. Besides, a sound implemental style that based on E-learning cannot be distributed to meet the standard university students' quality learning of promoting and encouraging talents in our modern era today.

Accomplishing university students' quality learning by building system of networking service

A build campus system of networking service must be installed to be as an instrument to consist of management of schools and education. Therefore, the integrated campus system of networking service consists of: management of schools, administration, management of research, logistics services, news propaganda, employment leadership, forums of campus and psychological counselling, etc. By using resources of network which are very rich in various information, high attractively with high quality "Social networking and scientific sites" might be created as bases to publish modern advanced knowledge and culture as well arrange activities. Management of education network and logistic motivate learners to earn closely with the education environments as schools, universities, faculties network and so on; besides utilize it in their everyday life. News propaganda, vocational guidance and services of psychological counselling assist learners through effective guide of instructional activities which targeted. With these varied and rich instructional forms, the earlier organized negative tangible learning will be reconstructed into all-around positive subliminal one. Consequently, the effectiveness of university students' quality learning is improved in the Coherent Democratic climate.

Benefits of web-based guidance and changing learning conception

University students' quality learning alongside with E-learning, has aimed for the enhancing and developing the learners, captures humanitarian care as well as humanitarian teaching for students. Web-based guidance supports the school's students with a democratic study environment; the effectiveness e-learning for university students, nevertheless; is a positive operation in terms of information processing, through the employment of various methods to save and quote information, the environment of e-learning is organized in line with students' own goals. Further, all students are equal and can full freely connect and interact with each other. The more load of students' study is decreased, the more their psychological health statuses are increased and enhanced. Students are comforted in the course of teaching and that to be capable of examine their abilities and potentials.

Otherwise, creativity is inspired by consolidating and reorganizing what the students learn and know. In addition, the receivers of sit-and-listen often lead to transforming into initiative participants. Based on various requirements, students are ready to process information, sort out, obtained, examine, search, and eventually solve issues. By this way, they can enhance and develop their ability regarding knowledge acquisition, moreover access to high-level thinking. On contrary, this type of educational process is structured for the student' comprehensive development benefit, which makes students more active learners and more knowledgeable receivers as well.

Buildup system of web-based evaluation to ensure the influence of university students' quality learning

Online learning breaks the traditional method as face-to-face education. Lecturers' impact on learners is impaired that may occur in a bad education influence. Therefore, during learning online, the students must do all their efforts to examine or produce suitable means to communicate and interactive with learners rather than depending only on the learners themselves. Communication principles must be installed such as questions/answers online, post, message board, mode campus environments, email, online discussions and an online marking system. At the same time, students' views should be assembled through network system to improve and increase the effectiveness and make up for the shortage of web-based education.

Conclusion

To sum up, online webs are a brand modern phase for university students' quality learning. The study has been elucidated that E-learning with its services which are difficult to do without require being selection to promote and increase university students' all respects qualities. The quest towards quality in the learners' support system provided to the student should be viewed as a never-ending process. As such, efforts should be broadly utilized by educators and institutions to investigate new education mechanisms and then provide benefits for the learners as well as educational program.

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Mobile Technology and Interactive Lectures: The Key Adoption Factors

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The objective of this study is to investigate adoption factors for promoting interactive lectures in higher education from reviews of technology acceptance and motivational models, and cultural dimension theories. As lecture sessions continue to be central for teaching and learning in higher education, the study aims to elicit key factors influencing mobile technology adoption in the classroom as an interaction tool, focusing on the notion of communication barriers caused by lectures with large number of students. Quantitative (survey) method was applied, and factor analysis produced three factors – User System Perception (USP), System and Information Quality (SIQ), and User Uncertainty Avoidance (UUA). Results of regression analysis revealed UUA as the strongest significant predictor of adoption (beta=-.225,p<.001), and a high proportion of UUA was strongly explained by USP (r=-.513) and SIQ (r=-.537). This study underscore the need for researchers to explore deeper in the area of blended learning pedagogy using mobile technology.

Keywords: interactive lectures; mobile learning; technology acceptance; uncertainty avoidance

Introduction

Despite huge advancement in mobile technology evolution and its role in the fields of e-learning and mobile learning, lecture sessions are still fundamentally important in universities. Face to face lecture sessions where students congregate at scheduled venues to listen and participate in learning activities provide a myriad of learning opportunities for the students. The ability to engage in real-life discourses with their peers and lecturers are invaluable. Effective pedagogy principles emphasize the importance of prompt feedback to students' enquiries, active participation and conducting collaboration activities in the classroom (Reeves, 2006; Chickering & Gamson, 1987). However, lecture sessions with big number of students and conducted in large theatre halls are problematic for a number of reasons. Lack of opportunities for the students to ask questions, or for lecturers to encourage feedback and engage in discussions with their students due to time constraint is chief barriers (Dobson-Mitchell, 2011; Tesch, Coelho, & Drozdenko, 2011). In addition, students' personality traits such as shyness or introversion, and low language proficiency compound the problem further (Gan & Balakrishnan, 2014; Stowell, Oldham, & Bennett, 2010).

Incorporating effective use of the right technology in the classroom can be the solution to reduce some of the barriers preventing interactions during large lectures. Students and lecturers alike are already using mobile technology for numerous academic activities, namely retrieving or downloading learning resources on the Internet, accessing the institutions' learning management system for learning materials and reading the latest announcements, and opening lecture notes using tablets or laptops during lectures are common occurrences observed among higher education students (Balakrishnan & Gan, 2013). Technology-enabled lecture halls that promote interactions and real-time feedback in problem-solving scenarios revealed that the benefits gained outweighed possible technology distractions (Donovan & Loch, 2013). Venema and Lodge (2013) study on the use of digital ink technology to promote interaction in large lectures displayed promising positive results. Similarly, using instructional tool in the classroom with the aim of promoting active learning resulted in increased students' satisfaction pertaining to aiding their participation during lectures, although such tool does not increase their motivation levels to study (Oigara & Keengwe, 2013). Similar findings were reported by Chen and Lan (2013) study on the use of a personal response system in large lectures revealed that the perceived benefit of improving students' learning was inconclusive. Other drawbacks observed were technology-induced disruptions during lectures, the lure of the temptation among students to engage in personal conversations using their mobile messaging applications, or discretely playing online computer games (Scornavacca, Huff, & Marshall, 2009).

Therefore, using mobile technology in the classroom brings with it benefits as well as disadvantages. Concerns of possible disruptions are serious and warrants investigation towards drafting an implementation guideline for responsible use of mobile technology as proper learning tools. A level of maturity among the students is important to ensure students' readiness for responsbile use of such technology in the classroom. Alzaza and Yaakub (2011), and Mahat, Ayub, and Luan (2012) investigated Malaysian higher education students' readiness to use mobile technology, and results suggested that students possessed sufficient knowledge and maturity to use such technology responsibly. The findings point to growing awareness towards use of mobile technology inside the classroom to facilitate students and lecturers interaction in order to reduce communication barriers of large lecture sessions which are oftentimes unavoidable. Consequently, the present study aims to develop and evaluate a conceptual framework for acceptance of mobile technology for promoting interactive lectures by subjecting key determinant factors of adoption intention elicited for statistical analysis.

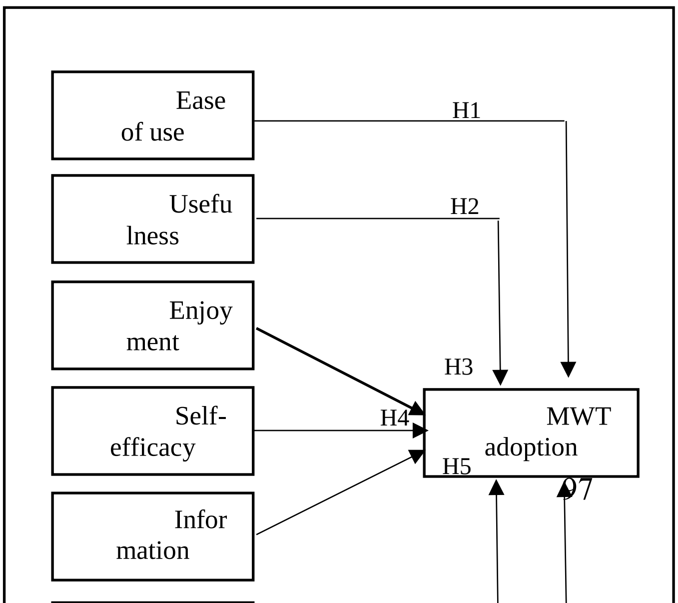
Background study and hypotheses development

This section presents the main theories from literature of past research studies on technology acceptances focusing mainly on any form of computing technology adoption studies, motivational and organizational cultural theories.

Technology Acceptance Model

The well-known Technology Acceptance Model (TAM) hypothesized that perceived usefulness and perceived ease of use impact user attitude and behavioural intention towards subsequent acceptance of information system (Davis, 1989). Perceived usefulness is the degree in which one believes that using an information system will improve productivity, whereas perceived ease of use is the degree in which one believes using an information system will require minimal effort (Davis, 1989). A field study (on two existing systems with a sample size of 112 employees from IBM) and a laboratory study (on two new IBM PC-based graphics system with a participant size of 40) to test the reliability and validity of perceived ease of use and perceived usefulness was conducted by Davis (1989). Perceived ease of use and usefulness have been replicated in many past and recent studies of technology acceptances across a wide range of study areas. Recent studies proved that ease of use and usefulness are pivotal predictors of technology acceptances.

Figure 1. Proposed conceptual framework



Calisir, Altin Gumussoy, Bayraktaroglu, and Karaali (2014) study on web-based learning system acceptances among college students revealed usefulness to be the strongest determinant of behavioural intention, which was strongly influenced by information and system quality, and ease of use. Similar study on e-learning technology validated the importance of ease of use and usefulness as important determinants (Tarhini, Hone, & Liu, 2014; Lin & Wang, 2012; Šumak, HeričKo, & Pušnik, 2011). Ease of use and usefulness were also deemed vital mediating factors, such as in the study of blended learning approaches where usefulness was strongly correlated to attitude among the male respondents (Padilla-Meléndez, del Aguila-Obra, & Garrido-Moreno, 2013), and in another study by Huang, Liu, Huang, and Yeh (2014) where ease of use and usefulness strongly influenced attitude towards behavioural intention for using a disaster prevention education system.

Therefore, it is hypothesized that user acceptance of mobile wireless technology (MWT) for promoting interactive lectures will be determined by ease of use and usefulness. The conceptual framework proposed is presented in Figure 1.

Intrinsic motivator theory

Social cognitive theory (SCT) is mainly based on common cognitive mechanism that mediates changes in events. According to the theory, people are neither driven by inner forces, nor driven by external motivations. They are however explained by a model where a person's cognitive, behaviour, personal factors and environmental factors act as determinants of each other. SCT was proposed as an attempt to explain human behaviour by placing importance on intrinsic factor, i.e. self-efficacy as a direct determinant of a person's behaviour (Bandura, 1977, 2001). Another form of intrinsic motivator is enjoyment in performing a set of task, without any need for external positive rewards or reinforcements (Scott, Farh, & Podaskoff, 1988). Self-efficacy was deemed an important factor in a study among older people or people with disabilities when using everyday technologies (Laver, George, Ratcliffe, Crotty, 2012). Self-efficacy also emerged as significant predictor of usefulness and behavioural intention in studying user behavioural intention to use Youtube (Lee & Lehto, 2013). Enjoyment and usefulness were also revealed as strong determinant variables of intention to use mobile social network games (Park, Baek, Ohm, & Chang, 2014). And recent study on e-commerce disclosed enjoyment and self-efficacy as significant mediator variables influencing perceived value towards online consumer purchase intention for online content services (Wang, Yeh, & Liao, 2013). The present study incorporates the construct of self-efficacy and enjoyment into the proposed conceptual framework to examine its influence on mobile technology adoption for interactive lectures.

DeLone and McLean information system success model

Studies have acknowledged the importance of system design, and one of the models includes the DeLone and McLean Information System success model (D&M). In D&M model, the determinants that lead to intention to use and user satisfaction are information quality, system quality, use, user satisfaction, individual impact and organizational impact as distinct factors but related dimensions of information system success (DeLone & McLean, 2003). Study by Lin and Wang (2012) that integrated D&M model with TAM reported information quality and usefulness as strong determinants of e-learning. Both service and the content quality were found to be significant contributors in a study of an e-government website (Tan, Benbasat, & Cenfetelli, 2013). Information quality was also proved to be vital towards influencing use of an online community municipal portal

(Detlor, Hupfer, Ruhi, & Zhao, 2013). Information and system quality were found to directly affect perceived user benefits and satisfaction, which in turn determined user continuance intention to consume and to provide information in an information-exchange virtual community (Zheng, Zhao, & Stylianou, 2013). It is therefore hypothesized that user acceptance of mobile technology for promoting interactive lectures will be determined by the quality of information generated and system quality.

Uncertainty avoidance

Uncertainty is characterize as the absence of predictability, composition, and information. Hofstede, Hofstede and Minkov (2010) defined uncertainty avoidance as the degree in which people feel uncomfortable with the presences of uncertainties or doubts. The effect of cultural influences such as uncertainty avoidance is gaining traction as a key determinant of information system adoption in recent years. Lin (2014) study revealed cultural differences influenced physicians' perceptions toward knowledge management system acceptance in healthcare organizations. Differences in cultural background between Korean students and U.S. students revealed Korean students to be more apprehensive towards new Web 2.0 technologies compared to their counterparts in the U.S despite similar personal characteristics (Yoo & Huang, 2011). Similar results were also found in a study of e-commerce adoption where respondents from different nationalities revealed cultural influences to be significant predictors (Ashraf, Thongpapanl, & Auh, 2014). Cultural factors were also significant in the area of mobile health applications (Mohamed, Tawfik, Al-Jumeily, & Norton, 2011). Lastly, negative correlations were revealed between uncertainty avoidance and cell phone and Internet subscription study by Matusitz & Musambira (2013). Therefore, it is expected that the presence of uncertainty avoidance will influence adoption intention in the present study.

Research methods

The survey comprised of two main sections - the demographics section, followed by five item statements for each of the constructs identified (usefulness, ease of use, self-efficacy, enjoyment, uncertainty avoidance, system quality, information quality, adoption intention). Respondents can rate their level of agreement for each item statement using a 5-point Likert scale (1 = “Strongly disagree”, 3 = “Neutral”, and 5 = “Strongly agree”). The study survey instrument was subjected to pilot testing involving ten selecting students. All students completed the survey within ten minutes, and feedback were gathered to removed or re-defined ambiguous statements. Respondents were recruited via email invitations sent to students of higher learning institutions in Malaysia, and data were collected from April till November 2014. Students were invited to fill up an online survey hosted by Google drive. Data from the online survey was transferred into *IBM SPSS Statistics 21* software and organized for statistical analysis.

A total of 396 Malaysian students of higher education participated in the online survey. Average age of respondents was 21 years old. Majority of the respondents were undergraduates (N = 258, 65.2%). None of the respondents are using mobile technology to interact with their lecturers during lectures. Majority of the respondents are using their mobile devices for learning purposes (N = 335, 84.6%). Table 1 tabulates the gender and education background of the respondents.

Table 1. Respondents’ gender and education background.

		Frequency (percentage)
Gender	Male	198 (50.0%)
	Female	198 (50.0%)
Education	Foundation	44 (11.1%)
	Diploma	70 (17.7%)
	Bachelor/Undergraduate	258 (65.2%)
	Master/PhD/Postgraduate	24 (6.1%)

Results

Principal Component Analysis

Constructs identified from reviews of acceptance models, motivational and cultural theories for examining adoption of mobile wireless technology (MWT) for interactive lectures, i.e. Usefulness (U), Ease of Use (EU), Self-Efficacy (SE), Enjoyment (E), Uncertainty Avoidance (UA), System Quality (SQ) and Information Quality (IQ) with five research items each were subjected to principal component analysis (PCA). Examination of the correlation matrix revealed the presence of many coefficients of .3 and above (with the exception of research item SE2 and research item SQ2). Kaiser-Meyer-Olkin value was .964, indicating sample size adequacy and exceeding the recommended value of .6. Bartlett's Test of Sphericity reached statistical significance, supporting the factorability of the correlation matrix (x^2 = 12979.32, df = 561, $p < 0.001$).

Principal components analysis (PCA) revealed the presence of four factors with eigenvalues exceeding 1, explaining 54.2%, 7.2%, 4.1% and 2.9% of the variance respectively. Examination of the scree plot revealed an uncertain break after the third factor. Parallel Analysis was then conducted and results revealed two factors with eigenvalues clearly exceeding and the third factor just slightly exceeding a randomly generated data matrix (35 variables and 396 respondents). Therefore, three factors was then retained for further analysis and results explained a total of 67.07% of the variance, with factor 1 contributing 55.52%, factor 2 contributing 7.38%, and factor 3 contributing 4.17%.

Oblimin rotation was performed to aid the interpretation and solution revealed the presence of simple structure with all research items loading substantially on only one factor. The factors are named User System Perception (USP), System and Information

Quality (SIQ), and User Uncertainty Avoidance (UUA). Solution revealed strong loadings for User System Perception (USP) from Usefulness (U), Ease of Use (EU), Self-Efficacy (SE) and Enjoyment (E), suggesting that user perception towards system usefulness, ease of use and their intrinsic motivations (enjoyment and self-efficacy) are tightly interrelated. Only one research item from Self-Efficacy (SE) was removed for further empirical testing (loading < 0.4). Pattern and structure coefficients for the three factors are presented in Table 2.

Table 2. Pattern and Structure Matrix for PCA with Oblimin Rotation of three factor solution of research items

Item	Pattern coefficients				Structure coefficients			Communalities
	SP	IQ	UA	U	SP	IQ	UA	
U1	**866**	.007	.090	-	**815**	465	350	.671
U2	**864**	.001	.018	-	**854**	509	425	.730
U3	**672**	.149	11	.2	**690**	368	476	.509
U4	**792**	080	.025	-	**827**	543	424	.688
U5	**866**	.106	56	.0	**831**	445	443	.698
EOU1	**881**	009	.046	-	**863**	514	411	.747
EOU2	**862**	.052	14	.0	**837**	473	428	.703
EOU3	**927**	014	.102	-	**882**	516	380	.786
EOU4	**697**	070	05	.0	**742**	492	401	.554
EOU5	**858**	111	.052	-	**898**	599	448	.814
SE1	**748**	174	.062	-	**821**	591	416	.692
SE3	**779**	150	.015	-	**861**	610	464	.755
SE4	**583**	086	56	.1	**714**	520	500	.538
SE5	**703**	232	.004	-	**840**	652	481	.740
E1	**770**	025	64	.0	**818**	522	472	.673
E2	**685**	061	64	.1	**806**	561	548	.676
E3	**484**	.033	28	.3	**632**	434	558	.474
E				.1				.681

4		**715**	.006	90		**809**	526	554		
5	E	**787**	059	78	.0	**862**	574	513	.	.752
A1	U	287	176	**26**	**.4**	612	578	**668**	.	.562
A2	U	011	090	**11**	**.7**	430	478	**765**	.	.591
A3	U	.084	056	**03**	**.9**	413	491	**890**	.	.797
A4	U	088	063	**05**	**.8**	539	548	**884**	.	.793
A5	U	173	124	**89**	**.6**	601	599	**845**	.	.760
Q1	S	.076	**714**	44	.0	376	**692**	389	.	.483
Q2	S	.210	**808**	00	.1	327	**736**	427	.	.569
Q3	S	027	**713**	37	.1	526	**803**	534	.	.660
Q4	S	287	**540**	76	.0	651	**754**	513	.	.633
Q5	S	347	**510**	19	.0	663	**728**	470	.	.610
Q1	I	118	**681**	62	.0	560	**785**	488	.	.631
Q2	I	245	**669**	07	.0	651	**821**	492	.	.712
Q3	I	083	**755**	23	.0	549	**818**	472	.	.674
Q4	I	199	**739**	13	.0	650	**866**	512	.	.776
Q5	I	337	**601**	.052	-	671	**775**	443	.	.669

Note: Major loading for each are bold. USP = User System Perception; SIQ = System and Information Quality; UUA = User Uncertainty Avoidance.

According to Pavot, Diener, Colvin and Sandvik (1991), the survey instrument scale has good internal consistency, and results are presented in Table 3.

Table 3. Reliability analysis of each factor

Factors	N umber of Items	Cr onbach's Alpha	M ean	S tandard Dev.
1. User System Perception	19	0.9 7	4 .05	0 .93
2. User Uncertainty Avoidance	5	0.8 9	3 .56	0 .99
3. System and Information Quality	10	0.9 3	3 .73	0 .88

The proposed conceptual framework was then updated. Figure 2 illustrate the updated framework. The resulting hypotheses to determine adoption intention of mobile technology for promoting interactive lectures are:

H1: User system perception positively influence MWT adoption intention.

H2: User system perception positively influence MWT adoption intention.

H3: User uncertainty avoidance negatively influence MWT adoption intention.

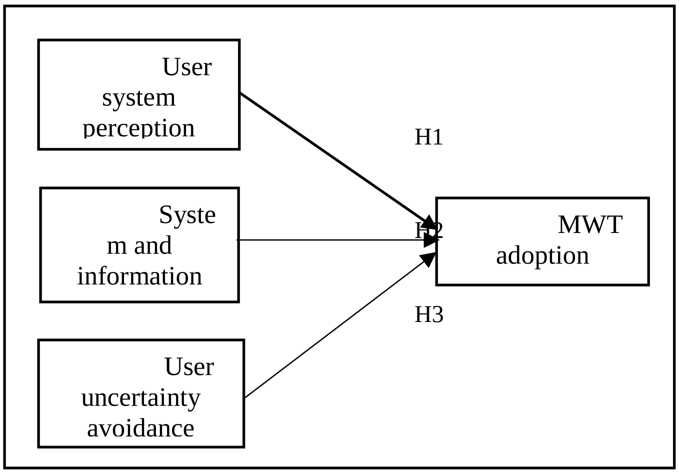


Figure 2. Updated conceptual framework

Pearson product-moment correlation

The relationship between user system perception (as measured by USP) and adoption intention was investigated using Pearson product-moment correlation coefficient. There was a small, positive correlation between the two factors, r = .151, n = 396, p < 0.005. The relationship between system and information quality (as measured by SIQ) and MWT adoption intention echoed similar results, with r = .171, n = 396, p < 0.005, suggesting small positive correlation. User uncertainty avoidance (as measured by UUA) revealed moderate negative correlation with MWT adoption intention (r = -.254, n = 396, p < 0.005), with high levels of uncertainty avoidance being associated with lower levels of MWT adoption intention. Correlations of the factors are shown in table 4.

Table 4. Correlations of the variables (N = 396)

Variable	2	3	4

1. MWT adoption intention		.		.1		-
	151		71		.254	
2. User system perception		-		.6		-
	-		01		.513	
3. System and information quality		-		--		-
	-		-		.537	
4. User uncertainty avoidance		-		--		-
	-				-	

Note: All correlations were statistically significant ($p < .005$)

Standard multiple regression

Standard multiple regression was used to assess the ability of USP, SIQ and UUA to predict levels of MWT adoption intention. The prediction model was statistically significant, $F(3, 392) = 9.240$, $p < .001$. However, the variables accounted for approximately only 7% of the variance of MWT adoption intention ($R^2 = .066$, Adjusted $R^2 = .059$). MWT adoption intention was primarily predicted by user uncertainty avoidance recording the highest beta value (beta = -.225, $p < .001$). User uncertainty avoidance accounts uniquely for about 3% of the variance of MWT adoption intention. Standardized regressions coefficients of the predictors and their squared semipartial correlations are shown in table 5.

Table 5. Standard regression results

Model		B	s
	eta	r^2	
User system perception		.	.
	009	00005	
System and information quality		.	.
	045	00116	
User uncertainty avoidance*		-	.
	.225	03312	

Note: Dependent variable was MWT adoption intention, sr^2 = squared semi-partial correlation, *$p < .005$.

Discussions

The study objective is to elicit crucial determinants of higher education mobile technology adoption during lecture sessions to promote interactivity. Review of literatures proved the importance of the usefulness and ease of use factors (widely replicated and validated across technology acceptances studies) from Technology Acceptance Model, user's intrinsic motivators in the form of enjoyment from motivational model and self-efficacy from Social Cognitive Theory, system quality and information quality from DeLone and McLean Information System success model, and uncertainty avoidance from Hofstede's national culture dimensions. An online survey was conducted among Malaysian higher education students to elicit perceptions of mobile technology adoption during lecture sessions to promote interactivity.

Results from principal component analysis produced three main factors (independent variables). Predictably, both system quality and information quality survey items loaded together and the factor was named System and Information Quality (SIQ). This can be attributed to the fact that the focus of the study is on harnessing the use of an appropriate mobile messaging application to increase interactions between lecturers and students in the classroom. With mass and widespread downloads and use of mobile applications, distinction between system versus information quality may not be as pivotal as it may be for more complex information system, such as a decision support system used by organizations. Therefore, there may exists an expectation among the younger generation for system and information quality to go hand in hand. Uncertainty avoidance (UUA) items loaded together and its name retained as a factor. Interestingly, survey items from usefulness, ease of use, enjoyment and self-efficacy loaded together. This is in contrast to many past and current technology acceptances study in the area of information system adoptions. Clear distinction of ease of use, usefulness, and intrinsic motivators such as self-efficacy and enjoyment as determinants of mobile technology such as a messaging application may no longer be imperative. The fact that the vast majority of the study respondents (84.6%) are already using mobile devices in their learning activities signifies an existing recognition of mobile devices as indispensable tools for the students. Park, Nam and Cha (2012) study among Korean universities students revealed attitude, which encompasses their beliefs or perceptions towards mobile learning, as the most important factor for successful implementation. Similar findings were reported by Shroff, Deneen and Ng (2012) in their study examining students' behavioural intention to use an e-portfolio system. Perceptions towards new technology may be representative of the existing confidence towards a system expected usefulness, ease of use and enjoyment. Therefore, the resulting factor is named as user system perception (USP).

The study hypothesizes that USP and SIQ positively influences MWT adoption intention. Results from correlation and regression analysis do not support these hypotheses. This disputes previous findings by Chong et al. (2011) on mobile learning adoption in Malaysia where quality of system functionality are revealed to be significant, and findings by Pay and Huang (2011) and Calisiri et al. (2014) where system service and content, usefulness, and ease of use positively influences adoption intention. However, user uncertainty avoidance is revealed to be conclusive, supporting the hypotheses that UUA negatively influences MWT adoption intention, thereby providing vital insight on the role of cultural and social influence towards the study of technology acceptance, as evidence by the findings by previous studies (Ashraf, Thongpapanl, & Auh, 2014; Matusitz & Musambira, 2013; Lin, 2014; Yoo & Huang, 2011). Strong correlations were revealed between USP and SIQ towards UUA, suggesting that UUA is intricately tied to USP and SIQ.

Conclusion and future work

Widespread use of mobile applications on increasingly sophisticated mobile devices is fundamental across all walks of life. The effect across the higher education landscape is enormous. The findings from this study hopes to serve as a catalyst for future research into the area of mobile technology acceptances. Existing validated factors such as ease of use, usefulness, enjoyment and self-efficacy may no longer be distinct entities, particularly in the area of mobile technology and mobile learning and thus warrants further investigations. Factors of cultural influence, students' background, personalities or attitudes are growing in prominence as antecedents of technology acceptance. Though linear regression results revealed user system perception as insignificant and non-predictive of MWT adoption for interactive lectures, strong correlation among user system perception, and system and information quality with user uncertainty avoidance suggest that user perceptions and existing uncertainties are pivotal in the area of mobile technology acceptance.

Therefore, further analysis is justified, and new acceptances framework or theories pertaining to mobile technology adoption are necessary. Existing technology models such as TAM may no longer be sufficient in areas of mobile technology acceptances among the young generation. Future work will focus on using advance statistical methods, namely confirmatory path and structural equation modelling analysis to validate and strengthen the framework model factors. As the respondents were sourced from large established higher learning institutions located in urban areas with strong technology infrastructure support, results cannot be generalized as representative of Malaysia's higher education. Sampling of respondents from smaller institutions or institutions located in rural areas should be included in the future.

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Adoption of m-learning applications: The case study of guided exploratory urban planning tours and site visits via a mobile application

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Abstract. This paper is about the design, development, and deployment of an m-learning application for urban planning students. We aim to find a model that can help predict its adoption and subsequent effectiveness of the application. In this paper, we first report the most important behavioural theories from which models and frameworks for technology adoption are derived. After, we provide a review of the literature dealing with predictive models and m-learning applications to assess what factors researchers specify are important determinants of adoption. Our final goal is to establish a framework that can aid us in predicting the adoption of our application and similar ones that educators in architecture, urban planning, and urban history may be exploring to develop for their own purposes.

Keywords: m-learning; technology acceptance; urban planning and design education; guided exploratory learning; collaborative learning.

Introduction and background

Mobile learning (m-learning) is a latest movement in educational technology and is receiving growing importance (Wu et al., 2012). M-learning has gone through three phases, from an initial focus on devices, to learning outside the classroom, to finally the mobility of the learner (Pachler et al., 2010). In the last phase, the concerns surround three overlapping learning affordances: mixed reality, context-sensitive, and ambient/augmented reality. All three of them seek to take learners as close to the actual, real environment as possible. Mixed reality learning is about combining two modes of representation to allow learners experience the world with added digital information. Context-sensitive learning tries to take into account where the learner is and provide contextualised and personalised information as needed—this 'where' can not only mean the actual, physical location of the learner but also more learning-dependent states. Mobile devices allow for easy location tracking (that is, location-aware systems) of their users and, with proper 'intelligent' applications (Rashvand & Hsiao, 2015), context dependent details given to users. Finally, ambient learning makes use of mobile devices to augment or enhance the world being explored (Nincarean et al., 2013; Hou et al., 2013; Chang et al., 2014).

The movement from one phase to another has been rather rapid, on par with the somewhat sudden proliferation of mobile devices. One of the biggest issues that still remains is that of evaluation to assess the effectiveness of m-learning systems (Sharples, 2006). To aid this, researchers have been exploring what factors or determinants affect the use or 'adoption' of m-learning systems, particularly in the current, third phase (Liu et al., 2010; Tosuntas et al., 2015)—in a way using predictive mechanisms to foretell their possible adoption and effectiveness. There have been a number of surveys assessing the state of current m-learning systems and applications (for example see: Wu et al., 2012; Lam & Duan, 2012; Lam et al., 2012; Fong, 2013; Pereira & Rodrigues, 2013), but they do not offer any suitable examination of models for m-learning systems. In their meta-analysis review of m-learning literature, Wu et al. (2012) have found that most studies focus on effectiveness followed by design of m-learning systems. However, they do not present the factors that make the studied systems effective or adopted by students and educators.

In this research, we want to identify the factors that can help us predict if our m-learning application will be used and, if it is used, how effective it is to support students to experience, observe and critique the parts of a city as part of their formal and informal learning (within and outside of the classroom). Field visits and tours are used widely by teachers of art, history, architecture, and urbanism, among others (for some examples see Spikol & Milrad, 2008; Pachler et al., 2010; Milrad et al., 2013), but very little literature exists on the pedagogical value of these tours and also on the factors determining whether such applications are used by learners. With this research we hope to begin to fill that gap. We also aim to assess how to use an app to bring hands-on learning to students in a large class and encourage active learning both within the class and beyond. This is important in the context of China and for urban planning students, given that they often tend to be taught mainly in lecture style formats without much hand-on, practical exploration.

Frameworks for predicting usage or adoption of m-learning applications

Models and frameworks have been in development to asses if a certain application or technology will be adopted by users. These models are variants of one behavioural theory or a combination of several theories (see Table 1 for a brief summary of the main theories).

Table 1. A summary of some main behavioural theories.

Theory	Brief description
Theory of reasoned action	It states that *intention* to act as the best predictor of future behaviour. Intention is itself an outcome of the combination of attitudes / beliefs towards a behaviour. That is, the positive / negative evaluation of the behaviour and its expected outcomes plus subjective norms, which are social pressures exerted on an individual resulting from their perceptions of what others think they should do and their inclination to comply with these, determine their future behaviour (Fishbein & Ajzen, 1975).
Theory of planned behaviour	It builds on the theory of reasoned action by adding a third set of factors that affect behaviour: Perceived behaviour control—the perceived ease or difficulty with which the individual will be able to perform the behaviour. (Davis, 1989; Munro, 2007; see Appendix 1 for a adapted diagram of the theory).
Self-efficacy theory	Individuals who perceive themselves as capable of taking action also do take action. Vicarious experiences, social models, and social persuasion will

	strengthen the sense of efficacy. In addition, reducing reactions when stressed and changing their way of interpreting negative physical states can also be beneficial (Bandura, 1977).
Social cognitive theory	The actions of others affects our perception. Observing others performing a behaviour influences the perceptions of an individual’s own ability to perform the same behaviour—i.e., self-efficacy plus the perceived expected outcomes (Bandura, 1986).
Self-determination theory	It is macro theory of human motivation and personality and focusses on the degree to which an individual’s behaviour is self-motivated and self-determined when making choices. STD identifies three natural or inherent needs: Autonomy, competence, relatedeness (Deci & Ryan, 2002).
Cognitive dissonance theory	Individuals seek consistency among their cognitions such as beliefs and opinions; inconsistency between attitudes and behaviours creates dissonance that needs to be eliminated (Festinger, 1957).
Goal setting theory	Goals are guides and direct our effort, focus, energy so that we strategize and plan steps towards their achievement. The highest goals produce the highest levels of effort and performance. To encourage higher performance, goals should be specific and somewhat challenging. People with high self-efficacy tend to set higher goals than people with lower self-efficacy, with the former also more committed to assigned goals and responding more positively to negative feedback (Locke & Latham, 2002).
Diffusion of innovation theory	It places on innovation as an agent of change, instead of individuals or social structures, with innovation defined as “*an idea, practice, or object perceived as new*” (Rogers, 2003, p.12). The theory posits four main elements of behaviour change: innovation, communication channels, time and social systems.

The Technology Acceptance Model (TAM; Davis, 1989; see Appendix 1 for a diagram of its main components) is one of the most widespread predicting models used and since its inception researchers have come with some variants. TAM is an extension of Ajzen and Fishbein’s Theory of Reasoned Action (TRA) by replacing TRA’s attitude measures with the two technology acceptance measures—*ease of use* and *usefulness*. Responding to critics because of the limitations of TAM, Vankatesh and colleagues have developed a variant, the *Unified* Theory of Acceptance and Use of Technology (Vankatesh et al., 2003; see Appendix 1 for a diagram). The theory posits that there are four key constructs: (1) performance expectancy, (2) effort expectancy, (3) social influence, and (4) facilitating conditions. The first three being direct determinants of usage and behaviour intention, and the fourth a direct determinant of use behaviour. Gender, age, experience, and voluntariness of use are used as impact moderators of the four key constructs. The theory was developed through a review and consolidation of the constructs of eight behavioural models, including theory of reasoned action, theory of planned behaviour, diffusion of innovations theory, and social cognitive theory (see Table 1 above for some of the main ones).

In the context of mobile devices and services, Kaasinen (2005) is one of the first to adapt the original TAM for these devices, named "Technology Acceptance Model for Mobile Services" (Kaasinen et al., 2011). In this model, Perceived Value replaces Usefulness, as value is thought to be a better predictive factor, to describe a whole set of features that can go into a mobile service. Trust, along with security and ethical issues, is important to mobile services, and is thus added as a new component. Perceived ease of adoption relates to how easy it is to set things up and start using mobile services and devices. To our knowledge, no application of this model, or its variants, has been carried out in m-learning services and applications so it is unclear how well this model will be fit for such applications.

When it comes to m-learning applications, a number of researchers have explored adapted versions of TAM, often by including other aspects of the behaviour theories not taken into account by TAM. A summary of some studies are provided in Table 2.

Table 2. Example studies of m-learning applications and their models they used.

Proposed Models	Application Domain	Main Findings
The model, an adaptation of both the theory of reasoned action and the theory of planned behaviour, includes Attitude (Perceived usefulness, Attitude to technology use, Educational compatibility); Perceived behavioural control (Facilitating condition, Computer self-efficacy) (Lai et al., 2012)	Unspecified. General use of mobile technologies.	Perceived usefulness of technology for learning and students' perception of their general and skills did not have great influence on their technology use. Instead, students' appreciation of the utility of technology in learning and teachers' and peers' support of it use have greater influence.
The model is an adaption of TAM with elements of Diffusion of innovation theory, where Perceived usefulness is subdivided into short-term and long term, Perceived ease of use, and Personal innovativeness are	Unspecified. A large number of their students are English students, and participants are students in a local	Perceived near-term/long-term usefulness and personal innovativeness have significant influence on m-learning adoption. Perceived long-term usefulness significantly affects the perceived

added (Liu et al., 2010)	Chinese university.	near-term usefulness. Personal innovativeness is a predictor of both the perceived ease of use and perceived long-term usefulness as well. *The most significant contributor is perceived long-term usefulness*, and this affected greatly the quality of content.
Zhao et al.'s proposed model (2011) is based on the self-determination theory with the addition of three constructs: enjoyment, flow, and curiosity. The flow construct by Csikszentmihalyi (1988) describes how people feel when they act with total involvement and focus on an activity.	Unspecified.	Main results: (i) for the perceived autonomy dimension, teacher support only significantly affects curiosity while parental support does not have any effect; ii) as to the perceived relatedness dimension, peer influence is found to exert the greatest influence on both motivations, and Internet self-efficacy, which belongs to the perceived competence dimension, also positively relates to enjoyment and curiosity; iii) as to the outcomes of intrinsic motivations, both enjoyment and curiosity lead to flow state, however, curiosity rather than enjoyment positively relates to online exploratory behaviour, and flow experience also predicts exploratory behaviours.
A pedagogical framework was used to assess mobile learning from a socio-cultural perspective which focuses on three aspects: Authenticity, collaboration, and personalization (Viberg & Grönlund, 2013)	Language learning (Mobile-assisted language learning); participants were from Sweden and China.	There results show that participants are positive toward mobile learning with individuation being most positive (83%), followed by collaboration and authenticity (both 73%).
Self-regulated learning (Sha et al., 2012)	Science (more specifically magnets)	Student *motivation* in this case can account for whether and to what degree the students can actively engage in mobile learning activities meta-cognitively, motivationally, and behaviourally.

Results from the above studies clearly shows that there are a variety of factors that can affect the adoption of m-learning applications and systems. As stated earlier, the purpose of this review is to assist us in predicting the adoption, usage, and effectiveness of our system aimed at supporting the delivery of a course in urban planning. The system is designed by faculty members in urban planning and computer science, and with it we want to give students a somewhat guided and focused, yet flexible and personalised, way to explore selected spots of a city. This knowledge is supposed to complement what they learn in the classrooms.

The features of our m-learning application under development is listed here.

- It supplements traditional class teaching;
- It is used for a short time (e.g., a week) and outside of the class;
- It aims at balancing guided tour exploration and students' schedule and interests;
- It attempts to foster collaborative exploration;
- It is about assisting students to actively engage, observe and critique the physical environments;
- It is for junior students attending a large class (e.g., 120+ students); and
- Students are mainly from a Chinese background attending an English university environment.

The studies cited above do not match the features of our application and our context, and we are not aware of research out there that deals with applications such as ours, with the same limitations and constraints. We also plan to establish a model that can help us predict how well our application will be adopted and to assess its overall effectiveness. In particular, we plan to establish a framework and determine what factors are to be part of this framework. Our aim is to be able to share our findings with other educators in areas such as architecture, civil engineering, urbanism (for example, planning and history), so that they are able to design m-learning tools and applications that are effectively and can achieve with high levels of adoption by students.

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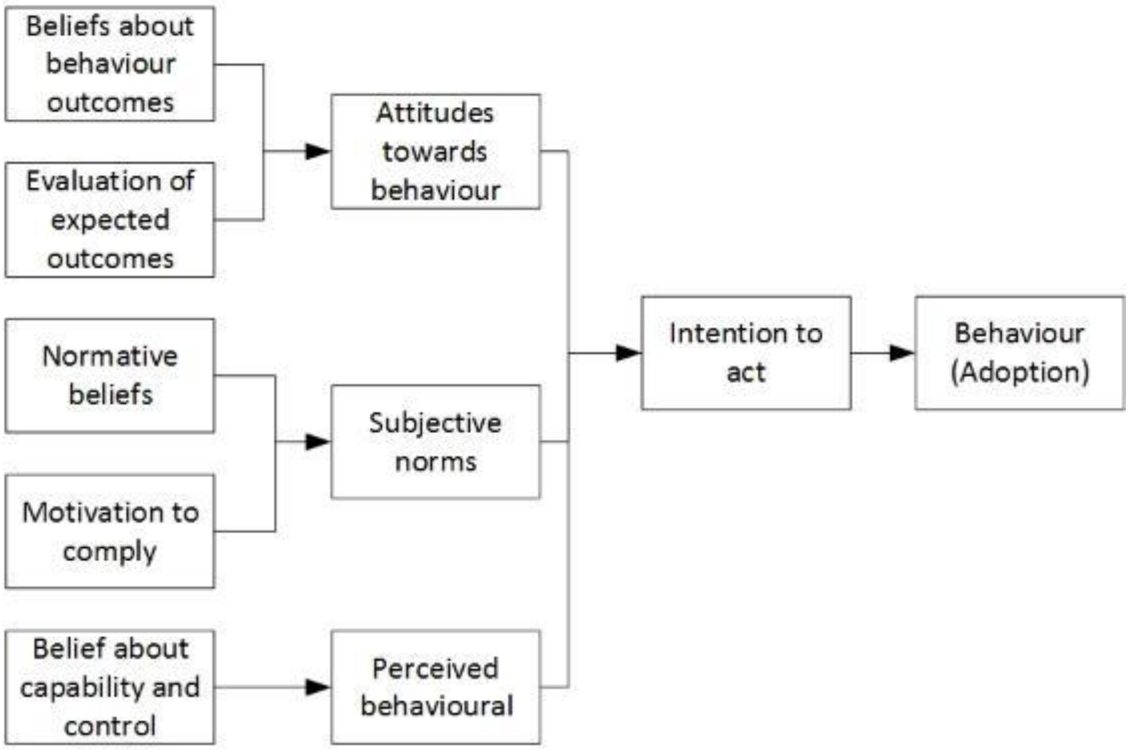
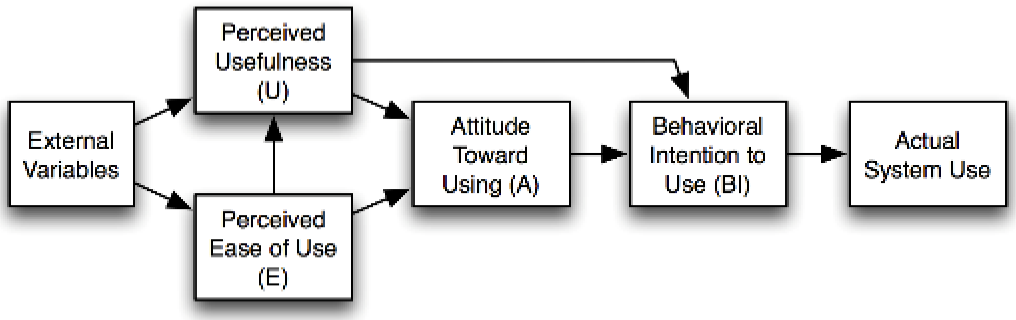
Appendix 1: Diagrams of theories, models, and frameworks

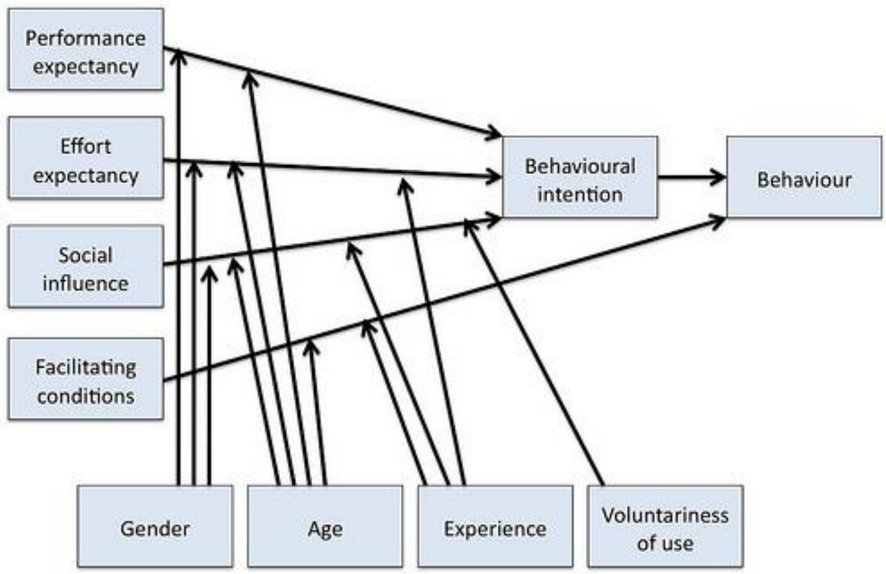
Theory of Planned Behaviour (Adapted from Munro et al., 2007)



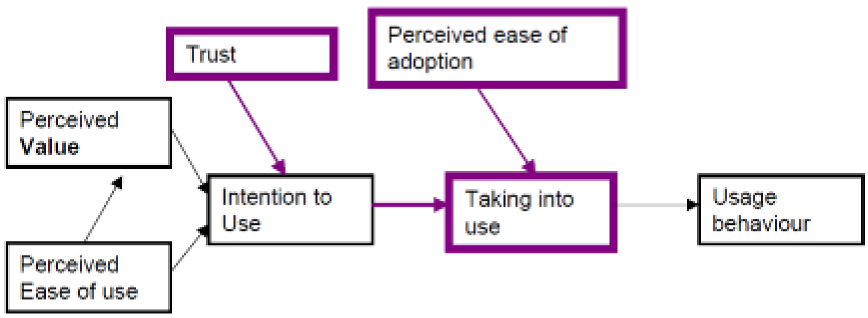
Technology Acceptance Model (Davis, 1986)



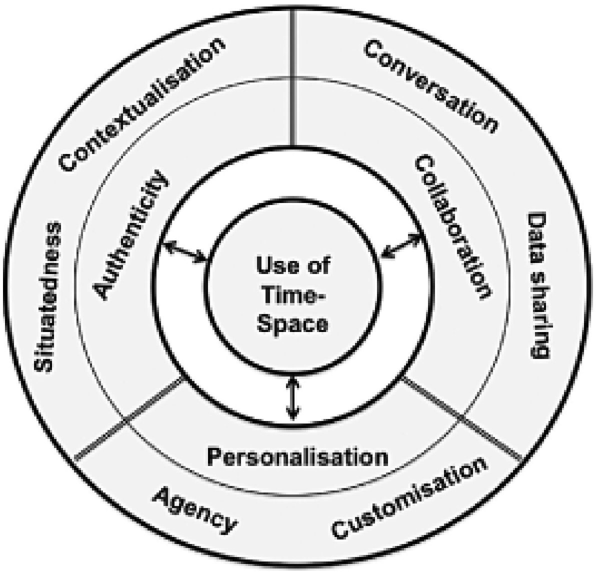
The Unified Theory of Acceptance and Use of Technology (Vankatesh et al., 2003)



Technology Acceptance Model for Mobile Services (Kaasinen, 2005)



A Socio-technical Framework for M-Learning Systems (Kearney et al., 2012)



Text Messaging for Out-Of-Class Communication: Impact on Immediacy and Affective Learning

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While out-of-class communication between instructors and students can impact all types of student learning it has its greatest impact on student affective learning, including motivation and engagement. One of the primary reasons for this is that the out-of-class communication enhances student perception of instructor immediacy. Immediacy is defined as behaviour which increases psychological closeness between communicators. Research studies in instructional communication suggest that improved instructor immediacy is linked to enhanced affective learning. A research study was conducted into the use of text messaging for out-of-class communication and the impact it had on student perception of instructor immediacy and student affective learning. Both quantitative measures of immediacy and qualitative feedback from students show that the instructor is perceived as closer, more approachable and responsive when text messaging services are offered. The student feedback also reveals that the use of text messaging has other positive effects on affective learning.

Keywords: text messaging, affective learning, immediacy, out-of-class communication, ubiquitous communication

Introduction

Effective communication between instructor and student is very important in the quality of the learning experience of students in higher education. Hill, Lomas and MacGregor (2003) used student focus groups to answer the question of what quality education means to students. Four themes emerged from the study, the most important being the quality of the instructor in terms of delivery, feedback to students and relationship with students in the classroom. However, there are many factors that limit communication between instructors and students in higher education including large class sizes, limited contact time and student reluctance to approach instructors.

While educational institutions generally place most emphasis on student cognitive learning it has been shown that affective learning is also crucial especially to the development of independent and life-long learners. Learning in the affective domain includes the manner by which people deal with things emotionally, such as feelings, values, appreciation, enthusiasms, motivations and attitudes (Bloom, 1956). While communication outside of normal class time (known as out-of-class communication) between instructors and students can impact all types of student learning it has its greatest impact on student affective learning (McCroskey, 1994). The importance of out-of-class communication to student affective learning should not be underestimated. Research shows that out-of-class communication between instructors and students can help build more positive instructor-student relationships and hence increase the quality of student learning (Noels, Clement & Pelletier, 1999; Vaughn & Baker, 2004). One of the primary reasons for this is that the out-of-class communication enhances student perception of instructor immediacy (Jaasma & Koper, 1999). Immediacy is defined as behaviour which increases psychological closeness between communicators (Mehrabian, 1969, 1971). Research studies in instructional communication suggest that enhanced instructor immediacy has a positive effect on affective learning and is linked to more positive student-instructor relationships engendering positive attitudes, increased interest and motivation by students as well as improved attendance, retention, engagement and learning (Christensen & Menzel, 1998; Ellis, 2004).

The research presented here investigates the effect of the use of text messaging for out-of-class communication between instructor and student on student perception of the immediacy of their instructor and on student affective learning. An extensive review of research literature from both the fields of instructional communication and mobile learning was carried out prior to the commencement of a year-long research study. Both quantitative measures of immediacy and qualitative feedback from student participants in the study show that the instructor is perceived as closer, more approachable and responsive when text messaging services are offered. The student feedback also shows that the use of text messaging has other positive effects on student learning experience, including enhanced motivation and engagement. Some limitations of the research are also addressed as are some concerns with the use of text messaging in education.

Instructor Immediacy

The field of instructional communication is based on the assumption that verbal and nonverbal messages conveyed by instructors have the potential to significantly affect student learning outcomes (Witt, 2000). When it comes to instructor communication behaviour one important construct is that of instructor immediacy. Immediacy is defined as behaviours, both verbal and nonverbal, that reduce physical or psychological distance between individuals (Andersen, 1979; Mehrabian, 1969, 1971, 1981). The results of a significant body of research conducted on instructor immediacy behaviours indicate that it can have a positive influence on student learning outcomes. For this reason instructor immediacy should be treated with great importance by any person or institution concerned with improving the quality of student learning (Witt, 2000).

Research studies have shown a linear relationship between student reports of teacher immediacy behaviours and perceptions of state motivation, and of cognitive, affective and behavioural learning (Christensen & Menzel, 1998; Pogue & Ahyun, 2006; Witt & Wheeless, 2001). This relationship has been shown to hold true for divergent classes (Kearney, Plax & Wendt-Wasco, 1985) and also in multi-cultural studies (McCroskey, Fayer, Richmond, Sallinen & Barraclough, 1996).

Text Messaging in Education

Text messaging has been exploited for supporting learning in a variety of educational settings. Studies of third-level students have shown that text messaging is used more regularly by students than email as it is perceived as being more personal and informal and is often students' preferred way for receiving information from their institution (Harley, Winn, Pemberton & Wilcox, 2007). However, because a text message is limited to only 160 characters it is more suitable for certain types of learning activities than others. A review of the current research literature shows that the ways in which text messaging has been employed in education fall generally into four categories. The first category is when text messaging is used to support and enhance classroom interactivity and dialogue (Clarke & Doody, 2008; Markett, Sanchez, Weber & Tangney, 2006). The second category is when text messaging is used for administrative purposes such as notifications of changes in the timetable and reminders of assessment submission dates (Naismith, 2007; So, 2009; Stone, 2004). The third category is when text messaging is used as a means of supporting micro-teaching activities including the sending of short summaries for revision, the sending of links to a relevant page on a Virtual Learning Environment (VLE) and also the provision of quizzes and feedback to students (Stone, 2004; Tretiakov & Kinshuk, 2005). The final category is when text messaging is used not for learning purposes directly but rather to guide, motivate and support students, encourage participation and engagement, and promote collaboration and co-operation. This fourth category includes many examples where it is used to enhance student affective learning, develop a sense of community amongst students and positively affect student retention rates (Trifonova, 2003; Harley et al., 2007). The fourth category may include messages from some of the other categories but the key difference is that the primary goal of the text messaging is to support students and enhance affective learning. As this research paper is concerned with the effect of text messaging on student affective learning it is this final category that is of primary interest.

There are many examples in the research literature where text messaging is not used specifically for the purpose of directly improving academic learning or for administrative purposes but is rather used to support and help students when they are outside class. Such out-of-class (OOC) text messaging may have the aim of enhancing affective learning and improving the learning environment, improving communications, supporting students' transition to third-level education, developing a sense of community among students or positively affecting student retention rates. The potential of the mobile phone as a communications medium in education prompted a research study by Brighton University to explore the use of mobile communication as a way of encouraging a supportive dialogue between students and relevant academic staff. The main motives behind the research were to support students' transition to third-level education and improve retention (Harley, Winn, Pemberton & Wilcox, 2007). Another very interesting and relevant research study by Griffith University in Australia relates the experience of a female instructor using out-of-class text messaging as a means of staying in touch with her students. The study demonstrates how it can be used as a means of providing connection and a sense of community for first year students and also how it encourages them to persist with their studies (Horstmanshof, 2004). Text messaging has also been used by the University of Ulster in Northern Ireland for supporting first-year chemistry students and for the reduction of student drop-outs. The university sends out messages to students of the type ‘Sorry, we missed you today’. The students do not find the messages obtrusive in any way, and actually welcomed them (Keegan, 2006).

Methodology

An empirical study was designed to investigate the impact of out-of-class communication between instructors and students using text messaging on student learning experience. The study was based in a real educational setting. It was hoped that analysis of the results of the study would provide evidence of an effect of the text messaging on student affective learning. In total 44 participants from 4 different classes took part in the study. The participants were all third-level undergraduate computing students who were taking between five and six modules each semester. The research study itself took two academic semesters to complete.

Text Messaging Service

The 44 students who volunteered to participate in the study had the use of a text messaging service for out-of-class communication with one of their instructors. The instructor used a freeware application called MyPhoneExplorer that was installed on the instructor’s laptop together with a mobile phone that was connected to a USB port on the laptop. The software application on the laptop was very versatile and easy to use. In terms of text messaging it operated much like an email program allowing the creation, viewing, editing and deletion of text messages as well as the sending and received text messages via the connected mobile phone. The application could be synchronised with the mobile phone allowing access from the laptop to both the SIM and phone memory. During synchronisation contact details of participants and text messages sent and received could be copied automatically from the phone to the application and visa-versa. The application allowed the sending of text messages to individuals or groups and it also supported the archiving of text messages on the laptop.

Categories of Text Messages

While it was difficult to categorise some of the messages they generally fell into one or more of three main categories. The first category was for messages that were sent for administrative purposes. The vast majority of these messages were sent as broadcasts to all participants in a treatment group. Only very rarely was there a need to send a message of this type to an individual participant or subgroup of participants. Examples of the use of this type of message include class announcements and cancellations, and reminders of class tests and assignment submission dates. A few examples of text messages of this category that were sent to participants were as follows:

"Hi, I have put the final marks for your continuous assessment up on Moodle. Paul"

"Don't forget you have a test on databases this Friday!"

"Just to remind you that John from BT Ireland is coming in to give us a talk next Tuesday. Paul"

"Hi, DCN class is postponed tomorrow, I have to attend an important meeting, will make it up to you. Paul"

The second category was for text messages that were specifically related to the topics covered in a module that were being delivered by the instructor and the contents of these messages were supplementary to the course material. These messages were sent as broadcasts to all participants and were used for the purpose of micro-learning activities. The messages included short summaries for revision purposes, short or multiple-choice questions and advice on how to prepare for forthcoming classes. Each message was restricted to 160 characters so the messages had to be short and precise. In the case of a text message containing a short question or a multiple-choice question the correct answer was sent as a broadcast text messages to all participants after a suitable period of time. A few examples of text messages in this category that were sent to participants were as follows:

> "What is the name of each layer of the OSI network model?"
> "What does the letter 'S' stand for in the acronym ISDN? Answer (a) Signals (b) Services (c) Switching or (d) Segment?"
> "Do you have any questions on what we covered today in class?"
> "The lecture next week is on the topic of DSL. Please look over the lecture notes on this topic prior to coming to class. Thanks"

The third category of message were those whose main purpose was to promote affective learning and included messages that were designed to motivate students in their studies, enhance interest in the subject and to encourage attendance, engagement and participation in class. While messages from the other two categories could have an indirect effect on affective learning this type of message was specifically aimed at enhancing it and included messages expressing pleasure at the effort students were putting into their studies and thanking students for their participation in class. These messages were always sent as a broadcast to all participants and care was exercised to make sure they were always positive in tone and never critical. A few examples of text messages in this category that were sent to participants were as follows:

> "Thanks for all your work and study this week. Glad to hear the projects are getting off to a good start. Have a good one & c u nxt week, Paul"
>
> "You learn something every day if you pay attention ~~ Ray LeBlond"
>
> "Very enjoyable class today. I will try to sort out the issue with the timetable tomorrow. Paul"

Data Collection

For the purposes of this investigation students who used the out-of-class text messaging service were asked to complete a questionnaire. The questions were formulated based on a review of the research literature on the use of text messaging to support students together with a review the findings of the preliminary studies and the use of the text messaging service to provide out-of-class support to students during the main study. The first section of the questionnaire consists of 30 specific questions about student perception of the use and impact of the text messaging service. Participants were asked to indicate their response to each question on a 7-point Likert scale. The second section of the questionnaire uses a series of open questions to give participants the opportunity of anonymously expressing their personal opinions in terms of communicating with their instructor using text messaging and its impact, if any, on them or their class in terms of learning and education, and the relationship with their instructor. It was hoped that analysis of the student responses to the questionnaire would provide data on the effect of the text messaging on student affective learning.

Results and Discussion

Both quantitative and qualitative data is presented in this section from the responses of participants to the questionnaire. The data is analysed to reveal any evidence of the impact of the text messaging on affective learning. The responses by students to the open questions are especially revealing as they contain many references to the effect of the text messaging on their affective learning.

Levels of Participation

Participation in the study was purely voluntary and overall the rate of participation was 88%. The total number of messages sent by the instructor during two 13-week semesters of the study was 202. The number of broadcast messages sent to groups of participants was 89 while 113 messages were sent to individual participants usually in response to individual queries.

A total of 155 messages were received by the instructor from participants indicating that participants not only received text messages but actively participated in the communication. Between broadcast messages and individual messages the total number of individual messages received by all participants during the study was 1,005. This means that on average 23 messages were sent to each of the participants and it equates to an average of less than two messages per participant per week.

Quantitative Results

The first section of the questionnaire consisted of 30 specific questions on the use and impact of the text messaging service. Participants were asked to indicate their response to each question on a 7-point Likert scale. In addition, for each question the percentage of responses that were scored with 5 points or more is also shown. As score of 5 points or more on any item by a respondent is taken to indicate agreement.

Analysis of the results shows that participants generally felt very positive about the introduction and use of the text messaging service with 91% of participants agreeing that they thought that being in touch by text messaging with your instructor was a good idea and 86% of participants agreed that they liked receiving text messages from their instructor.

In terms of the effect of the text messaging on their relationship with their instructor three-quarters of participants agreed that the text messaging service had been beneficial to their relationship with the instructor and over 80% of participants agreed that it had both improved their attitude to their instructor and made their instructor more approachable. Just over half of participants agreed that the service had improved their attitude to the college, had increased their liking for the subject and had increased their motivation, engagement and participation.

When asked if they were concerned about the potential cost of replying to the text messages 34% agreed that they were. However only a small number of messages sent had needed a reply and more and more students are now availing of free text messaging. While 84% of participants did not agree that receiving text messages from your instructor was intrusive a small number of participants had responded to question 30 with a score of 5 or more. This was taken seriously and further emphasised the need for careful and judicious use of the service and the need to speak to participants about any concerns they might have and also the need to make sure they fully realised that they could withdraw from the service at any time of their choosing. When asked what they thought about the use of text messaging to support learning 86% of participants agreed it was an effective approach.

In summary the participants generally liked receiving the messages and they perceived that it improved their relationship with their instructor and his attitude towards them. It also made the instructor more approachable and made it more likely for them to talk to the instructor informally. Many participants agreed that the service had improved their attitude to the college, had increased their liking for the subject and had increased their motivation, engagement and participation. This was taken as evidence of an effect on student affective learning of the out-of-class text messaging.

Qualitative Results

The second section of the questionnaire gathered qualitative data from participants on their perceptions of communicating with their instructor using text messaging and its impact, if any, on them or their class in terms of learning and also in terms of the relationship with their instructor. A series of open questions were used to give participants the opportunity of anonymously expressing their opinions. The responses from the participants to the open question provided a great deal of valuable and insightful feedback into their perceptions of the effect of the text messaging service on their learning experience. Analysis of the responses provides further evidence of the effect of the text messaging on student affective learning.

The overwhelming majority of the feedback was very positive. The participants generally perceived that the text messaging had made them feel closer to the instructor and they felt more comfortable asking questions in class, or outside of class, about the course. One participant, who was a mature student, responded it "has motivated me more to come to class, has improved my attitude towards college and subjects". When asked in what ways (if any) they thought the text messaging service has been beneficial or detrimental to your class in general they again mostly responded very positively. They felt it improved communications and had improved the class' relationship with the instructor and as a result they felt they had a more comfortable atmosphere in class and they perceived that their learning was better. They also felt it had brought the instructor closer to the class, had become a talking point among them, and had brought the class closer together as a result. They also perceived that there were many benefits from it and that the class had a higher attendance as a result. When asked in what ways, if any, they thought the text messaging service has helped or hindered them in their learning some of the participants responded that it reminded them to study before class and was better than email for notifying them at short notice of any changes to the schedule.

The responses to the last question are particularly revealing in terms of the overall assessment by participants of the use of text messaging for out-of-class communication and their perceptions of the study. The participants generally responded that it was a good service to students and improved communications. They also felt that others should use text messaging as a means of communication and that it was easier to communicate by text than by email. One participant felt that it should be applied to all modules. They also felt the research study was innovative and should be developed further as it was a different approach in dealing with instructor-student communication.

Reflections and Conclusions

Analysis of the quantitative and qualitative data provides evidence that the use of text messaging for instructor-student out-of-class communication has a positive effect on instructor immediacy and student affective learning. The participants perceived that it made the instructor more approachable and made it more likely for them to ask questions in class and engage in discussions with the instructor. In addition, it made them feel more comfortable and at ease in the classroom and gave them a feeling that the instructor cared for them.

Enhanced immediacy is very important in terms of the quality of student learning experience and has many implications in terms of education, including improved attendance, motivation and engagement by students. This research is interdisciplinary in nature, intersecting the fields of both instructional communication and mobile learning. The findings of this research are a contribution to both fields as they demonstrate how the use of mobile technology in education can lead to enhanced instructor immediacy and improved learning experience.

Concerns with Instructor-Student Text Messaging

Some of the participants in the study who used the text messaging service had some concerns as was evidenced in their feedback. Their concerns were around the potential cost of replying to the text messages, the timing of the messages and the relevancy of the messages to their course. In terms of cost many of the participants used the same mobile provider as the instructor and so had no cost associated with sending messages to the instructor. However the cost may have been a concern for some of the other participants. In the interests of fairness it was decided to give this concern serious consideration in terms of any future operation of the service. It was felt that if it could be demonstrated that the text messaging was beneficial to the learning experience of students then perhaps a way could be found to persuade the management of educational institutions to subsidise or make free text messaging available to students to support their learning. It should be noted that the cost was only a concern for those who wanted to send messages to their instructor. It must be pointed out that there is no charge for receiving a text message in Europe. However, this is not always the case in countries outside Europe.

A few participants also seemed to have concerns about the timing and relevancy of the text messages. This highlights the importance of judicious use as well as the need for guidelines on the sending and receiving of text messages. All those involved with the text messaging need to be aware of the guidelines and it is important that they be adhered to as much as possible. A few of the participants also felt that some of the text messages were not relevant. This may be explained by the fact that some of the messages were not directly course-related but were aimed at enhancing affective learning among students and encouraging interest, attendance and engagement.

Another potential concern may surround the often colloquial nature and ad-hoc use of text messaging that might potentially lead to misuse of the service, a phenomenon that was observed in the early days of the introduction of email in organisations. Students should be made aware that text messages in this context are still part of the learning experience and that they need to bear in mind that it is their instructor they are communicating with and not one of their friends. There is a fine but significant line between high-levels of perceived instructor immediacy and close personal friendship.

Students might misinterpret the higher availability and closer interaction with the instructor as a kind of peer relationship. This may lead them to be surprised or disappointed when the instructor executes the necessary duties of their role such as disciplining students or allocating marks. The experience of the instructor is that the text messaging makes it more likely from students to communicate informally with them. While this is a positive effect it also highlights the importance for the instructor of always bearing in mind their role as an educator and not as a personal friend.

In their feedback participants indicated that they would like text messaging to be used by more instructors and some felt it should be used with every module. However it stands to reason that the number of different modules taken by students would need to be taken into consideration as to how many text messages they can receive from each instructor and how often. While the experience of the instructor who provided the text messaging service was very positive not all members of academic staff might agree that it is worthwhile. The experience of the instructor was similar to that of Horstmanshof (2004). Some older more traditional colleagues had reservations to this approach. They argued that it would add to their work burden and they also felt the approach was ‘mothering’ the students and would lead to dependency. However, the amount of extra work required was minimal. Text messaging is asynchronous and therefore the instructor does not need to reply immediately. In addition, text messages are usually short and to the point due to their limited length. The use of a software application such as the one used for the main study also makes the text messaging very easy. However, for very large classes there could possibly be quite a bit of extra work involved. This could be explored in future work. In terms of the criticism of the text messaging as ‘mothering’ the students it can be argued that if students feel an affinity with their instructor and their course they are more likely to explore new areas of learning independently, especially if encouraged to do so by their instructor. There is also a strong connection between enhanced affective learning and lifelong learning (McCombs, 1991).

Guidelines for Instructor-Student Text Messaging

The guidelines for instructor-student out-of-class text messaging that were developed as part of the study are a very important output of the research work. The guidelines are necessary to avoid incorrect expectations of the text messaging service by students. They inform the student of the level of service they can expect and this may help to avoid misunderstandings. The student is required to read and familiarise themselves with the guidelines prior to consenting to participate in the service. The guidelines were drawn up on consideration of the feedback from the student focus groups and on reflection by the instructor as to the appropriateness and effectiveness of text messaging for communicating with students. These guidelines were used throughout the study and they worked very well in so far as there were no complaints from participants and no participant withdrew from the service.

The guidelines cover the need for informed consent for participants as well as the right of participants to withdraw from the service at any stage. They also specify the quality of service that participants can expect, including maximum limits on the number of messages as well as maximum response times and hours of operation. In addition the guidelines also include some stipulations about when text messages should not be sent to students, for example the day before an examination. This is intended so as to avoid what might be perceived as unfair advantage by some of their peers.

While this research concludes that guidelines are very important for the use of text messaging for instructor-student communication there is little doubt that the guidelines could vary somewhat from one institution to another. It is hoped that the guidelines developed as part of this research work may be of interest not only to researchers but also to practitioners who may be interested using text messaging for instructor-student out-of-class communication.

Conclusion

The main conclusion of this research is that the judicious use of text messaging for out-of-class communication can significantly enhance student perception of instructor immediacy and has many other benefits in terms of student learning experience. This finding is very important for all those involved in teaching students. While it is recommended that more instructors adopt the use of text messaging for out-of-class communication with students there are some barriers to mainstreaming this approach in higher education that need to be considered. As with any new development many instructors and educational institutions may be slow to adopt this form of communication. Their concerns may be well-founded and this paper has attempted to show how these may be addressed. It is felt that if proper precautions are exercised, the benefits of using text messaging for instructor-student out-of-class communication far outweigh any potential risks.

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Enhancing graduate employability of the 21st century learner

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Today's higher education students want choice, personalisation, efficiency and relevance leading to maximal outcomes, including employment. They need heightened media literacy and advanced higher order thinking, which can be facilitated through technology-enhanced pedagogies. The reported research inquired into how higher education can heighten graduate employability in the context of 21st century learning. Analysed Australian national data from 705 completed surveys, and interviews/focus groups with 147 people revealed that there are discrepancies between stakeholder groups (students, graduates, higher education personnel and employers) that must be acknowledged and rectified if the 21st century learner is to maximise employability. Research results indicated that the primary strategy towards improving graduate employability is supported participation in work experience, internships and placements. Furthermore, interviewed stakeholders advocated that employability in the 21st century requires that students pursue a well-rounded experience including extra- and co-curricular activities.

Keywords: employability; higher education graduates; 21st century learners

Introduction

Quality is a predominant theme in higher education, and one of the primary concerns is that the particular wants and needs of 21st century learners are not being met (Hung, Shu-

Shing, & Lim, 2012; Irvine, Code, & Richards, 2013). Why are the words – *21st century learner* – so prevalent in the literature? In other words, what is different about this generation of learner from those who came before? The primary difference appears to be created by their lifelong access to the internet (Kinash, 2011; Lambert, & Cuper, 2008; Prensky, 2012). As a result, 21st century learners are described as more connected and empowered than previous student generations (Green, 2012; Prensky, 2012). Today's students acknowledge feeling *entitled* to quality education (Kinash, Wood, & Knight, 2013) and researchers have reported that contemporary students want choices as to their mode of study (on-campus, online or blended) so that learning is accessible and personalised (Green, 2012; Irvine, Code, & Richards, 2013). Students also insist that learning be relevant, practical and efficient (Freeman, & Wash, 2013; Green, 2012). In addition to what 21st century learners seem to *want*, the changing contexts of technology, higher education and the employment marketplace have also created new learning *needs*. One of the most prevalent needs is that of media literacy (Mundt, & Medaille, 2011). Students seem to compartmentalise *literacy* and *communication*, unlinking day-to-day practices such as texting from study-based assessment so that functional literacy (clear self-expression, professionalism, spelling, punctuation and grammar) are declining (Amicucci, 2014; Nichols, 2012; Young, 2012). While some authors map the 21st century educational experience to the wants and needs of learners, others identify opportunities and affordances previously unavailable to learners. Due to technology-enhanced pedagogies, there is heightened capacity to develop graduates' critical, complex and connected thinking (Hung, Shu-Shing, & Lim, 2012; Lambert, & Cuper, 2008; O'Connor, McDonald, & Ruggiero, 2014).

In summary, there are three predominant educational propositions in the literature about the 21st century learner. Each of these has associated corollaries in the context of graduate employment. First, contemporary students want higher education that is flexible and personalised (i.e. layered choices about online and face-to-face study) and learning that is practical, relevant and efficient. These educational preferences are linked to employment outcomes in that one of the reasons why students want access to online learning is so that they are able to engage in activity other than study while enrolled in university such as working part-time jobs and participating in extra-curricular activities (Horspool, & Lange, 2012; Pastore, & Carr-Chellman, 2009), and that the operational definition of *practical*, *relevant* and *efficient* is that the university degree is structured around employability skills (Daily, Farewell, & Kumar, 2010; Tate, Klein-Collins, & Steinberg, 2011). Second, the predominance of social media in the 21st century has both heightened the need for media literacy and weakened overall literacy, as youth tend not to acknowledge the importance of consistent written conventions such as spelling and punctuation across all forms of communication. The associated employment proposition is that it is incumbent upon higher education to instil media (and comprehensive) literacy so that graduates are employable (Moody, Stewart, & Bolt-Lee, 2002). Third, the 21st century makes heightened learning possible, in that students have access to nearly limitless information and can access it prior to reporting to class, so that teaching time can focus on strengthening application and connected knowledge. Priority and development of higher order thinking skills heightens graduate employability (Aman, & Sitotaw, 2014; Kim Lian Chan, 2011).

Graduate employability means that higher education alumni have developed the capacity to obtain and/or create work. Furthermore, employability means that institutions and employers have supported the student knowledge, skills, attributes, reflective disposition and identity that graduates need to succeed in the workforce (Hinchliffe & Jolly, 2011; Holmes, 2013; Knight & Yorke, 2004; Yorke, 2006; Yorke & Knight, 2006).

Methods

This research project was commissioned by the Australian Government, Office for Learning and Teaching (December 2013). The views expressed in this report do not necessarily reflect the views of this government department. The research was conducted through collaboration between three universities and the Australian Council for Private Education and Training (ACPET). The lead institution was Bond University. The partner institutions were James Cook University and University of Southern Queensland. The main campuses of all three institutions are in Queensland, Australia.

The research commenced in January 2014 and the final report was submitted in February 2015. All project activities were conducted in full compliance with ethical guidelines as reviewed and approved by Bond University and through gatekeeper clearance at the partner institutions.

The aims of the research were to: achieve a greater clarity on the issues, challenges and contexts (including the 21st century learning experience) of graduate employability; identify and review the strategies that have been successfully used to address these challenges; create opportunities for the diverse stakeholder groups to share their perspectives; and promote strategies that may be used by the various stakeholders to collaborate on improving graduate outcomes. Data collection was conducted in three phases. First, the literature was reviewed to identify and report on higher education strategies for which there was heightened evidence of improved graduate employability. Second, four stakeholder groups (students, graduates, higher education personnel and employers) were surveyed to capture their experiences of the strategies identified through the literature review. Third, people from the four stakeholder groups were individually interviewed and focus groups were facilitated to qualitatively research their experiences.

Literature Review: Empirically evidenced employability strategies

A structured literature review was conducted using the approach of Kinash (2008). The literature review identified strategies for which there was empirical evidence of heightened employability. Overall, the literature provided evidence that students are expected to do more than study and complete their courses in order to be employable upon graduation; additional employability strategies are necessary in order to secure suitable work (Nagarajan, & Edwards, 2014; Rae, 2007; Yorke, 2010). Authors were clear that employability requires collaboration between four stakeholder groups; higher education personnel and employers make strategies available, and students and graduates (alumni) must actively initiate and make the most of these strategies for them to be effective (Harvey & Shahjahan, 2013; Walkington, 2014). The full results of the literature review are reported in a separate publication. Upon approval for distribution, research publications from the full project will be available through http://graduateemployability.com For the purposes of this current publication, the twelve strategies for which there was published empirical evidence of a positive relationship between the approaches and graduate employability are listed below. The abbreviated form in parentheses is inserted to reference the results tables inserted below.

(1) Capstone/final semester projects (Capstone)
(2) Careers advice and employment skill development (Careers Advice)
(3) Engaging in extra-curricular activities (Extra-curricular)
(4) International exchanges (Int Exchange)
(5) Mentoring (Mentoring)
(6) Attending networking or industry information events (Networking)
(7) Part-time employment (PT Work)

(8) Developing graduate profiles, portfolios & records of achievement (Portfolios)

(9) Professional association membership/engagement (Prof Assocs)

(10) Social media/networks (Social Media)

(11) Volunteering/community engagement (Volunteering)

(12) Work experience/internships/placements (Work Experience)

Notably, the literature predominantly used the term “extra-curricular” activity as an employability strategy and this was therefore the term used on the surveys. However, a clarification emerged in the subsequent interviews whereby many educators prefer the term co-curricular, implying that experiences are not separate and apart from the formal curriculum, but aligned and supported in conjunction.

Surveys: Employability strategies

The research team designed four complementary versions of a brief survey. A separate colour-coded version of the survey was designed for each of four stakeholder groups of: students; graduates; higher education personnel (educators, career development professionals, other); and employers. The surveys were designed to take a maximum of five minutes to complete and were available online and in paper format (a single back-to-back A4 page). The surveys were accompanied by an Explanatory Statement and a Consent Form, in order to maintain ethical protocol. The first section of the survey instrument included questions relating to demographics and perspectives about employability. The main component of the four survey instruments asked participants to respond to a checklist of the twelve employability strategies listed on the previous page. Respondents were directed to tick each of the strategies that satisfied the respective survey question below and invited to provide any additional written comments they felt were relevant.

- Students –
  What strategies are you using to improve your graduate employability?
- Graduates -
  What strategies did you use to improve your employability?

- Employers -
  Which of the following strategies undertaken by students does your organisation value when recruiting graduates?
- Higher Education Personnel -
  Which of the following employability strategies do you provide for students?

In total, more than 1500 individuals received a personal invitation to participate in the project and complete a questionnaire through recruitment strategies such as operating booths at graduate career fairs, sending messages through LinkedIn and visiting universities. A total of 821 responses were received (55% response rate). There were more online (70%) than paper surveys submitted. Of submitted surveys, 705 were valid (86%). The 116 invalid responses were surveys with missing fields and/or repeated submissions from the same respondents. Response numbers in the four stakeholder groups are shown in Table 1.

Table 1. Survey responses.

Stakeholder group	**Valid surveys completed**	**Percentage of total number of surveys**	**Response numbers and rates (including invalid surveys)**
Students	442	63%	800/58%
Graduates	102	14%	350/39%
Higher Education	108	15%	250/59%
Employers	53	8%	100/73%
Total	705	100%	1500/55%

The survey responses were categorised on a spread sheet. Descriptive and inferential quantitative analysis was conducted using the Statistical Package for the Social Sciences (SPSS) software. Thematic qualitative analysis was conducted using NVivo, which is a computer software package used to sort, classify and reveal salient themes from qualitative data such as survey comments. NVivo was used in conjunction with a thematic matrix. The project team created a matrix from full literature analysis. NVivo functions allow researchers to test the qualitative validity of theories against the collected data. Employability theory, as represented in the matrix, was compared with the themes emerging from the survey comments. The primary challenge of the survey phase was overcoming the analytic constraints resulting from limited sample sizes. While the overall response rate was commendable, some of the specific statistical fields were relatively small and only achieved the requisite size for valid statistical measures of significance, at minimum confidence intervals. The discrepant group sizes also limited the statistical measures that could be applied. The phased project design compensated for the limitations of the survey sample size in that findings emerging from the survey data were explicitly followed-up through interviews and focus groups.

Interviews

Participants for interviews were identified through multiple methods. If respondents addressed a relevant theme in their narrative survey comments and indicated on their consent form that they were willing to be contacted, an interview or focus group was scheduled. Participants were also identified through team member networks, snowball referrals and literature searches. Interviews and focus groups were intentionally scheduled in all eight Australian States and Territories in urban, rural, remote and regional contexts. The total number of participants in interviews and focus groups was 147; the distribution of participants across stakeholder groups is shown in Table 2.

Table 2. Interview and focus group participation

Stakeholder	Interviews	Focus Groups	Focus Group Participants	Total Participants
Students	5	5	22	27
Graduates	8	3	16	24

Higher Education	32	17	48	80
Employers	16	0	0	16
Totals	61	25	86	147

Maximum one hour semi-structured interviews and focus groups were conducted using key, common questions probing participant's demographic details and contexts, their use of the employability strategies identified in the survey phase and the roles/responsibilities of the four stakeholder groups in enhancing employability. The methodological interview approach was adapted and applied from van Manen (1997). In accordance with this phenomenological hermeneutic approach, interviewees were asked open questions about their employability-related experiences. Questions started with such phrases as, "What is it like to" and "Describe your experience of." All interviews and focus groups were recorded and fully transcribed. A minimum of two researchers independently analysed the transcripts, identifying keywords, themes and strategies/challenges/solutions to employability issues expressed by the participants. A third researcher confirmed qualitative validity through applying the narrative analysis approach of Shaddock (2014).

Results

Proposition one: Employability strategies

Responses of the four stakeholder groups were analysed to determine comparative responses to the survey questions addressing key employability strategies identified in the literature. The data was queried to determine, on average, how many of the twelve strategies were ticked by students, graduates and higher education personnel. Overall, surveyed students and graduates indicated participating in an average of nearly five of these employability strategies and higher education personnel indicated providing/supporting an average of four of them. Seven of the twelve strategies received responses from at least 50% of respondents in one or more stakeholder groups as shown in Table 3.

Table 3. Identification of Key Employability Strategies

Strategies	Students	Graduates	Higher Education	Employers
Careers Advice	59%	47%	64%	28%
Extracurricular	48%	47%	65%	60%
Networking	49%	52%	51%	40%
PT Work	53%	53%	36%	38%
Prof Assocs	29%	37%	54%	34%
Volunteering	47%	50%	48%	53%
Work Experience	74%	74%	40%	87%

The contributions of these strategies and how they might be realized within and across the stakeholder groups to enhance employability in the context of the 21st century experience were further interrogated by analysis of the survey written comments and during the interview phase of the research.

Thematic analysis of written comments on surveys and analysis of the interview/focus group transcriptions identified emergence of eleven themes that had impact on employability: Multi-national corporations ; Competitive sport, athletes &

employability ; Entrepreneurship; Private institutions; Career development centres; Indigenous employment; Employability endeavours; Government; Emerging careers; Generalist disciplines; and Graduate attributes.

As analysis proceeded it was clear that these were not entirely independent constructs but are inter-reliant in respect to their relationship(s) to the three propositions about the 21st century student experience outlined in the *Introduction*. Of particular relevance are the responses to strategies that address a student's engagement with "real" employment contexts including work experience, internships and placements. This was a highly rated strategy with 74% of students indicating on surveys that they used it and 87% of employers indicating they valued it. Although a minority of higher education personnel chose this strategy on the surveys, it must be noted that the question asked which strategies they currently use rather than those they believe to be effective. Further exploration during interviews provided evidence that higher education personnel support these strategies but often lack the resources to consistently apply them within their programs of study.

Not all engagement with employment is equally as supported – part-time work, for instance, whilst being seen as a useful strategy by students and graduates, is not seen as positively by higher education personnel and employers. These groups appear to distinguish between employment contexts that relate to the student's discipline area and provide extension of their studies in that area and those that are unrelated to their discipline. The former are more highly valued particularly if they include evidence that the student has displayed initiative in obtaining/completing the work as is evident by the high ratings of extracurricular and co-curricular activities that are voluntary in nature.

Proposition two: Literacy and communication

The use and value of social media which had been highlighted in the literature review as a potential employability strategy did not feature prominently in the stakeholder responses in the survey phase. There was no group in which a majority of respondents listed it as being important (Table 3).

Table 3. Stakeholder perspectives on the use of Social Media as an employability strategy.

Strategies	Students	Graduates	Higher Education	Employers
Social Media	33%	37%	40%	15%

Throughout the interviews, however, there were signals of growing awareness of the ubiquity of social media and the need for higher education to prepare students in ways that enable them to maximise the benefit of 21st Century skills. For example, an illustrative quote from an educator was,

“[There is a] need to train students in new skills rather than the old skills because students have to differentiate themselves from the old market.” Quote from an educator

Whereas media literacy did not emerge as a salient theme in the surveys or interviews, there were many mentions of the importance of effective, comprehensive communication skills. Related comments were articulated across stakeholder groups. The communications theme emerged most strongly among educators and then among employers. Communication was operationally defined as including written and presentation skills. The four comments inserted verbatim below are illustrative of the content of the numerous mentions of communication skills in the context of employability.

"I understand that nowadays, with social media, people just type things out and they have lower case [the word] 'I' – if you put lower case [the word] 'I' – it's honestly not correct. Attention to detail; it's an important part of it." Quote from an employer

"I think writing, as well, is very important and we often underestimate its importance. We often assume it is something that students learn in the first-year composition class. I think the difference between a first-year student who has successfully completed, and a graduate who has learned how to synthesise, analyse, express succinctly and edit in a polished way is just enormous." Quote from an educator

"It may not be the 'straight in the face' skills they are trying to get you to perform, but over time you will develop your presentation skills and your communication skills. It is not a crash course, rather it is slowly building your skills over three years and then in third year with professional development you will recognise 'oh, I have already been over that in my degree.'" Quote from an educator

"Presentation skills are important, because if a student can overcome all of the anxieties around speaking up in a group it helps in an interview, in can help in meetings, it can help engage colleagues. It is a very difficult skill to teach but it is quite a good skill." Quote from an educator

Proposition three: Technology-enhanced learning and higher order thinking skills

The importance of "new skills" and students being able to differentiate themselves were articulated as important aspects of developing and demonstrating higher order and critical thinking skills. The importance of concepts such as critical analysis, transferable skills, innovation and capacity to learn were salient themes throughout the interviews across all stakeholder groups. The linking of technology-enhanced learning (in the context of emergent technology provoking industry and thus career change) and the need for higher order thinking skills was most prominent among the educators. Whereas a salient theme in the literature was that education technology provided affordances that strengthened teaching capacity of critical thinking, this did not strongly emerge in this research. An illustrative quote is provided verbatim from each of the four stakeholder groups.

"Innovation and creativity sets you apart from the competition. If an employer asks 'we want you to resolve this problem, how are you going to resolve this?' You can give them a black and white answer, or you can work around it and show employers something that is different." Quote from a student

"We had a compulsory subject, as part of a university industry-based learning program, that was all about information technology for communication. It was things that the employers told the university that 'we needed to know' for them to take us on in an internship." Quote from a graduate

"The ability to critically analyse new information. Don't take things at face value because it is written on the internet. But also be able to make comparisons between one type of technology or software and another." Quote from an educator

"You need to teach them transferable skills; how to think and how to write, how to form an argument, weigh evidence. I think as an industry we are losing that. There is a lot of focus on academe of just being job-ready, and I agree with that, but you need the caveat of 'What job?!' because the job that you are ready for now exists, but the job you have in ten years might not [currently exist]. There needs to be an acknowledgement that the broader skills and creativity are what makes stuff happen." Quote from an employer

Discussion

The relationship between 21st century employability and the learning experience is a key higher education quality assurance factor. Unique attributes of the 21st century context were salient throughout the research data. In the 21st century, the graduate employment marketplace is thematically linked to what is referred to throughout international literature as the economic or financial crisis (e.g. Huayong, Zhurong, Jikun, Rozelle, & Mason, 2013). Just as there are buyers' and sellers' markets in real estate, contemporary university graduates are entering a hirers' rather than an applicants' market (Rae, 2014). Based on 2013 survey data, Graduate Careers Australia (2014) reported that graduate employability rates are the lowest they have been in twenty years. In other words, it is necessary to understand the 21st century employment context in order to support students / graduates for success. The concept of heightening employability of university students is a salient concept in the modern day university. In a context whereby graduates are not assured employment by virtue of successfully completing a university degree, the university's personalised value-add component of employability supports is particularly relevant. Furthermore, until higher education leaders identify and address the wants and needs of the 21st century student and graduate, graduate employability will not be lifted. Employers and employment are different in the 21st century; so too are graduates. The three sets of propositions emerging from a review of the literature and presented in the introduction to the paper are reconsidered here, in light of the results from the research surveys, interviews and focus groups conducted within this national Australian project.

Proposition One: Flexible, personalised education with practical, relevant, efficient learning

A review of the literature indicated that contemporary students want higher education that is flexible and personalised (i.e. layered choices about online and face-to-face study) and learning that is practical, relevant and efficient. The literature links these educational preferences to employment outcomes in that one of the reasons why students want access to online learning is so that they are able to engage in activity other than study while enrolled in university such as working part-time jobs and participating in extra-curricular activities, and that the operational definition of *practical*, *relevant* and *efficient* is that the university degree leads to employability skills.

This proposition was strongly supported by the research data. Across the four stakeholder groups, the pervasive theme was that the purpose of university in the 21st century is to prepare graduates for employment. No challenges to this perception were articulated. The rationale for flexibility and personalisation articulated across all four stakeholder groups was that technological advancements are changing the nature of the labour market and universities must therefore be agile and responsive in order to practically prepare graduates for career success. Students were clear that they want personalised supports to identify career pathways. They do not want to be confined to bundled degrees with set curricular units and confining time-tables. They want to be able to take only the specific units they will need to prepare them for graduate employment. Across the stakeholder groups, there was vocal support for flexibility. Numerous employers expressed a belief that universities are confined by long-standing structures and systems and are not "keeping up with the times" to adequately prepare students for graduate employability. While educators agreed, they also expressed worry about the barriers to broad-reaching systemic change. Furthermore, students want personalised offerings so that they can take some of their subjects through a regular time-tabled semester and others through intensives and/or online. Course delivery flexibility also means that students have time to engage in pursuits beyond the formal curriculum.

A salient theme across all four stakeholder groups was a belief that a degree on its own is not adequate preparation for employment. There was widespread agreement that to be employable, students must have pursued other experiential avenues beyond course-based study. There was united support for internships, placements and work experience as a primary means of gaining employability experience while in the role of student. Educators expressed a concern over the resources (human and financial) required to support this strategy, but expressed a belief that overcoming these constraints is a higher education priority because of this strategy's employability efficacy. Perceptual discrepancies between stakeholder groups were revealed in regard to other employability strategies. For example, whereas a majority of students and graduates expressed a belief that part-time work is a worthwhile employability pursuit, higher education personnel (educators and career development professionals) and employers believe that students are better advised to participate in extra-curricular activities such as sport, clubs and societies and to reflect on the ways in which these activities experientially support the development of employability soft-skills. A salient theme overall was that employability needs to be a higher education priority and that all stakeholders have a role to play in ensuring that graduates are well-placed to meet the needs, adapt, change and thrive in a challenging and changing 21st century labour market.

Proposition Two: Importance of literacy (including media) and communication

The second identified theme in the published literature is that the predominance of social media in the 21st century has both heightened the need for media literacy and weakened overall literacy, as youth tend not to acknowledge the importance of consistent written conventions such as spelling and punctuation across all forms of communication. The associated employment proposition is that it is incumbent upon higher education to instil media (and comprehensive) literacy so that graduates are employable.

Notably, a minority of survey respondents (across all four stakeholder groups) ticked the provided social media employability strategy. This research result was queried with experts, particularly career development professionals. The main interpretation was that social media such as LinkedIn are only starting to be accepted as viable and valuable employability tools. Experts believe that this research result would be different if the survey were to be replicated in a few years.

Whereas the specific use of social media did not emerge as a strongly supported employability strategy, the communication attributes associated with social media were saliently vocalised. Educators and employers expressed a shared worry that students and graduates largely communicate in informal ways, giving little thought to spelling, grammar and punctuation. These stakeholders believe that there has been a corresponding slide in communication skills which impairs the quality of job applications and an inability and/or lack of appreciation for the importance of formal professional communication. Notably, some employers and educators acknowledged that definitions of "effective communication" are fluid and changing. Others addressed communication in the context of digital foot-prints, worrying that too many students put themselves in compromising situations and that associated images will have a deleterious effect on these graduates' employability. The students and graduates themselves did not speak about formal and informal communication in the context of social media. They did, however, give frequent mention to the importance of learning practical employability skills such as report writing and presentations.

Proposition Three: Technology-enhanced learning and higher order thinking skills

The third proposition emerging from the literature was that the 21st century makes heightened learning possible, in that students have access to nearly limitless information and can access it prior to reporting to class, so that teaching time can focus on strengthening application and connected knowledge. Priority and development of higher order thinking skills heightens graduate employability. The importance of these skills is highlighted by all stakeholder groups and consequently there is scope to explore strategies using technology-enhanced learning to facilitate embedding of approaches to developing these skills within higher education programs.

This proposition was strongly supported through the research. Employers were particularly vocal about the importance of broad-based employment preparation. Multiple employers used the metaphor of the uppercase letter T. These research participants said that it is important that universities avoid a narrow, disciplinary focus (represented by the vertical portion of the letter T). Instead, graduates should be supported to achieve a broad-based and far-reaching experience (represented by the top horizontal portion of the letter T). Across stakeholder groups, participants acknowledged that particularly in the 21st century, the workplace and the overall employment contexts are changing. Research participants were unified in the belief that students need experiential variety to draw-upon to be resilient and to be able to think on their feet to adjust and adapt.

Conclusion

The Australian national research reported in this paper supports the 21st century propositions that have emerged in the published literature. In the 21st century, there is a dominant employability focus creating heightened expectation of higher education. Research participants acknowledged a continued economic and financial crisis which means that university graduates experience increased difficulty securing suitable employment. Furthermore, technological developments mean changes to career types, trends, roles, responsibilities and expectations. There is widespread recognition that participation in the 21st century labour market requires resilience and agility. Research informants across stakeholder groups, including educators, expressed a belief that it is incumbent upon universities to creatively and enthusiastically support graduate employability. The strategy set that emerged with the strongest support were internships, placements and work experience. Participants expressed that these strategies provide students with industry connected experiences to draw-upon. Furthermore, across stakeholder groups, a salient theme was that in order to support employability, the university experience must be broad-based and far-reaching; students in the 21st century must be encouraged to do more than study in order to prepare for graduate employability.

The acknowledged limitation of this research was the lower proportion of surveyed and interviewed employers as compared to the other stakeholder groups (students, graduates and higher education personnel including both educators and career development professionals). Further research is recommended to confirm employer agreement with the identified themes.

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Use of mobile learning during clinical practicum in Hong Kong: Nursing students' perspective

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Nursing students have to complete a clinical practicum in various specialities. However, the students may not be familiar with the necessary knowledge for nursing care in such different clinical settings. It was therefore anticipated that using a mobile device for learning in clinical nursing practicum could potentially be useful for the nursing students to tackle this and other similar problems. Nursing students at a university in Hong Kong were therefore issued with an internet enabled iPod Touch for individual use on practicum. This paper aims to report the evaluation of this practice. Eight nursing students were interviewed using questions based on the convergence of the mobile technology, human learning capacity and social interaction as suggested by the FRAME model. This enabled the purpose of using mobile devices and the required infrastructure for mobile learning from the university nursing students' perspectives in Hong Kong to be explored in detail.

Keywords: mobile learning; clinical practicum; FRAME model

Introduction

The requirements of nurse training in Hong Kong

All nursing students have to achieve the theoretical and clinical practice requirements of the Nursing Council of Hong Kong (NCHK) before their registration or enrolment. These require that all of the nursing students of a registered nurse training programme must attend 1,250 contact hours of theoretical training and complete at least 1,400 hours of clinical practicum in different specialties, including medical, surgical, obstetric, paediatrics, geriatrics, community, mental health, primary health care and emergency nursing (The Nursing Council of Hong Kong, 2013). Thus the clinical practicum is an extremely important element in nurse education.

According to the NCHK, there must be a system in place to assess students' clinical knowledge, skills, problem solving ability and professional attitudes as seen during the practicum and evidence must be provided on the assessment of the students' aseptic technique, administration of medications and professional nursing competencies (The Nursing Council of Hong Kong, 2013). Thus use of a mobile device not only can enhance students' learning during their clinical practicum through ease of access to reference material but can also act as a performance recorder to facilitate the nurse training institutions monitoring and collection of students' clinical assessment results.

Purposes of using mobile learning during clinical practicum

Indeed the one local university using a mobile device as a compulsory tool for the nursing students during clinical practicum reports there are two main purposes of using the mobile device during clinical practicum, as a handy reference tool and as a performance record. A mobile device, an iPod Touch, was given to each nursing students of this university before starting their first clinical nursing practicum and thus the device was to be owned by the students. The choice of the iPod Touch was as recommended by the supporting technician as it is user friendly and easy for the technicians to design the applications and maintain them.

It was also anticipated that having the mobile device would help with the necessary guidance or support needed to integrate the newly learned theoretical nursing care concepts into the real situation (Wu, Hwang, Tsai, Chen & Huang, 2011) as Clifford (as cited in Lai, Wu & Chen, 2006) had found that nursing students always complain of inadequate support from teachers or clinical mentors.

In addition, learning tools for clinical learning are needed to be small, portable and easily handled. According to Kenny, Park, Van Neste-Kenny, Burton, P. A., & Meiers (2009a), health care professionals have traditionally carried small booklets and index cards in their pockets which led the profession to become one of the early adopters for using Personal Digital Assistants (PDAs) as information resources in clinical learning. The mobile device facilitates health care professionals to access information and enabled a deeper contextualization of learning in clinical situation (Kenny et al, 2009a).

It has been found that during a clinical nursing practicum, both clinical mentors and nursing students can benefit from using the mobile device. According to Lehman (as cited in Kenny, Van Neste-Kenny, Park, Burton & Meiers, 2009b), clinical mentors or instructors from university can use mobile devices to keep records of student assignments, to complete checklists for students conducting physical assessments on patients and to document students' progress on-the-spot. This can include assessment tools such as examinations and tests, rating scales, and surveys (Woodill, 2010). Additionally, if a mobile device is connected with the internet, the relationship between university instructors and nursing students could be enhanced through direct communication via the device. Instructors could quickly understand students' problems and provide proper guidance to the students even if they are not together with the students on the ward (Lai, Wu & Chen, 2006). Other functions of the mobile device also useful for nurses on placement in the ward, for example, drug calculation, data collection for research and teaching and even error reduction through rapid access to critical information. All of which can lead to stress reduction (Kenny et al, 2009a; Kenny et al, 2009b).

Other functions used by nursing students during clinical practicums included using the mobile device for recording morning briefing with clinical mentors, audio-taping their conversation with patients (after obtaining the consent of patients), writing reflective journals and joining relevant forum discussions on the internet (Lai, Wu & Chen, 2006). From the study of Miller et al (as cited in Kenny et al, 2009b), nursing students who used mobile learning had asked more questions during the practicum than usual and they reported a significant increase in their self-efficacy. In the meantime, a mobile device can help nursing students to remember detailed information (Lai, Wu & Chen, 2006) and assist them to be more efficient (Daniel, 2010). The above information all indicated to the local university whose mobile learning initiative is reported in this paper that nursing students are likely to benefit from using a mobile device on their clinical practicum.

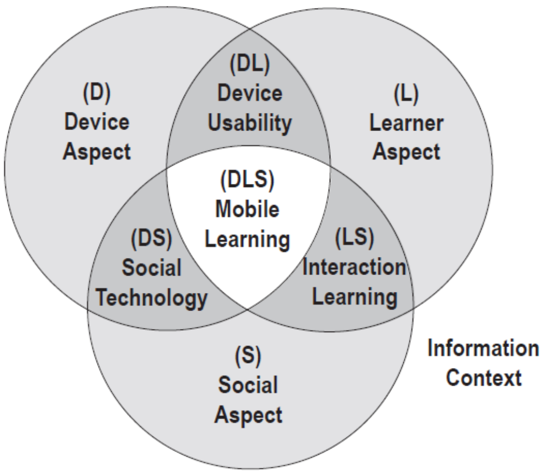
However, a few barriers to or disadvantages in using mobile learning in clinical practicum have been reported. Difficulty in accessing the network is the chief problem in using mobile learning (Lai, Wu & Chen, 2006). Other most commonly encountered problems on using mobile learning among clinical mentors included being afraid of possible loss of patient data, lack of knowledge about technology and software, and, difficulty in using mobile technology for teaching (Kenny et al, 2009b). Among nursing students, obstacles reported in using mobile device on the ward include the small screen of the mobile device, the lack of mobile device customised webpages, disordered webpage content, due to the lack of formatting of the webpage for the device, and the difficulty in finding a spare power socket on the wards to recharge their device (Lai, Wu & Chen, 2006).

Thus the local university reported here arranged for all learning objectives of the clinical nursing practicum which included: essential concepts in clinical nursing, video clips for different nursing care procedures and the different assessment items to be available for students to download to their iPod Touch. Students could also review the teaching materials from the university's Online Learning Environment (OLE), the online learning system of the university, via the internet. Students were expected to carry the device in their uniform pocket during their clinical practicum and use the device as a handy reference tool whenever they felt unsure about certain nursing procedures (Lee & Tsang, 2006). In addition, the students' clinical assessors were required to rate student's performance during the clinical practicum period using the assessment tools on the mobile device. Students had to upload their practicum performance results to the university via the internet and the OLE once their clinical assessors had entered the information.

Methodology

This was a descriptive qualitative study that focused on using interviews to secure rich data and to ensure a comprehensive evaluation of the experience of using mobile learning, a semi-structured interview guide based on the Framework for the Rational Analysis of Mobile Education, FRAME, (Koole, 2009) was developed for the data collection. The FRAME model itself was originally developed in order to facilitate conceptual understanding of the ways in which various mobile devices can act as distance learning tools. Koole (2009) describes the FRAME model as a process resulting from the convergence of mobile technologies, human learning capacities, and social interaction, therefore, mobile learning is formed through three aspects, the device aspect (D), the learner aspect (L) and the social aspect (S). Among these three aspects, the device aspect (D) refers to features of the mobile device, the learner aspect (L) signifies the distinct features of an individual learner and the social aspect (S) points to the features required for conversation, cooperation and social interaction (Kumar, Jamatia, Aggarwal & Kannan, 2011). These three aspects overlap as shown in the Venn diagram indicated in Figure 1 and these intersections contain attributes that belong to both aspects. The three intersections are named as device usability (DL), social technology (DS) and interaction learning (LS). The attributes of DL and DS intersections describe the affordances of mobile technology while the LS intersection represents the relevant instructional or learning theory (with an emphasis on social constructivism). In the centre, the three aspects overlap together (DLS) making for a convergence of all three aspects which represents an ideal mobile learning situation.

Figure 1. Koole's FRAME model



(Koole, 2009)

Eight year four (final year) students who were studying for the Bachelor of Nursing in general health care degree programme of the local university using mobile learning were recruited for semi-structured interviews described above through purposive sampling. The interviews were conducted after they had completed all of the required clinical practicums of the programme and all of them had used an internet enabled iPod

Touch as a mobile device during their clinical practicum period. Each interview lasted for about forty-five minutes, was audio-recorded, and transcribed. Content analysis was then adopted to analyse the transcriptions in order to identify major categories that captured the students' opinions and experiences on their use of mobile learning in clinical nursing practicum.

Finally, ethical approval has been granted from the university involved. Particular concern was taken to ensure that participating in the interview was voluntary. A consent form included the explanation of the purpose, main procedures and the right of the participants to withdraw from the study at any time was given to and signed by the participants before the interview. The researcher also assured participants that all of the records and the scripts of the interview were destroyed after data analysis was complete.

Results and Discussion

The purposes of using mobile device among nursing students during clinical practicum

All of the students who participated in the interview used the mobile device during clinical nursing practicum. However, they did not always use the device in ward. Depending on the workload in the different kinds of wards, students sometimes used the mobile device on the ward for searching information about a nursing diagnosis, nursing procedures, or drug information from their teaching materials that had been uploaded before their practicum by the university academics to the Online Learning Environment. They also used the mobile device for taking notes, calculation or used it as a phone book when on the ward especially when a calculator or rough paper was not available. The teaching materials, applications and ebooks though were downloaded onto the device by the students themselves in advance. This limited use indicated that students did not fully utilize the functions of the mobile device compared with previous studies (Daniel, 2010; Kenny et al, 2009a; Kenny et al, 2009b; Lai, Wu & Chen, 2006). The heavy workload when on the ward and a fear of misunderstanding of the role of the mobile device amongst the clinical staff appeared to be the reasons as to why students did not always use the device on the ward. Student D, during the interview, revealed that:

> *"I only used the iPod (Touch) during my meal time unless it is necessary or no rough paper available in ward. I am afraid that the clinical staffs or patients misunderstand that I am playing the games in the device...although I really always play the games in the device but only at home…haha….and the routine nursing cares already made me busy in ward." (Student D)*

The mobile device also helped students to store important information. The information entered by the students for storage included new medical terms or drug names, patients' information for writing nursing care plans, special tasks or setting in different wards and even clinical staffs' name. They did this by using the Notes or Phone book functions provided by the device. As explained below, students preferred to use the mobile device to store important information over using rough paper:

> *"Sometimes, I write down the new and useful information in the device because I may throw the rough paper away accidentally after left the hospital." (Student B)*

The infrastructure required for effective mobile learning among nursing students during clinical practicum

The device aspect (D)

For the features of the mobile device required for effective mobile learning, most of the students pointed out that the pocket-size of the mobile device was most important. As they were afraid to lose the device and as there is no locker for them in ward, they could keep the pocket-size mobile device in their uniform after they used it. Besides this, the mobile device features included the user-friendly operational system, durable battery power and the light weight of the mobile device which were all also important to them.

The learner aspect (L)

Students considered that active learners and those familiar with information technologies would be more advantaged in using mobile learning however, Li and Wong (2012) also pointed out that students' engagement is important for students to learn effectively. It was found that this happened particularly when the ward staff were not available to answer the students' questions due to their heavy workload. This led to students actively using the mobile device for searching for information.

The device usability aspect (DL)

Though the students did not always use the mobile device on the ward, students valued it, saying that a mobile device is good as a reference tool on the ward. Besides the teaching materials provided by the university staff, students also used online information such as webpages which provide drug information, medical terms or nursing procedures. Students could search many reference books from the online store according to their needs. Two of the students said that:

> *"This device makes it easy to find e-books online and use them for preparing assessment in ward." (Student F & Student A)*

Students also have to upload their practicum performance results once they left the hospital. To do this they needed to find some place with Wifi access or connect the device to their own computer or Smartphone to send the data via the internet. At least half of students reflected that:

> *"Uploading the results is inconvenient because Wifi access is not available in ward." (Student C, Student E, Student G, & Student H)*

The social aspect (S) and the interaction learning aspect (LS)

The social aspect is also useful for the students. However, they usually used the communication applications of their own Smartphone, Whatsapp for example or SMS, to communicate with their classmates and even clinical mentors. The information stored in their Smartphone could be shared with others through the mobile network so as to enhance communication among students and between students (the interaction learning aspect, LS). Students were keen on asking or sharing information and their own emotions with their classmates immediately. For example:

> *"I was so excited when I come across patients with special conditions! I can share my experiences and feelings with friends once I left the ward! It is wonderful!" (Student A)*

The social technology aspect (DS)

Several difficulties were also encountered by the students. Technical problems were one of the most common difficulties. Although the university had provided a telephone hotline for technical support, students criticized it in that it is difficult to solve technical problems by phone. In addition, similar to other countries, there was no Wifi access in the majority of hospital wards in Hong Kong which is another disadvantage. Therefore, as mentioned before, students have to download the required information for the use on ward ahead of time or use their own Smartphone for searching for information during meal times and breaks.

Besides, many of the clinical staff on the wards were reluctant to use mobile device as a performance or assessment record. Two of the students requested to use paper instead of mobile device for recording practicum performance to keep to the staff preference. Student H claimed that:

> *"Sometimes, the clinical staff grumble that paper record is more convenient for them." (Student H)*

In general, students perceived that using mobile learning in clinical nursing practicum was feasible and desirable. However, the nursing students did not always use the device on the ward as students' positive attitudes towards the use of mobile devices do not guarantee their use in practice (Garrett & Jackson, 2006). Students were clearly pleased that, through mobile learning, clinical learning could be facilitated. Nevertheless, it would be better if the mobile device could be completely reliable in preventing data loss and Wifi access could be available in all wards. As for recording assessment data, complementary paper practicum performance records may be needed to prevent unnecessary conflict between clinical staff and students.

Limitations of the study

There was only one researcher to conduct all of the interviews. Researcher bias may exist although member checking, sending the interview transcripts in brief after categorization to the participants for verification or adding any supplementary information, was applied. Besides, as the researcher is one of the teaching staff of the local university, students may not have fully expressed their opinions in front of the researcher.

Conclusion

Use of mobile learning in a clinical nursing practicum is clearly practical in Hong Kong although both advantages and disadvantages were commonly encountered in using mobile learning. For the advantages, students can have a handy reference tool to solve their queries on ward immediately, they can bring important information including teaching materials to the ward to help them familiarize to the ward setting and lastly, they can also enhance their learning through communication with their classmates or ward staff who are not currently present. On the other hand, misunderstanding and unnecessary conflict between clinical staff and the nursing students may occur due to the presence of the mobile device. Students appreciated being able to use mobile learning during their clinical nursing practicum, however, to further facilitate the use of mobile learning in clinical nursing practicum, training for clinical staff, using advanced mobile device and technologies, sufficient technical support and more encouragement and promotion of using mobile learning are necessary.

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2. The use of Figure 1 was approved by Dr. Marguerite Leanne Koole, the developer of the FRAME model.

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MOOCs Severely Underutilise the Pedagogic Potential of:- Video, Self-Assessment, Teacher Guidance

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Firstly, the paper considers 34 techniques and teaching functions for which video is outstandingly capable – in four domains: Cognitive, Experiential, Affective, Skills. A selection of these 34 will be illustrated with video clips. These potent roles are in contrast to the paucity of video roles in the typical MOOC – often just a talking head. Secondly, the paper describes two styles of video-print hybrids, both of which are divided into short segments, interspersed with self-assessment questions (with suggested answers). The depth of these questions and answers are contrasted with the superficial, multiple-choice quizzes after each MOOC video segment. Finally the paper considers the benefit of the flipped classroom, in which the teacher is a guide by the side, interacting closely with learners, as opposed to a MOOC's almost zero personal interaction (because of the vast numbers of learners).

Keywords: potent pedagogic roles for video; segmented self-assessed video-print hybrids; MOOCs; flipped classroom teacher is guide by the side

Introduction

The paper argues that MOOCs (Massive Open Online Courses) typically underutilise the pedagogic potential of three of their ingredients: their videos, their self-assessment quizzes and the guidance provided by the teacher to students.

The latter underutilisation is contrasted with the guidance provided in the flipped classroom approach.

Potent pedagogic roles for video

Figure 1 lists 34 categories of potent pedagogic roles for video. It will be argued that each of these can add substantial value to instructional multimedia.

The pedagogic roles comprise video techniques and teaching functions that exploit video's distinctive presentational attributes and that other media cannot achieve as. The roles are categorised into four domains.

(1) Facilitating COGNITION

(2) Providing realistic EXPERIENCES

(3) Nurturing AFFECTIVE dispositions (motivations, feelings)

(4) Demonstrating SKILLS

1. Facilitating COGNITION [1]	**2. Providing realistic EXPERIENCES by showing otherwise inaccessible:-**
1 **composite images,** e.g. split screen, superimposition 2 **animated diagrams** exploring processes 3 **visual metaphor/analogy/representation** 4 **illustrating** concepts with real examples 5 **modelling** a process by wise simplification 6 **juxtaposition** of contrasting situations 7 **simulating** variable features 8 **condensing time** by editing real life 9 **narrative power** through sync narration and pedagogic design	1 **movement** with sync location sound 2 **viewpoints** e.g. aerial, undersea, microscopic, extreme close-up 3 **places** e.g. dangerous/overseas locations 4 **3D:** good lighting & move object or camera 5 **slow/fast** motion 6 **people/animals** interacting, real or drama 7 **chronological** sequence and pacing 8 **resource material** for viewers to analyse 9 **one-off / rare events,** and archive film 10 **staged events** e.g. role play, experiments

3. Nurturing AFFECTIVE dispositions	**4. Demonstrating SKILLS [2]**

[1] The types of learning anticipated through each item of Domain 1 (Cognition) are examined in Figure 4

[2] Demonstrations take the form of a tutorial if the demonstrators talk through the thinking behind their skill

ac tivation re solve	1 **galvanize / spur into action**, provoke viewers to get up and do things 2 **motivate a strategy** by showing its success
attit udes emo .	3 **stimulate** appetite to learn, e.g. reveal the fascination of the subject 4 **change attitudes/appreciations**, e.g. engender empathy 5 **alleviate isolation of the learner** by showing the teacher or peers 6 **reassure, encourage self-efficacy** 7 **authenticate academic abstractions** by solving real-life problems
	8 **create sense of importance,** e.g. by using famous presenters

1 **manual/craft:** cookery, joinery, painting, designing
2 **body movement**: dance, fitness routines, athletics
3 **reasoning**: problem solving, planning, brainstorming
4 **interpersonal**: counselling, interviewing, teamwork, teaching
5 **verbal**: language proficiency, singing, recitation, authoring
6 **studying**: researching, exam strategy, collaborative learning
7 **technical**: laboratory, mechanics, nursing

Figure 1. Potent Pedagogic Roles for Video: techniques and teaching functions to facilitate learning

The provenance of the techniques and teaching functions in Figure 1

The claim that the 34 categories in Figure 1 add distinctive value to learning derives largely from expert teachers' opinions rather than from empirical research. Their provenance is as follows.

About half the functions correspond to the "distinctive video-value list" drawn up in the 80's by the UK Open University's *Broadcast and Audio-Visual Subcommittee,* with the purpose of ensuring cost-effective use of video. This list comprised pedagogic roles that video could deliver outstandingly well compared to other available media. OU Course Teams had to make a compelling case that the learning outcomes they intended for video really did need video's distinctive presentational attributes. And they had to supply convincing arguments that other, cheaper media would be less effective. Through the years, this procedure led to the compilation of 18 functions that were adjudged by consensus and research to exploit the distinctive strengths of video (Bates, 1984 – Appendix). These 18 have been expanded into the above 34 categories, mostly as a result of further deliberation during ten three-month courses on Educational TV for Development, run at the BBC Open University Production Centre between 1982 to 1994 (Koumi, 2006, pp. 3, 99). Workshops by this author have led to further refinements and to the categorisation into the four domains of Figure 1.

Video's presentational attributes

The basis of the learning-facilitation claim for the techniques and teaching functions in Figure 1 is the rich *symbol system* of video – its presentational attributes, listed in Figure 2.

- moving images with synchronous narration and location sound
- real-time or slow motion
- real-life or diagrammatic
- real or dramatised behaviour (can include comparing styles of personal interaction)
- extreme close-ups
- chronological sequencing and pacing of sound and images (e.g. enabling the display of body language and the phrasing of speech)
- visual metaphor
- specially constructed physical models to represent objects or concepts
- camera moves, zooms and framing
- customised lighting to 'sculpture' objects (hence bring out their three-dimensionality)
- shot transitions (including editing to condense time)
- composite images, e.g. split-screen, superimposition (including key-word screen-text)
- varying format (e.g. a segment in studio, then on location, interspersed with animation)

Figure 2. Video's presentational attributes

In most circumstances, in all of the 34 categories of Figure 1, the presentational attributes in Figure 2 make video more effective than other media. Indeed there are some categories for which there is no alternative to video, because it can provide *amplified realism* – e.g. 2.5 (*fast motion)*, whereby real life can be speeded up thousands of times.

The nature of the four domains: presentational attributes and teaching functions

The presentational attributes of video listed in Figure 2 are the techniques that are shown distributed between the Cognitive and Experiential domains of Figure 1 (domains 1 and 2).

The techniques in the Cognitive domain facilitate learning while those in the Experiential domain engender realism. Domains 3 and 4 both comprise teaching functions rather than techniques – affective functions in Domain 3 and skills functions in Domain 4.

These points are elaborated in subsequent sections, as are the relationships between domains.

Presentational Attributes need to be potentiated through Pedagogic Design

It has been claimed above that video can achieve the 34 pedagogic roles in Figure 1 distinctively well due to its rich presentational attributes, resulting in learning facilitation. But to achieve this potential video needs to be designed for cognitive engagement and constructive reflection. Figure 3 offers a minimal framework of indispensable pedagogic design principles (précised from Koumi, 2006, Chapters 5-6).

1. Hook (a. capture attention, b. sustain interest) a Shock, surprise, appetise, delight b Create suspense, entertain /amuse, enthuse	**5. Sensitise** a Consistent style b Personalise the teacher
2. Signpost a Distant Signpost: what's coming later b Chapter Heading: what's next? c Focus: what to look out for d Educational Rationale: why are we doing it?	**6. Elucidate** a Vary tempo to indicate syntax b Restrain image-word density c. Alleviate Cognitive Complexity d. Enhance Legibility / Audibility
3. Facilitate Cognitive engagement[3] a Pose questions b Encourage prediction c Establish relevance to personal life **4. Enable Construction of knowledge**[3] a Words *not duplicating* images b Pause commentary for contemplation c Invent visual metaphors	**7. Reinforce** a Repetition (with a different angle) b Re-exemplify c Compare / Contrast d Synergy between words and images **8. Conclude / CONSOLIDATE** a Chapter Ending b Summarise key features c Integrate complementary materials

Figure 3. A of pedagogic design framework for each chapter of the video story

Each principle of Figure 3 has several versions and needs interpretation as to *whether* and

[3] Categories 3 (*Facilitate Cognitive engagement*) and 4 (*Enable Construction of knowledge*) enable active construction of knowledge rather than passive reception, hence affording *student reactivity* (# 8 in Figure 2).

how it should be used to accommodate the target audience, the learning context and the learning objectives (Koumi, 2006, p.100).

Another aspect of Figure 3 is that the principles embrace a narrative structure, delivering a *video story*. Narrative coherence was the main concern of the study by Laurillard et al, (2000). Indeed the cognitive efficacy of narrative has been proposed by many writers, such as Gudmundsdottir (1995), Gibson (1996) and Laurillard (1998).

Also, a well-sculpted story, being engaging, has *motivational* as well as cognitive effects. This is also addressed specifically by design principle 1a (e.g. *delight*), 1b (e.g. *enthuse* by bringing out the topic's fascination) and 3c, *establishing relevance for the learner,* which is an affective incentive for cognitive engagement.[4]

Learning through the video techniques and teaching functions in Figure 1

A considerable number of studies have investigated the claim that video can facilitate learning through the techniques and teaching functions of the four domains of Figure 1.

Learning ANTICIPATED through the techniques of the Cognition Domain

Provided a video has been well designed pedagogically (Figure 3), the learning outcomes of the techniques and teaching functions in the Cognition domain of Figure 1 are posited in Figure 4.

[4] Note that this motivational affordance, is a *proximate stimulus* for learning from the video – to be distinguished from the *sustained* affective changes addressed by Domain 3 of Figure 1.

1.1 composite-image techniques can aid synthetic, analytic and discrimination skills

1.2 animated diagrams – for explaining dynamic processes, helping students to share the teacher's imagery

1.3 visual metaphor/analogy/representation – to concretise abstract processes

1.4 illustrating abstract concepts with evocative real-world examples, hence making the concepts more tangible. (Overlap with domain 2 - presenting real-world examples entails experiential techniques, such as *staging events* or *visits to dangerous locations*. However, domain 2 is **what** we show, whereas 1.4 is a **why** we show it (a **teaching function)**

1.5 modelling a process with a simplified version – which scaffolds learning by showing only the pertinent features. (Like 1.4, this is another teaching function.)

1.6 juxtaposition in quick succession, of contrasting situations/processes – to aid discrimination

1.7 simulating variable features – thereby students can be given control of the parameters and chose which features to view and in which order

1.8 condensing time by pruning real-world processes (e.g. editing out non-salient events) thus bringing the duration within the viewer's concentration span

1.9 narrative power – narrative creates coherence and aids recall through its network of causal links and signposting (Laurillard et al, 2000)

Figure 4. Learning anticipated through the techniques in Domain 1 of Figure 1 (Cognition)

Evidence of learning through the techniques of the Cognition domain

Figure 4 (anticipated learning), as well as Figure 1 (pedagogic roles for video), derives from experts' opinions rather than empirical research. As for evidence, many studies have shown that video helps learning, summarised in Wisher and Curnow (2003), Saltrick, Honey and Pasnick (2004 – for specific topics, such as Science, History, Mathematics, Social Studies) and Paulsen and Bransfield (2010). This is despite the fact that the videos investigated were produced without the benefit of comprehensive design principles such as those in Koumi (2006).

Learning through Domain 2 – provision of Realistic/Amplified Experiences

Apart from some abstract subjects like Logic and Pure Mathematics, learning in the Cognitive domain is largely concerned with knowledge about the real world, therefore when learners experience the real world (vicariously but realistically) their study is grounded in context. Jonassen (1991) argues that context provides ‘episodic memory cues that make the acquired knowledge more memorable’ (p. 37). McLellan (1994) pointed out that context in learning environments can be provided by an anchoring context such as a video or multimedia program.

Consequently, instructional video is often used to transport learners into the real world. A particular example is learning how lab techniques are scaled up in industry (Koumi, 2006, pp 90-91). Indeed, apart from *animation* and *visual metaphors,* all the roles in the Cognition domain, involve real life experiences.

The above arguments, which were focussed on cognitive learning, apply even more so to skills learning. Admittedly, many vicarious video experiences of skills demonstrations need to be followed up by real life practice, but the video depiction would provide valuable grounding.

The same is true for all the Affective roles – they all involve showing real life experiences and behaviour. For example, changing attitudes towards people might involve seeing various contrasts in situ, like peoples’ socialising behaviour (Bates, 1984, p. 246).

An added bonus of the Experiential domain is Amplified Realism, through *extreme close-ups*, *slow/fast motion*, and *staged events,* which supply *amplified realism* that cannot be experienced in real life.

For example, an *extreme close-up* of a carpenter's chisel preparing a depression for a mortice lock; this shot can be so tight that trainee carpenters could not experience the view in real life because they would need to stand too close for their eyes to focus.

The extent to which video engenders Affective changes in students (Domain 3)

To what extent can video affect motivations and emotions, and over what time frame?

Miller (2005) reports social learning theorists who suggest that observing a model via video is a viable method of learning a new attitude, while affective-cognitive consistency theorists suggest that the affective component of attitude may be changed by first changing the cognitive component through providing new information, e.g. as in anti-smoking or literacy campaigns on TV.

Altinay, Brown and Piccoli (2012) report a more nuanced result in which the cognitive component did not correlate with attitude change. They found a significant change in attitude and intentions to act following the viewing of a video on Climate Change which was personally framed (framed in terms of the effect on the individual). A video framed globally and one depicting facts only did not reach significance on attitude change.

Zimbardo & Leippe (1991, p.154-58) report research findings on attitude change: that a complex message is more persuasive when presented in writing "presumably because, it could be better comprehended if it was read", while an easy-to-understand message was most persuasive when presented on video. Other findings were that experts and likeable presenters on video were much more persuasive than unlikeable non-experts and the effect was stronger for video than for print.

Other researchers (Azevedo, 2006; Renninger, Bachrach & Posey, 2008) note that sustained changes in students' interest require multiple triggers rather than through video alone.

Evidence of learning Skills through video demonstration (Domain 4)

Typing *video demonstration of skills* into Google results in a billion entries, including many videos demonstrating skills, in every category of the Skills domain. But how effective are such videos?

There is a large body of research regarding the efficacy of Cognitive Apprenticeship (Collins, Brown and Holum (1991), Cash, Behrmann, Stadt and Daniels (1997).

Collins, Brown and Holum (ibid) characterise Cognitive Apprenticeship in terms of four main phases: modelling, coaching, scaffolding and fading. In modelling, the *Master* demonstrates the target task and exposes the thinking behind it. The master then coaches the apprentice who undertakes activities towards becoming an expert. These activities are designed to support or *scaffold* the learning. For example, the activities could be sub-tasks or simplified versions of the task. *Fading* refers to progressive withdrawal of the scaffolding as the learner becomes more proficient.

Video demonstration of skills covers the first phase, modelling. The other three are invariably necessary to become an expert; however the efficacy of modelling alone, using video, has been exemplified in several studies, while being challenged in others.

Nova Scotia Online Learning have produced creditable videos in their Virtual Campus Apprenticeship programme, which has produced an average of 800 graduates per year between 2005 and 2011. Some of the videos, for coaches, encompass both manual skills and teaching skills.

Kemper, Foy, Wissow and Shore (2008) found that 59 of the 61 clinicians who viewed demonstration videos on communication skills judged that their skills had improved significantly.

Donkor (2000) showed, as expected, that Video was superior to Print materials in practical skills and craftsmanship of block-laying and concreting.

In contrast, a study carried out on 40 students of Nursing and Obstetrics by Mouneghi, Derakhshan, Valai and Mortazavi (2003), showed that live demonstration was superior to a video demonstration for the skills of *changing a wound dressing and washing the hands*. However, students grades were still high after video demonstration, so the authors concluded that video can be a suitable substitute whenever live demonstration was difficult to manage.

All four studies above show that video can be effective in the learning of skills, although the fourth showed that live demonstration was superior to video.

Caveat: a fundamental problem with media comparison studies

Care should be exercised in interpreting the third and fourth studies above. There are many media comparison studies such as these, but they all suffer from a fundamental problem: how well were the different media designed for the topic they tackled? Neither of the studies gave a description of the video design.

In order to be fair to each medium, we would need to employ creative practitioners and allow them adequate resources and thinking-time to exploit the full potential of each medium's presentational capabilities. This means not only good design but the concept of *comparing like with like* has to be abandoned in favour of judging which *different treatments* of the topic best exploit the affordances of the different media.

These methodological problems apply just as well in the Cognitive and Affective domains.

Video designed to be viewed in short segments, self-assessed via complementary notes

Long-form video (non-segmented) is suitable for providing image-based overviews of a topic. There are also learning tasks that are a hybrid of *concentrated study* and *image-based overview*, for example *tasks that need concentrated study but flexible access to dynamic visual material*

During the 1980s, materials requiring such tasks were distributed extensively by the UK OU on video cassettes, with complementary notes and self-assessment questions on paper.

Learners invited, but not obliged, to self-assess

These videos were not intended to be viewed non-stop – they were deliberately designed to exploit the stop-start facility of the video player, inviting student-activities during the stops (Crooks and Kirkwood, 1988). To this end, the videos included captions every few minutes that asked the viewer to stop the video and carry out a self-assessment activity (SAQ) described in the complementary notes. For example, the caption could read as in Figure 5.

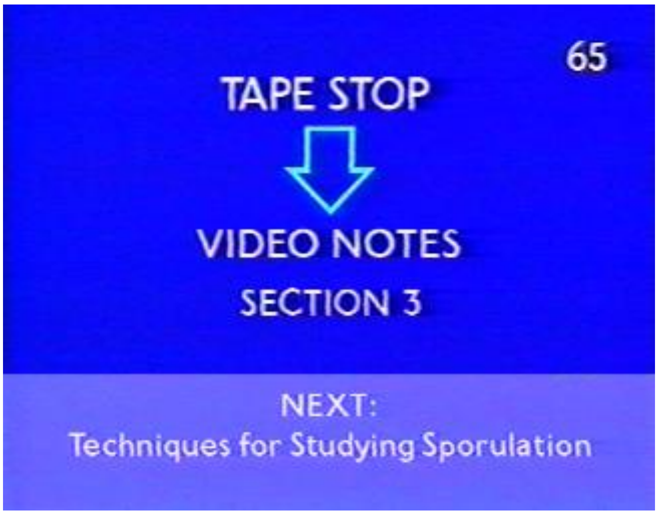

Figure 5. A caption in S325 Video 4, Sporulation, inviting students to stop and do activities in Video Notes section 3 (although they could choose to continue with the NEXT segment).

The videos were indexed, for example with a time-code showing the video's duration. Alternatively, when less precision was acceptable, the index incremented every few seconds, as in Figure 5 (top right). This allowed the Video Notes to reference specific segments of the video. Hence the video and print were inextricably integrated into a *composite* video-print medium that needs to be designed as a *hybrid* medium.

Nowadays the print need not be in a separate paper booklet. Instead, within a VLE or e-Book, the print can be viewed as screen-text. Also, the video would not need a *stop-the-video* caption, since the video could stop automatically wherever the designer wanted to invite student activities.[5] However, the affordance of *student control* could still be encouraged: at each video stop: students could be told what comes next on video (as in Figure 5) so that they could choose whether or not to continue viewing before attempting the SAQs. Granting students the autonomy to defer self-assessment builds self-reliance,

[5] The videos and quizzes in Massively Open Online Courses (MOOCs) employ essentially this format.

but could jeopardise proximate learning. Some recent studies, below, are relevant to this reservation.

Recent studies reporting learning facilitation through segmentation without SAQs

The principle of segmentation has re-surfaced in recent studies, but *without* the inclusion of SAQs (Mayer, 2005, Chapter 11; Hasler, Kersten and Sweller, 2007; Spanjers, van Gog & van Merrienboer, 2010; Ibrahim, 2012). These authors report positive results when animations and videos were segmented to allow student reflection. For example, Mayer (2005, Chapter 11) reports positive results of such learner-pacing. In one version, a 140-second animation on lightning formation stopped after each of 16 segments until the learner clicked *continue*. In another version, an animation stopped until the learner clicked on a choice of topics in a list, and that topic would be addressed by the subsequent segment.

Hence segmentation has been shown to enhance learning, even without SAQs, showing the powerful effect of allowing students to reflect on the content of a short media segment.

Recent studies that added SAQs to previous non-SAQ treatments

A priori one would expect learning to be further enhanced when students' reflection is focussed, through SAQs, onto the specific elements that the teacher intended to be learned.

This expectation has been borne out in some recent studies which addied SAQs to some of the above non-SAQ treatments, resulting in improved learning.

Cheon, Crooks and Chung (2014) adapted Mayer's (2005) lightning-formation animation by providing a pause after every four of the 16 steps. Students who were given embedded cued-recall questions during the pauses performed better than those who merely had to reflect during the pauses, irrespective of whether the text was spoken or written.

Evans and Gibbons (2007) modified Mayer's bicycle pump animation so as to include SAQs after each segment (plus a simulation) and found considerable learning improvement.

Two distinct versions of hybrid video-print learning packages

In one type of hybrid video-print learning package, the video is pedagogically scripted and does most of the teaching, while the supplementary print prompts self-assessment. In a second type, the video observes unrehearsed behaviour and the pedagogic guidance is supplied in printed form.

The first type of hybrid video-print package – video-led

This type will again be illustrated with Video 4 on Sporulation from the OU Course S325, Biochemistry and Cell Biology (1985).

Figure 6. S325 Video 4, Sporulation. Tube neck inserted into a flame

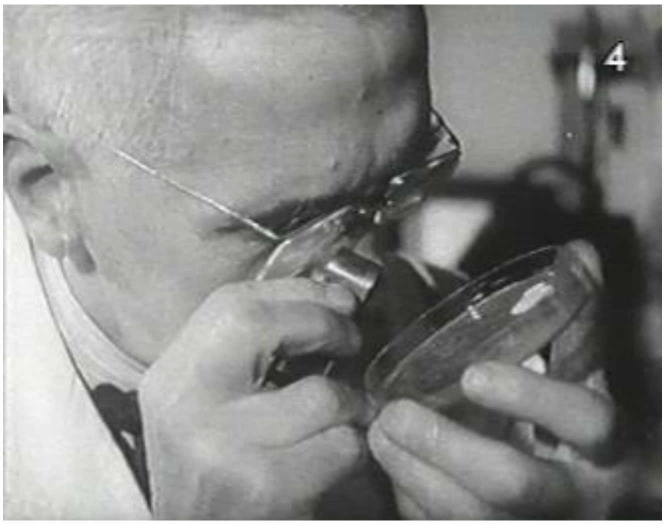

Figure 7. S325 Video 4, Sporulation. Flemming re-enacts his discovery of penicillin

Figure 8 shows two of the Self-Assessment Questions (SAQs) in the Notes for Video 4.

Section 2. Laboratory techniques in segment 2 of the video (video index 17 - 35)

Q 7 for Tape Stop 2. At the beginning of the video segment, Dr Dring inserted the necks of tubes into a flame before transferring material from one to the other. He said he wanted to prevent contamination. Can you think of TWO ways in which this procedure prevents contamination?

A relevant screenshot from the video is shown in FIGURE 6

Q 11 for Tape Stop 2. Penicillin is a fungal product that inhibits the growth of some bacteria. However, penicillin does not affect fully mature bacterial cells. Bearing this in mind, recall the film report of Fleming's discovery (video index 3-5) and critique what Fleming claimed he had observed.

A relevant screenshot from the video is shown in FIGURE 7

Figure 8. SAQs in the Notes for Video 4 of the Sporulation course

Following SAQs such as those in Figure 8, there would be *suggested answers*[6].

The proportion of UK OU video that was designed in this form increased steadily, reaching 30% by 1994, and still rising in 2000. (After about 2002, the Open University moved away from *long-form narrative video* to using short clips, termed *video assets,* inside digital multimedia packages).

Figure 1 lists 34 pedagogic roles for video, but greater detail can be tackled with segmented video plus notes than with video designed to be viewed non-stop.

The average duration of a UK OU video was 30 minutes but students had to spend about 2 hours studying the video-print package. In the above Sporulation example the required study time was several hours: the 52-minute video had six segments, and the Notes contained 55 self-assessment questions. These, together with the suggested answers, constituted comprehensive formative self-assessment.

A second type of video-print hybrid – print-guided, fly-on-the-wall video

In a second type of video-print hybrid, all the study guidance is in print, relating to successive short segments of the video. For example, a teacher-training package might be in this style, with the video-clips being *fly-on-wall observational* recording of unrehearsed behaviour, such as video observation of classroom activity, *without narration*. The printed material would contain pedagogic rationale for the classroom methodology and would suggest reflective activities related to the observational video. The examples in Figures 9 to 11 below are from video-print materials developed in Vietnam for Primary Teacher Education, Koumi (2008).

[6] The answer for question 11 suggests that the discovery of penicillin's effect was the result of a misinterpretation by Fleming, following a careless procedure!

Figure 9. Work in pairs in a grade 5 Geography class

Figure 10. Girl not concentrating on the handicraft work

Examples of print material for such print-guided *video-print* hybrids are shown in Figure 11.

1. Geography class for grade 5 Continue viewing the video from index 10:56 until 13:59. There is a caption at this point that tells you to stop and discuss the following question**:** The teacher divided the mixed ability group of 4 pupils into two pairs of 2 each. If

this is done randomly, one of the pairs might have both pupils of high ability and the other pair might have both pupils of low ability. Is this appropriate for the tasks that the teacher assigned, or should she ensure that each pair is mixed ability?

A relevant screenshot from the video is shown in FIGURE 9

2. Handicraft class for grade 1

In the video clip, there were some negative behaviours. For example:

– playing in the lesson, at 07:34 to 07:42

– at 08:25 to 08:28 you can see a girl who does not concentrate on the work.

Discuss what should be the teacher's reaction to these behaviours.

A relevant screenshot from the video is shown in FIGURE 10

Figure 11. Some self-assessment questions for a print-guided video-print package for the Vietnam Primary Teacher Education course

During the teacher-education course, the self-assessment questions in Figure 11 could be carried out by individual in-service teachers. This is the 'pure' form of video-print package, which lacks *interactivity*. However, the course recommended discussion in small groups, which was organised if scheduling permitted. In a proposed online adaptation of the course, this networking would be carried out online (Koumi, 2008).

Caveat: adding segmentation and self-assessment should not be an afterthought

Subdividing a long-form video story into chapters is a fundamental narrative technique. But chapters are not the same as segments that are to be self-assessed.

If self-assessment questions are to be answered by students, the teacher needs to judge learners' intellectual predicaments before segmenting. A segment needs to end when a coherent set of such intellectual predicaments needs to be addressed with self-assessment questions. This might not coincide with the 'natural chaptering' of the narrative. On the one hand coherent, non-trivial questions may need a segment to encompass *two* ‘narrative chapters’. Conversely, a full narrative chapter might entail too many self-assessment question, so may need to be segmented into two sub-chapters.

Implications for MOOCs (Massive Open Online Courses)

Bearing in mind the above caveat, the style of video-print hybrid illustrated in Figures 5 to 8 could be a basis for teachers who are developing a MOOC, since the transmissive elements of a MOOC are typically short narrated videos interspersed with on-screen printed quizzes (Glance, 2013; Conole, 2013), that is, video-led video-print hybrids.[7]

Conole (ibid) notes a variety of other ingredients and characteristics that MOOCs can include. In particular MOOCs invariably include forums with peers, which ameliorate some of the limitations of transmissive media. However, there are other severe limitations, as follows

Limitations of typical MOOC videos

The vast majority of MOOCs’ videos are ‘head and shoulders’ lecture-capture (sometimes in reasonably short segments), hence use few of video’s rich presentational attributes and pedagogic roles described in Figures 1 and 2.

Limitations of multiple choice quizzes

Self-assessment in MOOCs is most often in the form of multiple-choice quizzes. But multiple-choice cannot include anywhere near the intensity of reflection and retrieval practice enabled by the SAQs and suggested answers in the two illustrations in this paper (Sporulation and Vietnamese Teacher Training). A paucity of pedagogic roles, reflective opportunities and retrieval practice would severely undermine learning outcomes.

[7] The print-guided type of video-print hybrid illustrated in Figures 9 to 11 could also form such a basis.

A severe limitation of MOOCs: the massive number of students

More crucially, the very fact that MOOCs are *massive* precludes the teacher's dialogic interaction with individual students.

The networking in a MOOC forum can stimulate learning for those students with the self-confidence derived from considerable previous experience of higher education. But for the majority, the *cognitive noise* of the amateur discussions may impact negatively on their learning, to the extent that many just drop out.

This is the so-called Matthew effect: For unto every one that hath shall be given, and he shall have abundance: but from him that hath not shall be taken away even that which he hath. (Gospel according to Matthew, XXV, 29)

For the majority that 'hath not', the 'spoiler' hullabaloo in forums needs to be ameliorated promptly by teaching staff, before the Matthew Effects sets in. But such well-timed intervention, for struggling disheartened individuals, is not possible in a MOOC, where the staff/student ratio is Few/Massive.

The Flipped Classroom

The so-called 'flipped classroom' design is where the lectures are provided on video for students to study at home, while the 'homework' (problems and projects) is worked on in the classroom, with the personal help of the teacher. The teacher is a *guide by the side* [8], interacting closely with learners on projects (and on any problems they've had understanding the video at home), as opposed to a MOOC's almost zero personal interaction (because of the vast numbers of learners).

[8] A phrase first coined by J Wesley Baker, who thought of classroom flipping in 1995 and wrote about it in 2000

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The Impact of Leadership on Transforming Traditional Classrooms: Lessons Learned from a Small Elementary District's 1:1 Mobile Technology Initiative

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This qualitative study included a series of formal interviews and focus groups conducted across an elementary school district to examine the connection between transformational leadership and transformational teaching and learning in their 1:1 iPad initiative. The study examined the characteristics of transformational leadership defined as 1) vision and sense of purpose, 2) systems for professional learning and 3) reciprocal accountability for student outcomes. Findings indicate the existence of transformational teaching practices are connected to transformational teaching and learning. To effectively integrate mobile technology it is necessary to examine the contexts that exist to support the changing role of the teacher necessary to achieve desired outcomes for students.

Introduction

Developing future ready learning environments where students are engaged in deeper learning requires dramatic shifts in school leaders from one of management to empowerment. Daniel Pink's (2009) motivational theory or Motivation 3.0 helps us understand that "human beings have an innate inner drive to be autonomous, self-determined, and connected to one another" (p. 71). Transformational school leaders understand this and foster a community that values mastery, purpose and autonomy amongst the staff, students and the community. For this study, transformational leadership is characterized as 1) empowering and inspiring followers to achieve great success; leading with a vision, confidence and greater sense of purpose (Castanheira & Costa, 2011) 2) providing opportunities for continuous learning that are cyclical, participatory and reflective (Robertson, 2010) and 3) developing a system of reciprocal accountability to ensure that instructional decisions have the desired impact on teaching and learning (DuFour & Fullan, 2013). In schools with transformational leaders, Moolenaar, Daly and Sleegers (2010) found that teachers were more likely to take risks to develop and implement new knowledge and practices. Whereas when leaders controlled the work-related knowledge and information, they stifled creativity promoting organizational cultures based on individuality rather than collaboration, which fails to transform systems.

The school district expanded the mobile technology pilot program district-wide in an effort to foster 21st century learning environments in all schools. The expansion began during the summer of 2012 when the district distributed an iPad to every teacher, equipped every classroom with an Apple TV, and provided professional development for teachers primarily in 1:1 environments. The district invested in the infrastructure to support Internet access for the optimal use of devices in the classrooms. Individual school foundations were used to purchase iPads.

By January 2013 the program expansion had reached the classroom and student level. Nearly 50% of the SBSD students had access to devices with student to device ratios of 1:1 in 25 classrooms across the district. Beyond those 25 classrooms, however, student to device ratios varied by the number of devices each school's foundation was able to purchase and the number of students in each school. Because of this, iPad distribution varied from school to school. One school made sure every classroom got the same number (six) of iPads. Another created two shared iPad carts that were wheeled from class to class. In the other four schools the principals solicited teacher proposals to select the first 1:1 iPad classrooms.

The goal of this research was to help identify the leadership characteristics and professional learning experiences that empower teachers to foster deeper learning experiences that prepare students with academic skills and mindsets to be successful in an undefined future. This study was designed to examine school level leadership factors to support teacher development and resources to effectively integrate technology to develop learner-centred environments.

Theoretical Framework

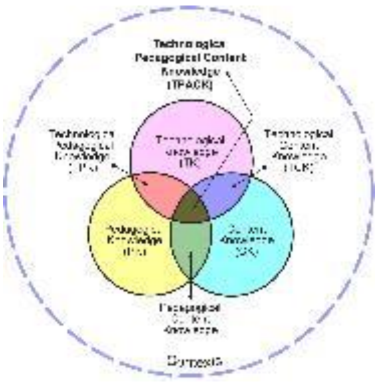
Vision

Transformational leaders empower individuals through a clear vision and an explicit "making-a-difference" sense of purpose (Fullan, 2013). When teachers believe that administrators are focused on student and teacher success, they feel more positive about the school environment and are more likely to keep teaching and learning within a supportive environment (Angelle, 2006). In this new information economy with a tremendous pace of change, leaders must resist the urge to manage the status quo and instead engage their teams in developing and achieving a shared vision (Godin, 2008; Robertson 2013). The principal's work as the instructional leader is not to manage the resources, decisions or data, but to ensure that the school remains focused on the vision and the continuous learning required to achieve it. Fullan (2013) suggests that principals achieve this by "being a talent scout and social engineer, building a culture for learning, tapping others to co-lead, and, well, basically being a learning leader for all." (p. 90)

Systems for professional learning

To facilitate the changing role of the teachers, effective technology integration requires understanding the dynamic relationship between pedagogical, content, and technological knowledge, known as TPACK (Mishra & Koehelr, 2006) (See Figure 1).

Figure 1. TPACK



As designers of learning experiences, teachers remain integral in the learning process through their intimate knowledge of students' developmental needs in the given context (Fullan & Langworthy, 2013). Innovative Teaching and Learning (2011) research findings concluded that innovation flourished when teachers collaborated on best teaching practices, were provided opportunities to learn and practice new methods, and were guided by a common vision and continuous support. Transformational leaders create systems to embed this work into the school day and facilitate teachers of the same content in continuous planning, analysing and reflecting on student learning through small collaborative learning communities (Joyce & Showers, 2002; Marzano, Waters, & McNulty, 2005).

Reciprocal Accountability

When teachers understand the vision and have clear expectations for teaching and learning, and they can share collective responsibility for student learning, it increases student achievement and personal satisfaction (Louis & Wahlstrom, 2011). A loose-tight system allows principals to monitor progress and support improvement through reciprocal accountability rather than top-down management (Fullan & DuFour, 2013). Teacher evaluation and accountability is often associated with classroom observations, yet an overwhelming majority of teachers are found to be satisfactory or better (Weisberg, Sexton, Mulhern, & Keeling, 2009). This practice is inadequate as it does not elevate exemplary teachers, rarely improves poor teaching and fails to use data effectively to improve instruction. DuFour and Mattos (2014) argue that to improve student achievement in their school they must focus the bulk of their energy on the collective analysis of evidence of student learning rather than the inspection of teaching.

Methodology

This case study examined the implementation of a 1:1 iPad initiative in a small affluent k-6 district. This qualitative study was designed to address the research questions from the perspectives of one district's instructional services team, principals, and teachers (Stake, 2000). The study included interviews with the Assistant Superintendent and the Teacher on Special Assignment (TOSA), as well as with each of the district's six principals. The interviews of key district personnel were supplemented by focus groups composed of selected teachers. Teachers at each of the six schools who were at the forefront of mobile technology integration were nominated by the district teacher leader to participate. These teacher focus groups were intended to provide a district-wide look at teachers' use of mobile technology. However, only three of the six schools in the district participated in focus groups. Each focus group included two or three teachers with a total of eight teacher participants. In sum, there were three sets of data: 1) interviews with the district's instructional services team members, 2) interviews with each principal, and 3) focus groups with teachers from three participating school sites. The goal of the focus groups was to understand teachers' perspective of the vision, the support they received and the level of use of technology in the classroom.

Interview and focus group protocols were reviewed prior to each interview to assure their alignment with the overarching research goals. Once interviews and focus groups were completed, the research team developed categories or themes and elicited meaning to develop an understanding of leadership and the perceived impact on teaching and learning (Patton, 2002). Researchers analyzed and coded each interview noting emerging themes and compared them with existing literature on transformational leadership. Principals were categorized by the extent to which they described the characteristics of transformational leadership, which included a clear vision, robust support for teacher development and systems of reciprocal accountability.

Once interviews and focus groups were completed, the research team coded and analyzed data using qualitative analysis techniques. Interview and focus group protocols were reviewed prior to each formal interaction with participants to assure their alignment with the overarching research goals. In addition to the formal data collected from each interview, researchers noted higher-order themes and reflections to document nuances that might not be accessible through transcripts. These data were then coded and analyzed through qualitative analysis processes. These included comparing each participant and participant group's perspectives on the three overarching research questions. Participants are identified by pseudonyms to maintain anonymity.

Findings

The context within the district and in each unique school resulted in varied approaches of teaching and learning through the integration of a mobile technology. Principal leadership, their expectations of 21st century learning, as well as systems that support teacher development in transforming teaching practices, impacted the school's integration of iPads. These findings are characterized by a principal's clarity and communication of the vision, related expectations for the transformation of teaching and learning at the school and the level of support provided.

The Impact of Leadership on Technology Integration

Each of the principals' visions generally aligned to their overall district vision to foster 21st century learning through mobile technology integration. While the shared vision of 21st century classrooms facilitated by mobile technology was widely understood across the district and supported by district level professional development opportunities, specific expectations for how to translate it into classroom practice at the school level were not as clear. Based on the interviews with the district and school level administration, the research team evaluated the level of transformational leadership related to the changing role of the teacher. We analyzed the extent to which transformational leadership was described at each of the sites. The levels of technology integration connected to characteristics of transformational leadership including, vision, systems for professional learning and reciprocal accountability provide insight into the critical role principals play as innovation leaders.

Learner-centered Technology Integration

Pervasive technology use that aligned with learner-centered teaching practices was observed more often in schools with leaders who had a clear vision, diverse opportunities and support for teacher development, and created systems for reciprocal accountability. In these schools, principals established clear expectations for teaching and learning with mobile technology combined with a system of support to transform teacher practices. Although these principals do not see themselves necessarily as experts in technology, they are innovative and lead with the belief that mobile technology is the mechanism to transform classroom practices. They demonstrated a vision of 21st century learning and consistently communicated that vision to their teachers. This was evident when one principal outlined her expectations for the use of technology at her school:

> Grade level teams needed to be willing to really re-examine the way we teach. This was not just going to be a device that came in and sat on the desk and got pulled out during math time to do math facts. This was really going to be a project where we explored the way we teach, and the way kids demonstrate mastery of something.

Principals at both sites where transformational teaching practices were perceived to exist on a large scale credit their school culture for positively affecting their teachers' ability to integrate technology. These principals were deliberate about connecting with professional learning "experts", such as Apple trainers or the teacher leaders to keep abreast of best practices to guide and support the desired pedagogical shifts. They scheduled weekly time for teachers to collaborate and learn about how to effectively integrate technology. One principal explained that her "expectation is that [teachers develop] content with the grade level team around these devices at least once a week for 'X' amount of time." This Loose-Tight (DuFour & Fullan, 2013) leadership style provided clear expectations and support but allowed the team to set the schedule and determine their own goals for the collaboration based on the group's needs.

Device-centered Technology Integration

Sporadic technology use that aligns with device-centered teaching practices was described in schools with leaders who recounted the district vision without building a shared understanding or clear expectations for instruction. Although there were multiple opportunities for collaboration and support for teacher development, this lack of clear expectations and reciprocal accountability to meet the desired expectations failed to develop teaching and learning aligned to the vision. The majority of technology integration described was focused on the device rather than learner-centered instruction. These school leaders reported that using mobile technology requires them to step out of their comfort zone and described accessing support services to guide them through the implementation process and keep up with new technologies.

Although the schools were perceived to have a culture of collaboration and support, they lacked ubiquitous access and clear expectations for how teachers should use technology to transform their teaching practices. Principals in these schools developed systems to facilitate regular teacher collaboration and provided their teachers with technology related professional learning opportunities. One principal's goal to create a "culture on campus where it's safe to share [ideas and experiences]" aligned with teacher practices and behaviors from these schools. Within these environments, teachers are more apt to experiment with technology and share their successes and challenges with colleagues. The same principal noted her teachers enjoying this learning process, “It’s added this element of, ‘Have you tried this?’ [There is] some excitement… fun conversations, and invitations to come in and see what they’re doing.” The structures set in place at these schools help facilitate collaboration and the exploration of one another’s practices. They often “go down the hall and watch one of their colleagues to learn from them.” The principals at these schools offered examples of teachers sharing new strategies that they had learned at conferences and school-level professional development meetings.

Beyond the collaboration to share new pedagogical approaches, however, teachers did not to have clear goals for implementation where there is reciprocal accountability to ensure the implementation is effective. The instructional coach was seen as a resource that was “available to our teachers on a weekly basis…and is able to help teachers or answer questions”. Without clear expectations of how the technology is to be used and instructional coaching support to integrate, the level of implementation is based on the teacher’s experience and preferences rather than the district’s vision, The consensus among teachers in each of these schools was that there is a great deal of time and expertise required to integrate mobile technology and change existing lessons to meet the Common Core Standards. Providing more structured time and expectations for how teachers could more effectively utilize technology is necessary in a collaborative environment to support the transition.

Pockets of Innovation

Leaders who lacked a level of comfort with mobile technology and demonstrated a less nuanced understanding of 21st century learning described a vision of technology integration based on tools (i.e., is driven by devices), rather than on transformed pedagogy. These principals responded to teacher's technological inclinations in isolation, rather than through school-wide support to foster dissemination of ideas and innovations. Additionally, they reported letting teachers who were excited about technology integration lead the way based on experience rather than a shared vision.

This leadership style led to a small percentage of teachers experimenting with technology and learning from network outside of the school, thus creating pockets of innovation For example, in one of these schools, two teachers who had access to professional development and support outside of the school as part of a district cohort for teachers with 1:1 iPads were seen as the innovators on campus and set apart from the rest of the faculty. Their teaching was described as learner-centered and they were highly regarded for their effective technology integration.. Beyond their classroom, however, these teachers lacked additional structured time to share newly acquired knowledge with the rest of the staff. Without time to share new thinking with their peers, these innovative teachers remain isolated and their ideas fail to spread beyond their rooms. To exemplify this point, one principal explains, "It's always like, 'here, try this out' [for] 10 minutes at a meeting… and then they go try it and it doesn't work and they're frustrated." These principals agree that an additional tier of support for the teachers needs to be available to differentiate professional learning but do not feel comfortable developing the support themselves. Although the need for more support was acknowledged, these principals called upon instructional coaches infrequently to support the integration of technology and did not see how it would benefit the teachers.

Discussion

Districts should examine the context in which teachers are successfully transforming their practice and ensure principals have the resources and capacity to create the context to support the transformation of teaching and learning. The schools that reported the most widespread transformative examples of teaching and learning worked in schools where there was a clear vision for the use of mobile technology, teachers collaborated regularly around best practices with their peers, coaches and outside experts to develop their instructional practices, and there was a shared responsibility for desired students outcomes built on reciprocal accountability. It is critical to ensure that school leaders articulate a clear vision and develop the capacity for the effective use of technology.

The professional learning model should address the diverse needs of teachers in the district to ensure learner-centered instruction for all students. Teachers have diverse skill sets and need multiple opportunities to learn, develop and practice the new skills to facilitate deeper learning. The current model of professional learning and coaching primarily supports early adopters in classes with 1:1 devices that integrate technology with ease compared to the majority of district teachers. To build capacity toward realizing the vision of deeper learning in all classrooms, the district should scale the resources to differentiate support to meet the needs of all teachers. Based on diverse teachers' expertise and experiences, they will require varied support and opportunities to learn. Preliminary findings suggest some teachers may be more ready to integrate technology than others. The district's professional development plan should address the needs of the diverse teachers and leaders and provide support for based on wherever they are along the continuum of technology integration. In addition, to build capacity the district would benefit by broadening the scope of the instructional coach to equally support all schools and meet with teams of teachers on a regular basis. Teachers benefitted from having an experienced guide to focus their collaborative meetings and a system that both held them accountable to high expectations while providing robust systems of support.

To support effective technology integration, we believe that a competency based system that provides clear expectations and offers multiple pathways for teachers to learn is necessary to effectively support the diverse teaching force. A competency-based system allows teachers to demonstrate proficiency in areas where they excel and seek support and guidance for specific areas of growth (Cator, Schneider, Vander Ark, 2014). Similar to demonstrations of student learning linked to purpose, mastery, and autonomy, a competency-based teacher development system allows leaders to identify the expectations and allows for differentiated paths to develop and demonstrate mastery of effective teaching practices. In sum, teachers need a more robust, personalized support system to transform teaching practices and foster 21st century skill development.

Conclusion

The district's efforts to leverage mobile technology to achieve its vision for 21st century learner-centered technology integration are noteworthy. The vision was shared across stakeholders, but the extent to which that transformational leadership existed in relationship to the transformation of teaching and learning impacted the implementation at school-level. The principals and teachers in transformational schools provide evidence of progress towards the district's vision to transform teaching and learning with mobile technology. To realize the transformation in all schools and classrooms, it is necessary to examine the contexts that exist to support the changing role of the teacher, including visionary leadership, systematic support for teacher development and reciprocal accountability to ensure students learn in environments that foster the skills necessary for future success.

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Using Mobile Devices/Smartphones to Generate Creative E-portfolio Content

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E-portfolios provide a selection of specific artifacts from which evaluation or assessment of specific learning outcomes may take place and documenting evidence of reflective practice and take ownership of their learning trajectory. Constructing an e-portfolio stimulates students to engage in critical thinking and self-evaluate reflect on their learning and personal development. This mobile e-portfolio project commenced in Fall 2014 and comprised of conducting an initial small-scale pilot with instructors assigning students to integrate mobile phones to gather and generate e-portfolio content as part of the course assessments. As the only tools required were smartphones, students were able generate ideas and collaborate in class, at home, or anywhere they had internet access. By using their smartphones, students worked alone or in groups to record ideas and experiences for their individual and group e-portfolios. Findings showed students generated creative content along with innovative ways to showcase their ideas.

Keywords: word; another word; lower case except names

Introduction

E-portfolios provide a selection of specific artifacts from which evaluation or assessment of specific learning outcomes may take place and documenting evidence of reflective practice and take ownership of their learning trajectory. Constructing an e-portfolio stimulates students to engage in critical thinking and self-evaluate reflect on their learning and personal development. Dewey (1938) asserted that students need learning experiences that will lead to life long learning. Technology must be easy to use or students will not use it (Hidayanto & Setyady, 2014). An idea for this pilot was to combine the engagement factors that drive social networking and incorporate them into e-portfolio development.

Barrett (2011) showed e-portfolios are similar to social media, so students can use similar skills to find information. Also, e-portfolios are different from social media because they focus on evidence of learning. By January of this year, facebook reported they have 1.9 billion mobile active users (Facebook, 2015/01/28). The mobile marketing research firm, eMarketer (2015/03/16), found that Nearly half of 19- to 22-year-olds spent at least 4 hours with the mobile internet every weekday. One idea behind this study was to take advantage of that ongoing use.

Using an ecology of resources perspective, Westberry and Franken (2012) suggested blending the online and face to face activities to enable learners to access outside experts and resources. By using their devices, students have access to most every resource on the internet.

Methodology:

In this pilot, the instructor assigned students to integrate mobile devices into the classroom. Students were tasked to use smartphones, to generate ideas and collaborate in class, or at home because these devices could be used to collect artifacts. The students used their devices to collect artifacts on three levels, a course e-portfolio, their group e-portfolio, and their own individual e-portfolios.

Course: The course level e-portfolio (a Google Site) content was created and using their devices students were asked to submit in-class surveys, interactive worksheet summaries, as well as summaries of self-evaluations/surveys regarding individual communication/learning styles etc. Also, the course e-portfolio linked to the group e-portfolios and individual class member reflective e-portfolios. Although this course e-portfolio student generated will not be shared with future classes, the content will be used for comparison with future with those future courses.

Group: At the group level, student groups were given a Google Sites Template as a model to guide them in developing their group project. This part of the assessment was created to model for students best practices in group work and allow guidance from the lecturer to help groups improve their effectiveness. At the beginning of the course each group choose a different case from a list of cases containing different but similar communication problems. Each week groups were given new perspectives on the problem during lecture, and using their mobile devices then groups began researching and answering questions on the given collaborative worksheets which assigned different tasks to the group members to help solve the problem from this new perspective. The group members were to research their own different tasks to solve the new perspective problem working on a collaborative worksheet in class. After researching and compiling solutions for the new perspective of problem, group members copied the information into their group e-portfolio. As all groups has access to other groups' websites, it was simple to create and distribute peer/group feedback (Google) Forms to students, so they, individually, could help other groups improve.

Individual: At the individual level, students were asked to complete self-reflection (Google) forms each week to create content for their own learning portfolio. The students submitted reflections of their learning and were asked to apply that learning to real-world situations. In each throughout the semester, class individual students were asked to reflect on their experiences from the different aspects of the Hong Kong Baptist University (HKBU) 7-Graduate Attributes; Communication, Citizenship, Creativity, Knowledge, Learning, Teams, and Skills.

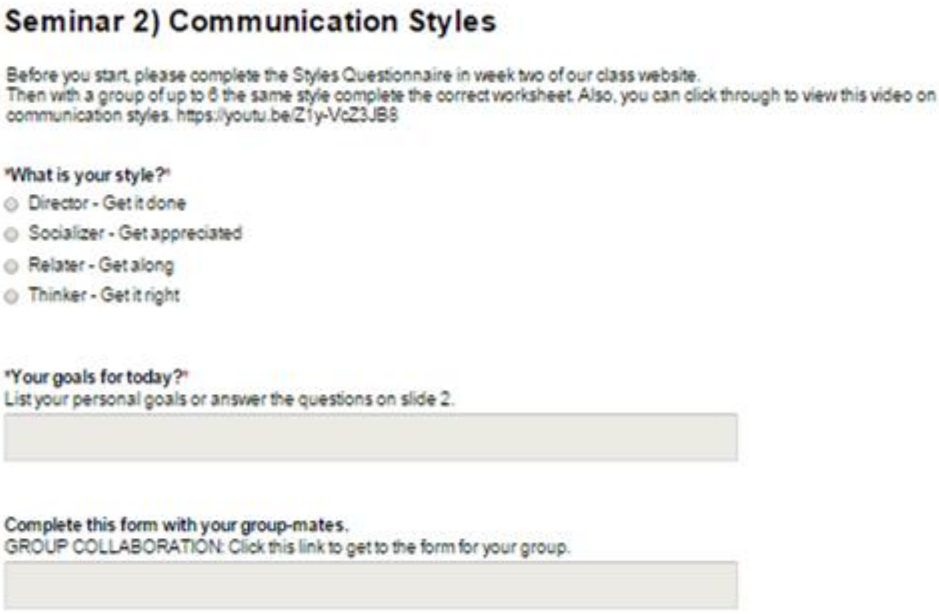
1. What did you learn relating to (one of the assigned graduate attributes)?
2. How can you use this to improve your personal, professional, or family life?
3. What will be some of the benefits when you apply what you have learned?

When students submitted the forms their reflections were automatically emailed back to themselves, and then they copied these reflections into their own personal e-portfolios. Students were asked to apply their learning to their personal, professional, or family life, because two mottos of HKBU are “Whole Person Education”, and “Developing Life-Long Learners”. The students were told the purpose of their individual e-portfolios was to create a product that will be given to potential employers, and therefore, would be open to the public.

Findings

Findings showed students generated creative content along with innovative ways to showcase their ideas.

For the course level, students responded to the surveys by submitting their answers. For example, here is an image of the Google Form and some of the students’ answers.



Seminar 2) Communication Styles

Before you start, please complete the Styles Questionnaire in week two of our class website.
Then with a group of up to 6 the same style complete the correct worksheet. Also, you can click through to view this video on communication styles. https://youtu.be/Z1y-VcZ3JB8

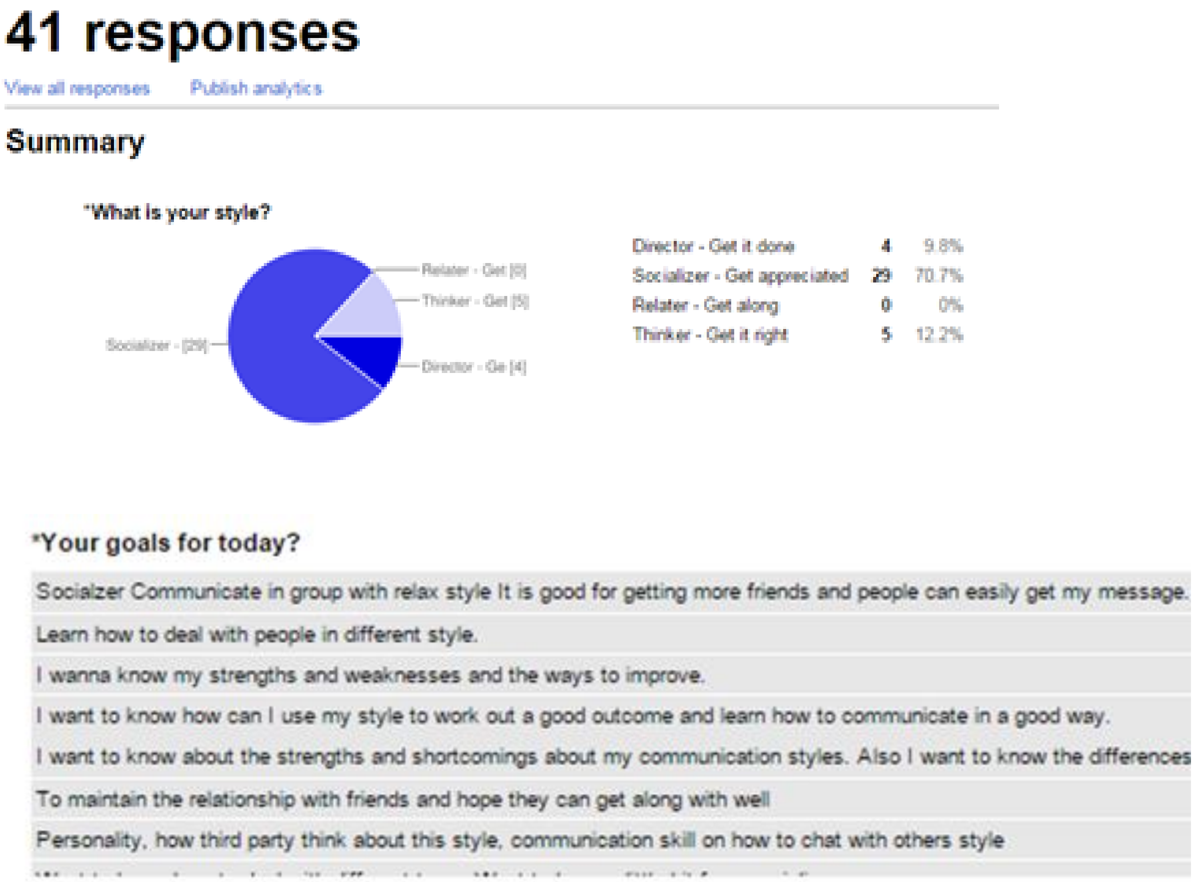
What is your style?

- Director - Get it done
- Socializer - Get appreciated
- Relater - Get along
- Thinker - Get it right

Your goals for today?
List your personal goals or answer the questions on slide 2.

Complete this form with your group-mates.
GROUP COLLABORATION: Click this link to get to the form for your group.

These are some examples of the responses to Form questions.



As the students responses were posted in the course website, they were able to reflect back to their experiences as the course progressed.

For the group e-portfolio level, the students simultaneously completed group worksheets (Google Docs) using their mobile devices.

Here is an example of a Group worksheet with the topic of Team Communication.

Team Communication (or Team Building) Smart-phone Skills In-class Research
Focus: Team communication (or team building or improving team morale)
Your Group Member Names will do some In-Class RESEARCH. CREATE ONE WORKSHEET PER GROUP* (Click File>Make a copy... then add your group number to the name and check the ☒ "Share it with the same people box.") For each of these resources, write (one sentence each of these three, 15-20 words per sentence)
1) give stars (poor) ☆ ☆ ☆ ☆ ☆ or ★ ☆ ☆ ☆ ☆ or ★ ★ ☆ ☆ ☆ or ★ ★ ★ ☆ ☆ or ★ ★ ★ ★ ☆ or ★ ★ ★ ★ ★ (good)
2) how it is useful/easy to use and help solve the problem,
3) how it is not useful/problems in use and help solve the problem, and
4) how it addresses team communication (or team building or improving team morale).
NOTE: Everything you submit must be from ENGLISH sources (and not translated into English).

Group Name:

<u>Critique a team communication (or team building) app (also it should have some images with team building posters you can copy into your site)</u> Group Member Name: Search Engine: Search Terms: Search hit number: App name: Paste link:	<u>Critique a YouTube team communication (or team building or improving team morale) video</u> Group Member Name: Search Engine: Search Terms: Search hit number: Video name: Paste link:
Answers: 1) 2) 3) 4)	Answers: 1) 2) 3) 4)

<u>Critique a team communication (or team building or improving team morale) exercise</u> Group Member Name: Search Engine: Search Terms: Search hit number: Website name: Paste link:	<u>Searching from the TED database (NOT Youtube) Critique a TED talk ON team communication (or team building or improving team morale)</u> Group Member Name: Search Engine: Search Terms: Search hit number:

As in-class research was started using mobile devices, students were able to find artifacts, and information sources, sites, books, etc. Although most groups edited the information on computers later, much of the research was completed using mobile devices.

Here is an example of information one group found and the finished product they uploaded into their group portfolio.


Home
Case Situation
Problem Solving Process
Proposal Letter
Proposal Report
Feedback
Tools
Collaborative Writing
Communication Styles
Design Communication
Find your communication style
Finishing Collaborative Writing
Project Communication
Self-Communication
Team-Communication
Time and Goal Communication
Value: After Project Reflections
Sitemap
Tools >
Team-Communication
APP
01
YOUTUBE
02
EXERCISE
03
TED TALK
04
WEBSITE
05
WEBSITE
06

At the individual e-portfolio level, students completed Google forms to reflect on their learning for the day with respect to one of the University graduate attributes.

Teamwork Graduate Attribute Team Comm

Be ready to serve, lead and work in a team, and to pursue a healthy lifestyle
具備領導和服務團隊的精神，實踐健康生活模式

* Required

群體
Teamwork

Name *

Email *

Teamwork graduate attribute for team communication *
Reflect on the lesson today. What are some team communication skills you gained that will help you get along or work with colleagues / family / friends in the future. Write three sentences of 15-20 words on average.

After the students submitted their answers using the in-class Forms, they automatically received an email with their answers. Again although they used their devices to respond, they often edited their answers on a computer after class. Below is an example of the a student's e-portfolio page from the above Form.


Open Communication:
Vital to Business Success
1
Honest
Honest communication is very important to a team,
we need to speak the truth
and hear the others in the same time.
2
I learn the importance to face my own fear to be more commit to my team.
Engagement
3
Unique
Life is about finding your unique contribution that only you can make to the world.
No one should get off with being a free-rider in society.
Piktochart

Discussion

A major focus of this pilot study was to gain understanding on how mobile devices can enable students to gather evidence of learning. Giving the students guidance with forms, Doc worksheets, and portfolio templates seemed to help helped the students show their creativity.

A the course progressed, the students began to increasingly use their mobile devices to gather content for their e-portfolios. They start noticing the learning is all around them and found new ways to apply and to continue learning (learning for life.)

In the future I will build their input into the course for more analysis. This seems to be a great opportunity to develop information literacy and critical thinking skills, as students have a guided environment to find and evaluate new ideas, information, and artifacts.

As this was just a pilot, it seems there could many more opportunities for creativity and alternative ways to gather e-portfolio content with mobile devices.

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LEARNING-ON-THE-MOVE (LOTM) TOOL: CASE STUDIES ON THE USE OF LOCATION-BASED TECHNOLOGY AND RAPID AUTHORING TOOL TO TRANSFORM OUTDOOR LEARNING IN SINGAPORE

Png Bee Hin and David Jeremiah Mok

LDR Pte Ltd

Schools of 21st century Singapore are tapping on advancements in infocomm technology(ICT) to enhance the educational landscape. With the advent of mobile technological advancement, teaching can now be brought beyond the four walls of the classroom to transform outdoor learning.
Setting the pace is the **Learning-On-The-Move (LOTM) Tool** trail creation platform, which is able to publish trails on iOS or Android mobile apps that can run and track the **trails created by teachers and even students** through an **easy-to-use LOTM user interface** and its supporting infrastructure.

Keywords: LDR, Pocket Trips, HTML5, case study, authoring tool, location-based, Image Recognition, Blue-tooth, GPS, mobile, trail, iOS, Android OS, smartphone, tablet, curriculum-based, learning, journey, training, leadership, team-building, live-tracking, results, innovative, ICT, heritage, history, culture, Singapore, transform, outdoor

Introduction

The LOTM tool comes with a **rapid authoring tool** with multiple **location-based technologies** that enables anyone without programing knowledge to create highly interactive and engaging mobile trails apps running on IOS and Android devices. It also integrates social media apps to create highly interactive digital learning trails, with live-tracking of location, quiz results and photo/video submissions.

Figure 1: Uniqueness of the LOTM

LDR’s innovative LOTM solution is able to drive a confluence of learning pedagogies such as self-directed, collaborative, experiential, problem-based, inquiry-based and place-based learning concepts through the use of location-based mobile technologies such as GPS, Bluetooth and Image Recognition (IR) to transform outdoor learning. The tool was built by LDR Pte Ltd in 2010 to develop the easy to use location-based mobile authoring software to help teachers create their own mobile learning trails to enhance learning beyond the classroom.

How does it work?

The LOTM tool enables media-rich content such as information, quizzes, videos, interactive animations to be rapidly created and fused with location-based triggers, such as GPS and Image Recognition along with a rich selection of social media apps. This enables content to be activated on users’ mobile devices only when they arrive on respective site of interests. The trails function something like a sophisticated treasure hunts, with new instructions released as students complete their tasks. From a central location teachers can track students' progress, location, activity results, and multi-media submissions, re-entering their students' learning spaces at appropriate moment to scaffold their understanding.

What's the benefit?

Trails created by the tool enable inquiry-based, collaborative, and situated learning experiences to take place in which participants can find out more about their environment in engaging manner while sharpening their leadership competency, language/ literacy as well as 21st century competency skills.

It is also equipped with the following features:

1. Ability to rapidly create content and publish them on both iOS and Android OS Platforms
2. Ability to fuse content with multiple Location-based triggers such as GPS, Image Recognition and Blue-tooth
3. Ability to support live-tracking of participants' location and performance through a mobile LMS system

When combined, the features enable any of the authors (such as teachers, instructors, writers, subject matter experts) who do not possess any programming or engineering background to

rapidly design, develop and operate their own outdoor self-directed or collaborative trails in 'Amazing Race' format for their own school or corporate learning at very low cost with having to resort to professional app developer, tour guides, or pen-and-paper solutions. The key benefits for authors, participants and organisers using the combined features of the LOTM Tool for the design, development and operations of mobile learning trails are as follows:

Advantages for Authors of Mobile Trails:

1. Facilitate the creation of user-generated content
2. Allow authentic learning to take place
3. Enable sharing / editing of existing trails
4. Reduce duplication of efforts
5. Enable publishing of trails apps on Android & iOS

Advantages for Participants of Mobile Trails

1. Enable collaborative learning
2. Enable self-directed learning
3. Build team-work
4. Strengthen social cohesion
5. Enable authentic learning
6. Develop creativity
7. Strengthen leadership
8. Develop 21st Century Skills (critical and inventive thinking etc.)

Advantages for Organisers of Mobile Trails

1. Do away with lengthy lectures
2. Eliminate marking of papers
3. Enable tracking of location & performance of participants
4. Enable capture of Real-time data
5. Enable communication with participants on the move.

What's the impact?

Using the tool, LDR has helped teachers and students in Singapore to design and develop more than 90 highly interactive mobile learning trails covering history, culture, geography, arts, mathematics, language appreciation and campus orientation trails running on iPads or Android devices. This includes 39 curriculum-based **interactive Heritage Trails (iHTs) and interactive Cultural Mapping Trails (iCMPTs)** in Singapore to support the outdoor learning of all Schools in Singapore ranging from Primary, Secondary and Tertiary (JC) levels. The trails were all completed in 2011 by LDR Pte Ltd, using the **LOTM Tool**, with favourable feedback all around. In April 2012, the iCMPTs developed using the LOTM Tool with National Junior College was launched by Minister for Transport, Mr Lui Tuck Yew. The **interactive Heritage Trails (iHTs)** developed for MOE Humanities Branch was launched by Minister for Education, Mr Heng Swee Keat on 30th May 2012. This year in 2015, LOTM is used for creating trails to commemorate and celebrate Singapore's 50th birthday as a nation, whereby schools are using the tool to create community heritage trails all around the nation.

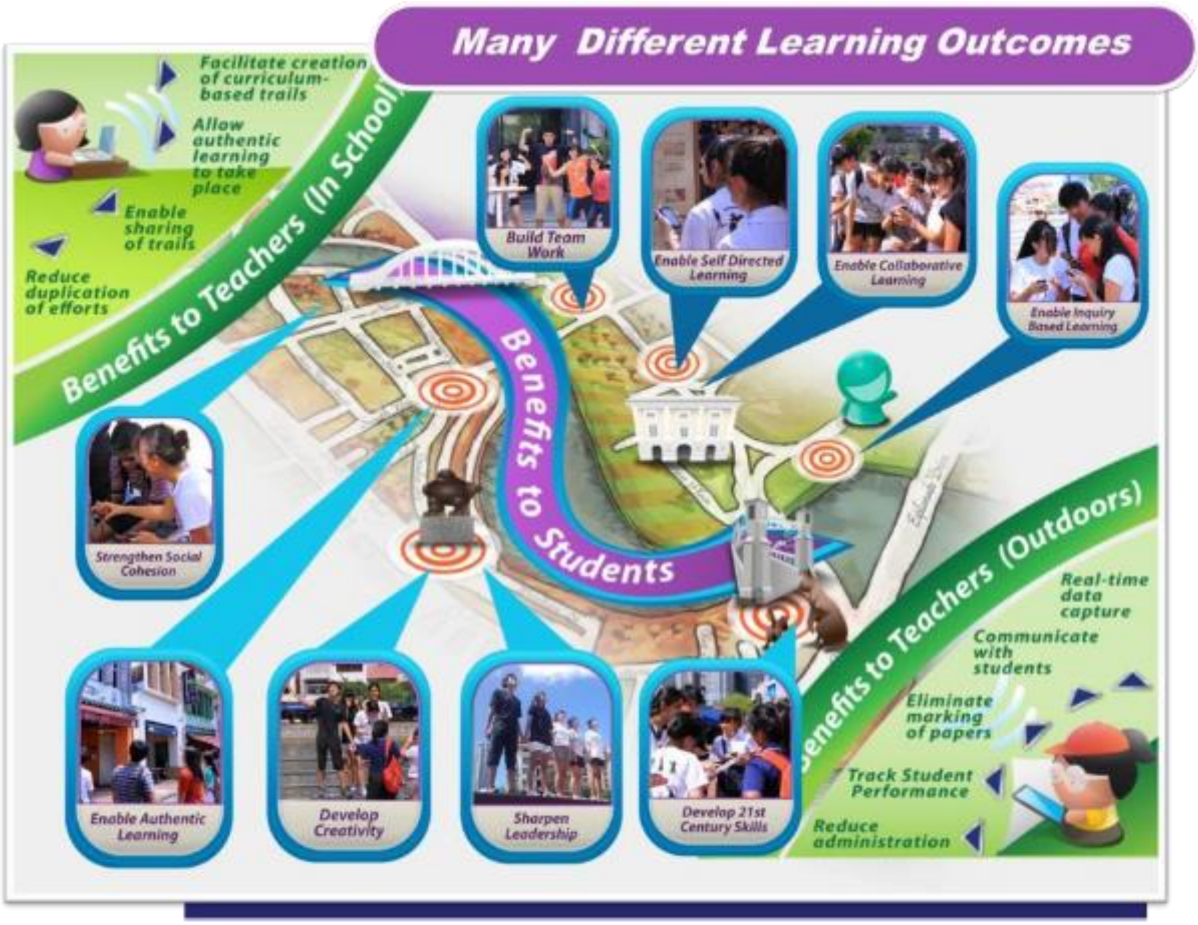


Figure 2: Outcomes of the MOE interactive Heritage Trails (iHTs) developed by LDR Pte Ltd.

Teaching and Learning Usage Scenarios

This section describes how the LOTM tool can be used by the teachers and/or students in class and/or beyond classroom environment. MOE school teachers (the end-users) begin application of the LOTM Tool through subscription of a license to access the online LOTM Portal.

Figure 3: Screenshot of LOTM Portal Homepage

This provides login user and password access for the school to **book** mobile interactive learning trails created by them or existing trails such as the CBD, Civic District, Chinatown, Little India or Kampong Glam Interactive Heritage Trail. The license also provides the ability to **run** and **create** mobile interactive trails as elaborated in the following paragraphs. . It supports LOTM Users in user admin functions such as user login, search, preview and retrieval of LOTM resources, booking of trail sessions, and ***monitoring of trails and students' performances during the trail***.

At the user end, the main interface is a mobile app to be downloaded onto Android OS 2.3 or iOS 4.2 (and above) mobile devices so that LOTM trails can be operated. mPlayer supports the backend configuration, interfacing and support to activate the mobile devices and enable them to be used with various components of the LOTM

Tool such as ***location-tracking, results-tracking and live chat features.*** Users can also ***watch videos (such as YouTube videos), listen to Audio, view Webpage, and contents can be produced in any language***. The report is live generated e.g. the bar graph showing live quiz results for MCQ questions grows as the trail progresses and answers are being submitted by students on the trail.

a. Booking of Mobile Interactive Learning Trails, Mobile Devices, Trail Maps and Facilitators

Under the booking function in the LOTM Portal, schools also have the option of leasing highend Smartphone devices which will be pre-configured with the highly interactive content for self-directed or team-based exploration of the desired subjects / topics contained in the selected trail. All mobile devices leased from LDR Pte Ltd are configured with the full-suite of technologies to make learning fun, engaging and memorable. These include pre-paid 3G/4G data cards, pre-configured hotspots, and use of location-based trigger technology such as GPS, Image Recognition for activation of hotspot content. The devices can also pre-packaged together with trail facilitators, customized trail maps, and augmented with customized experiential-activity stations to facilitate Teambuilding, Leadership Development and Creative Group Problem Solving activities to take place within each interactive trail. Each of these options can be booked via the LOTM portal booking function.

Figure 4: Singapore River 'Amazing Race' Trail Map

b. Running of Mobile Interactive Learning Trails

During the deployment and operation of a mobile interactive learning trail, the LOTM Tool transforms into a monitoring command station with a customizable dashboard to track student progress in terms of the following:

- Live progress assessment and status monitoring via M-Track.
- Live graphical tracking of students' location via Google Latitude.
- Closed-loop communication between teachers and students to promote timely guidance and feedback during the trail usage for both quantitative results (quiz and test) and qualitative results (video, photo, voice, memo submissions) via MPortal.
- Teachers and students conduct of live-chat on the move (using Skype).
- Instantaneous consolidation of survey results after the trail via the students' immediate feedback using their respective assigned mobile devices.

The LOTM portal provides quick access drop-down options to customize the look-and-feel of the command station, which can be set up using the teacher's client laptop.

c. Creating of Mobile Interactive Learning Trails

The LOTM Tool allows schools to rapidly create and customize their own trails. Each trail can be created with the following capabilities:

Location-Based Technological Triggers

Schools can utilize the LOTM Tool license to access the trail creation module to design trails using location-based technology such as GPS, Image Recognition, Blue-Tooth and WifiTriangulation identification mechanism to trigger media-rich contents on mobile device when a user enters into a designated Hotspot. These features will enable content to be pushed to students, alerting them to interesting things around them which they might otherwise not even know are in existence. They can also enable students to do mini-treasure hunt or solve puzzles and learn in a fun and enjoyable way.

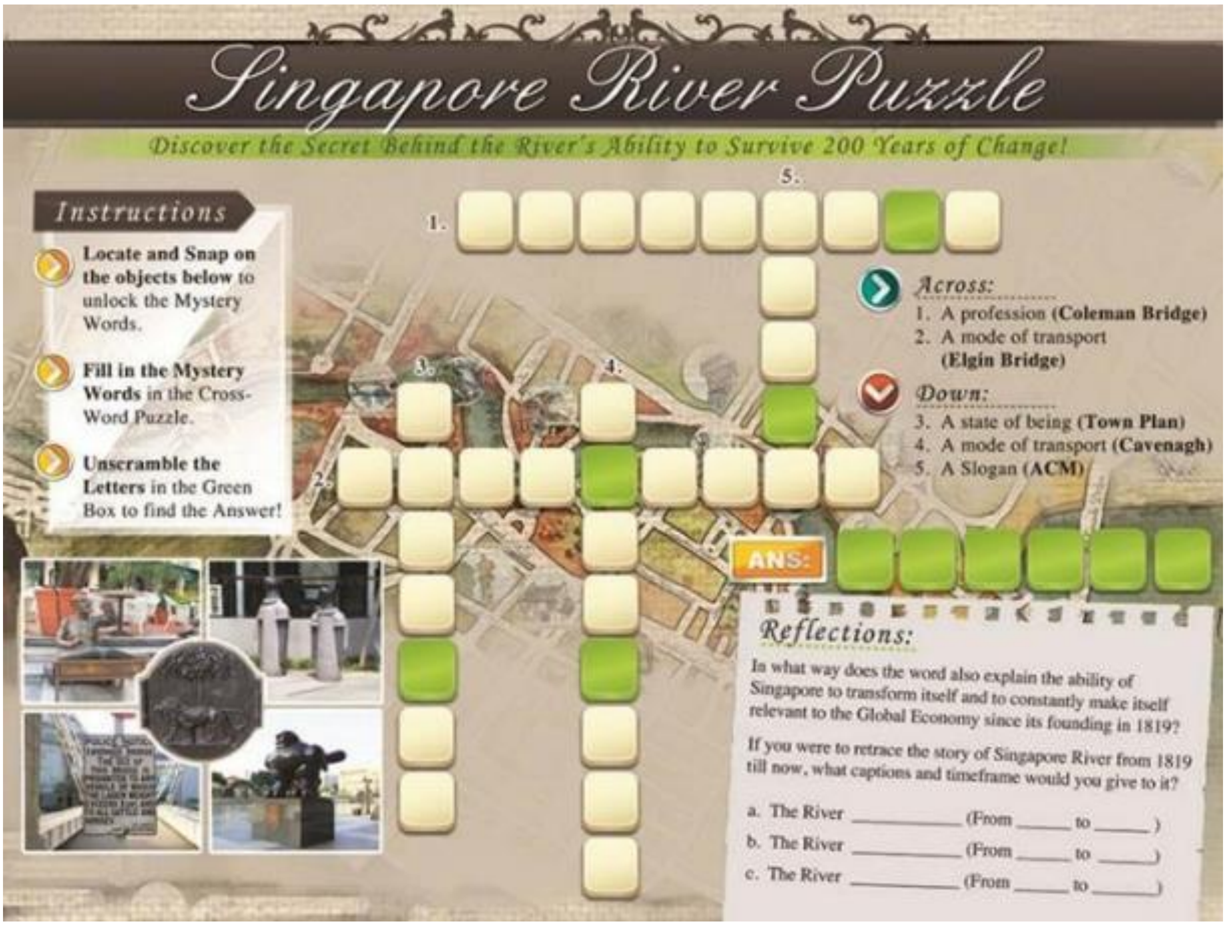


Figure 5: Singapore River 'Amazing Race' Trail Puzzle

Highly Interactive and Engaging Mobile Content

Schools can design user-friendly, intuitive and highly engaging mobile trails for participants to embark upon with very little instruction. LDR has pioneered the development of mobile interactive learning trails in Singapore using various location-based technologies (such as GPS, Image Recognition or Bluetooth) to seamlessly trigger contents over mobile hand-held devices, and the iHTs and iCMPTs created for MOE are now shared to serve as examples as well as templates for teachers to leverage on to create their own.

Figure 6: Samples of School Generated Trails using LOTM Tool

Consistent Look and Feel

Consistency in trail design can be achieved by applying proven pedagogical concepts and time-tested templates in the design and development of new trails.

Examples include trails for Science (e.g. in Singapore Zoo), History (e.g. Singapore River, Civic District 1 & 2), Cultural (e.g. China Town, Kampong Glam, Little India), National Education (e.g. Kent Ridge Park, Labrador Park, City, Army Museum, Singapore Discovery Centre) and Multi-Disciplinary (e.g. Woodgrove Secondary School, NCC Campus) theme using similar methodology. This process has enabled many of our previous participants to embark on other trails without having to go through another technical brief or to re-learn how to use new mobile devices, or grapple with new phone functionality or mobile technologies.

Figure 7: Snapshot of the various mobile trails created by LDR for various themes

Schools can employ the same methodology and templates to rapidly deploy trails and achieve their own desired learning objectives with minimal additional training before each trail for participants and facilitators. Further customisation can also be done, as per example given below for the Chung Cheng High School Heritage Trail, launched by Minister for Education.

Figure 8. Launch of the Chung Cheng Heritage Trail App Interactive Map by Minister of Education, Singapore (Centre)

Figure 9. Screenshots for Chung Cheng Heritage Trail App Map (top) / Cover Page (bottom left) / Menu Page (bottom right)

Figure 10. Screenshots for the Chung Cheng Heritage Trail App Introduction Avatars (left) and Interactive Timeline (right)

In this example, we also incorporated customized avatars, interactive timelines, Augmented Reality (AR) technology, whereby users are submerged in simulated real worlds, where they can visualize complex data and processes in a realistic sensory environment. This provided splendid opportunities to support and enhance the learning process by immersing users in fascinating worlds, that are entertaining, enjoyable, and most importantly, educational. The creative possibilities for such worlds are as unlimited as one's imagination. The key advantages of edutainment in virtual worlds are that complex scientific information or historical stories can be easily communicated through different visualization processes and intuitive interaction.

Team Performance Tracking Features

In addition, schools can make use of the LOTM Tool applications to organise mini **mobile**

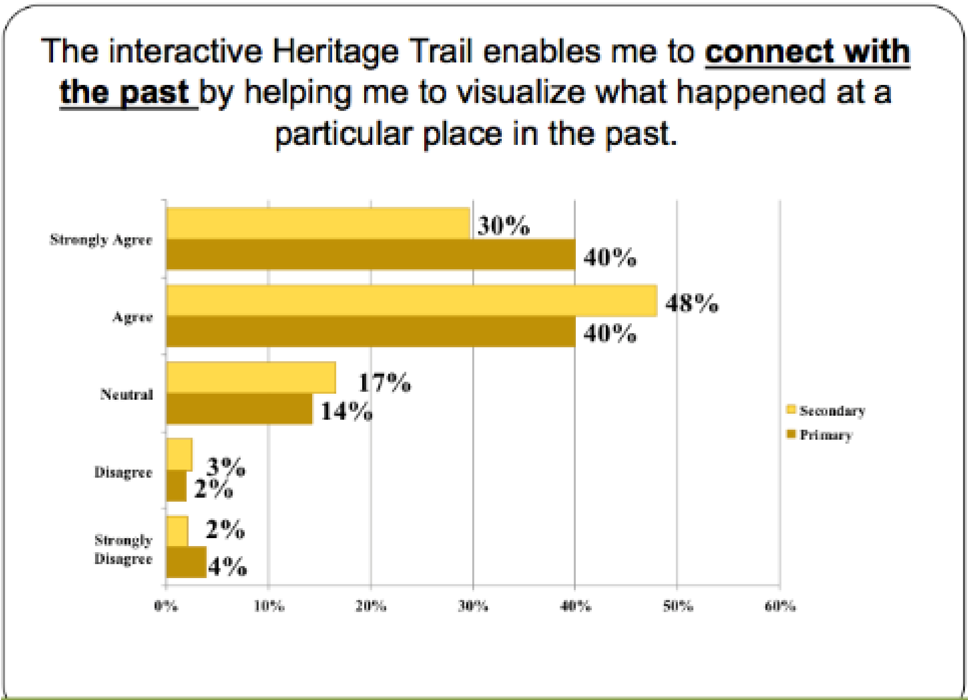
'Amazing Race' for their teachers and students to explore the various parts of the nation in a fun-filled manner. They can make use of the M-Track module of our LOTM Tool to track the locations and performance of users while they are on the move. On-line report generation of users' performance can also be executed through the M-Track module of our LOTM Tool using an iPad or Notebook.

Prizes can then be awarded for Best Photo and Best Video, on top of the Best Team based on quiz results and time to complete the 'Amazing Race' Team-building / Leadership Training trail.

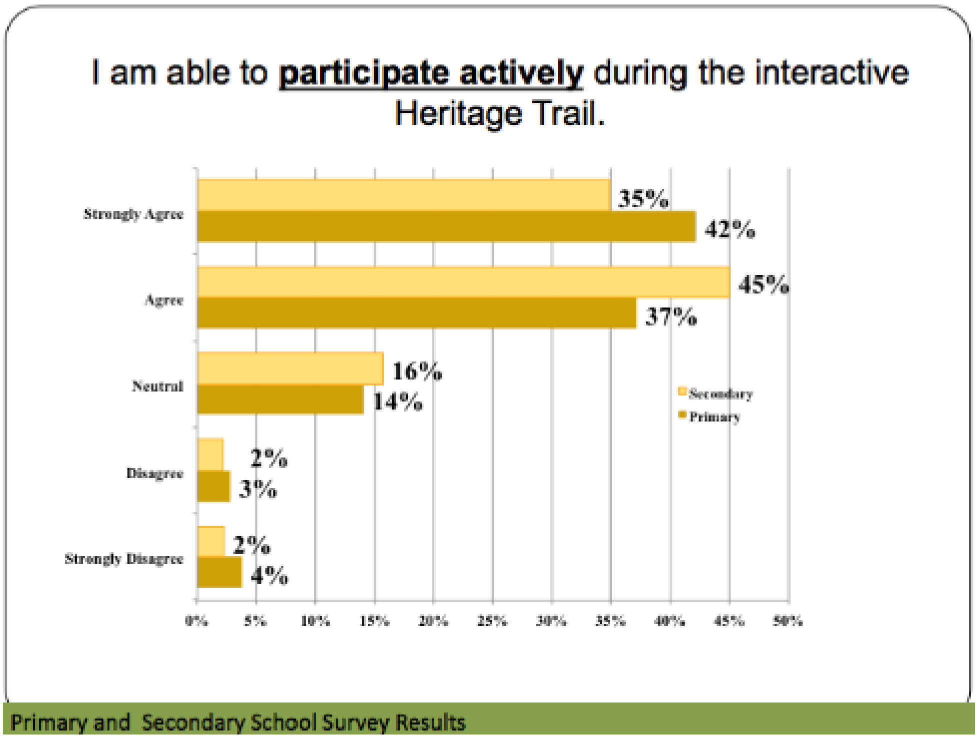
Figure 11. Montage of photos for the Singapore River 'Amazing Race' Challenge Trail conducted for more than 100 participants from United Overseas Bank (UOB)

Corporates, social development groups and other ministries are using mobile trails created by LDR for leadership, cohesion and team-building purposes while enabling their staff to rediscover the rich cultural, natural, historical heritage and lifestyle of Singapore in fun-filled manner. Feedback from the more than 100,000 students and adults who have participated on the mobile trails over the last two years have been excellent, with majority giving a 4 to 5 rating on a 1-5 point rating scale (5 being the highest). Mobile surveys conducted over the last two years at the end of every iHT mobile learning trail for more than 20,000 students reveal that large majority (about 80%) of students who had embarked on the trails said that they were able to learn, connect to the past and participate actively in the trails, and found the trails enjoyable.

The key charts are shown in the Tables below:



Primary and Secondary School Survey Results



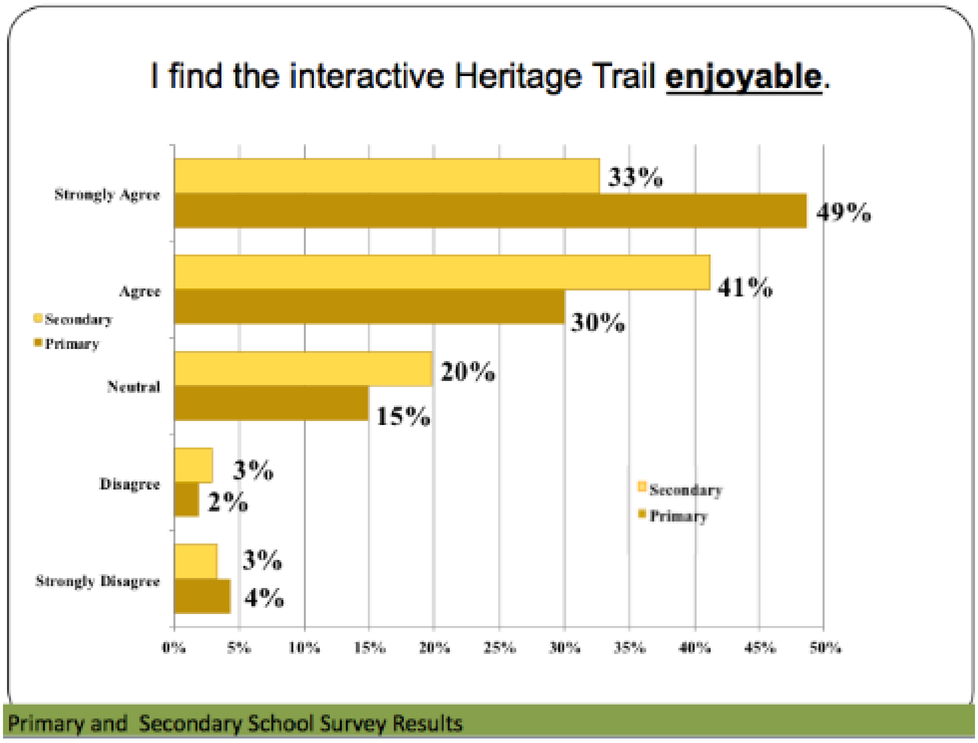


Figure 12. Survey results for iHTs from 2013-2014

What is even more instructive is the comparative analysis Chart below showing an overwhelming 96% of both Primary and Secondary School students preferring to go on iHT Trails that are organised and operated by us rather than Pen or Paper Trail that are run by some other tour/trail agencies.

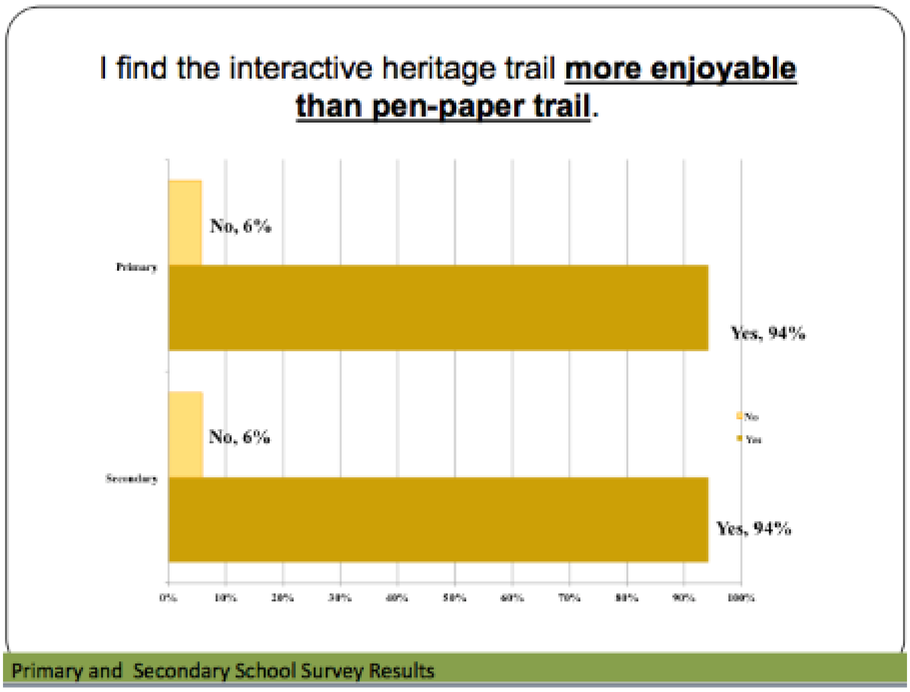


Figure 13. Survey results showing 94% of students prefer the iHTs over pen and paper trails

Awards and Recognitions

LDR's innovative solution has seen the company winning the Best Singapore Infocomm Technology Federation (SITF) 2012 Award in the Mobile App Category; as well as the Best Asia Pacific ICT Award (APICTA) 2012 in the eLearning category. In addition, SiTF has nominated our mobile solution for the **World Summit Award 2014** as the **best example for m-Learning & Education from Singapore.**

Moving Ahead

The Pocket Trips trail creation tool has been developed by LDR as the next stage of upgrade for LOTM. Pocket Trips comprises a powerful **web-based authoring platform** for users to design and develop new **location-based trails to run on their own mobile devices**. The platform is able to publish trails on iOS and Android mobile apps that can be used to create and host learning trails for students, teachers and members of public.

Figure 14. Pocket Trips by LDR Pte Ltd

The unique features of Pocket Trips include:

- •Augmented Reality for way-finding
- •Location-based Triggers: GPS, On-board Image Recognition, Blue-tooth
- •Easy-to-use web-based HTML5 authoring platform
- •Mobile interactive Information, Quizzes, Activities
- •For Android and IOS devices
- •Trail Creation in 3-Simple Steps

•Fully Customisable Content Pages

•Ready Templates, Buttons, Graphics

Once ready, the teachers can publish the finalized version and make it available for download on own public, school or student devices to enjoy the trail. Upon login in the mobile app, users will see a trip overview, and click Start to access the hotspots.

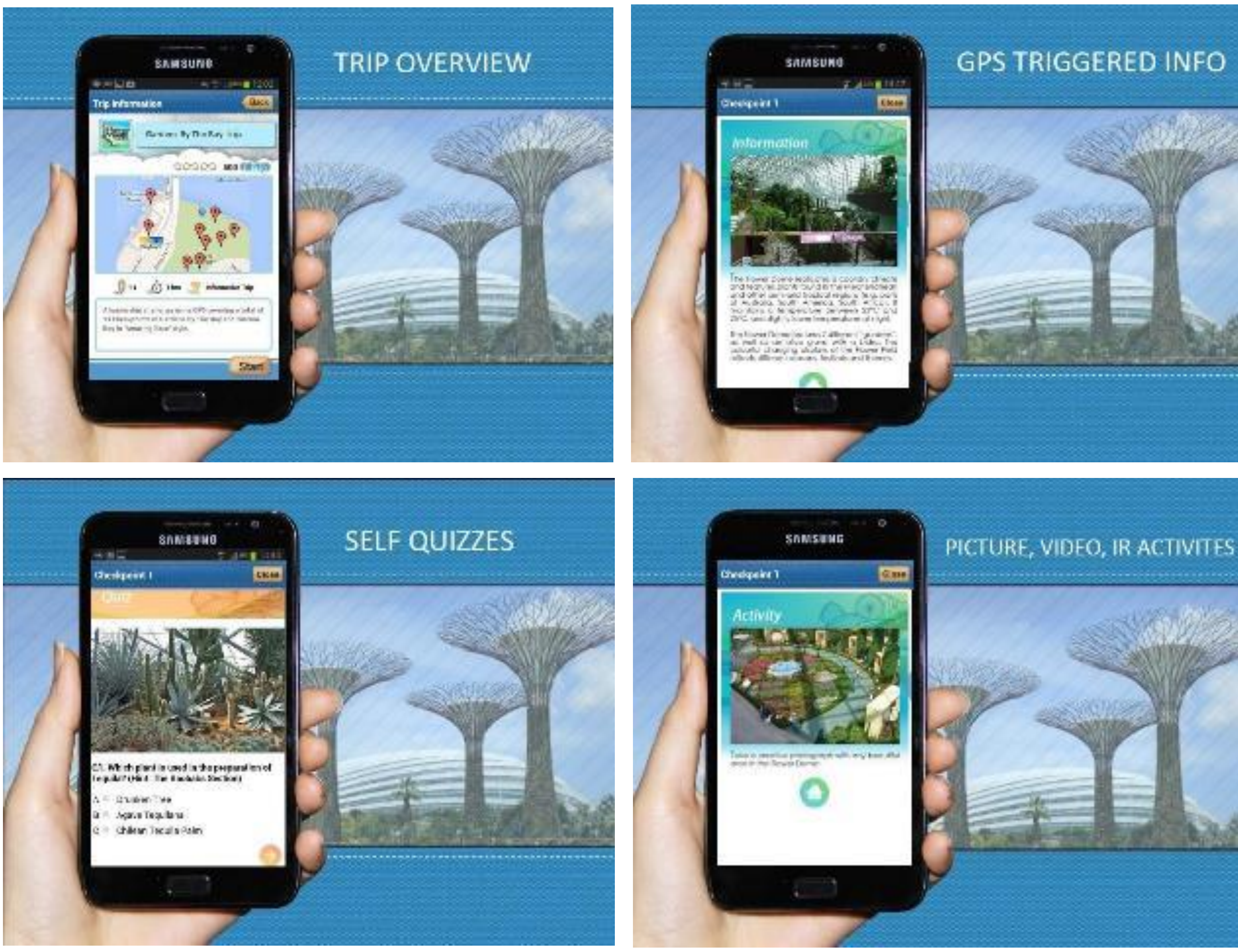


Figure 15. Mobile Hotspot Contents Triggered via GPS to reveal information, self quizzes, picture, video and IR activities in Gardens by the Bay, Singapore

Additional references and information on LDR can also be found in **Annexes A and B**.

More information and photos illustrating how our trails have benefited more than 100,000 participants (from students to working adults) can also be viewed at our corporate Facebook site (www.facebook.com/ldr.pteltd).

ANNEX A USER REFERENCES

A. Ministry of Education (MOE) Singapore

ITEM	DESCRIPTION
Customer Name	**Ministry of Education**
Contact Person (s)	**Ms Elaine Lim**, Deputy Director, Humanities Branch, Curriculum Planning and Development Division
Email	LIM_Pik_Ying@moe.gov.sg
Contact No:	+65 6879 6763
Nature of Customer's Business	Curriculum Planning and Development, Humanities Br, MOE
Project Description	To design, develop, deploy and host a total of **37 CurriculumBased and National Education interactive mobile learning trails for MOE.**
Nature of LDR's Involvement and Deliverables	LDR won the Proposal by MOE to design, develop, deploy and host a total of 37 Curriculum-Based and National Education learning trails for the Ministry of Education covering areas such as Singapore River, China Town, Little India, Fort Canning, Civic District, Central Business District (CBD), Bukit Timah Nature Reserve, Bukit Timah History Trail, Bukit Timah Heartware Trail, etc to help students from JC to Primary Levels experience humanities and national education subjects in an immersive, inquiry-based and experiential manner using location-based rapid authoring tool and hosting the trails on mobile devices supplied by us. MOE HQ has officially launched this new concept of outdoor learning by Minister of Education on 29 May 2012 at the inaugural Humanities Educators' Conference jointly organised by NIE and MOE.
Contract Period	2011-2012
Current Status	100% completed and delivered.

B. Changi Airport Group (CAG)

ITEM	DESCRIPTION
Customer Name	**Changi Airport International**
Contact Person (s)	**Mr Mohamed Shadiq Bin Shawall Hamid**, Senior Manager, Changi Airports International Pte Ltd
Email	mohd.shadiq@changiairport.com
Contact No:	6595 6886
Nature of Customer's Business	Management of airport e-services and corporate communications
Project Description	Design, Development And Deployment Of The **Mobile Explorer@Changi Airport Location-Based Interactive Learning Trail.**
Nature of LDR's Involvement and Deliverables	LDR was contracted by Changi Airport Group (CAG) to design, develop, and deliver a mobile interactive learning trail app in Changi Airport spanning across all three terminals. The content was interdisciplinary and covered topics from aviation and airport history to mathematics and art/architecture. The trail was very well received by the secondary school participants and LDR is currently in discussions with CAG to create more trails.
Contract Period	2013
Current Status	100% completed and delivered.

C. United Overseas Bank (UOB) Ltd

ITEM	DESCRIPTION
Customer Name	**United Overseas Bank Ltd**
Contact Person (s)	**Ms Susan Leong**, Vice President, Talent and Organization Development Human Resources, UOB Ltd
Email	susan.leong@uobgroup.com
Contact No:	68508709
Nature of Customer's Business	Banking and Wealth Management
Project Description	Corporate Trail Delivery for Team-building event using LDR's **'Amazing Race'@Singapore River Mobile Interactive Trail**
Nature of LDR's Involvement and Deliverables	LDR was contracted by United Overseas Bank (UOB) Ltd to customize and organize a team-building event for more than one hundred UOB IT management staff using LDR's location-based mobile trail. LDR combined the trail activities with situational leadership games and challenges and delivered the event with high satisfaction rates by UOB.
Contract Period	2014
Current Status	100% Completed and Delivered

D. National Heritage Board (Singapore)

ITEM	DESCRIPTION
Customer Name	**National Heritage Board**
Contact Person (s)	Mr Alvin Tan, Director, Heritage Institutions, National Heritage Board
Email	Alvin_tan@nhb.gov.sg
Contact No:	6332 5480
Nature of Customer's Business	Heritage and Conservation
Project Description	To design, develop and deploy a **"Battle for Singapore" Heritage Mobile App on iOS**
Nature of LDR's Involvement and Deliverables	LDR was contracted by NHB to develop a mobile interactive learning app on iOS as a downloadable self-directed app to commemorate the 70th anniversary of the Battle for Singapore during World War II. To date, more than 4,000 downloads have been recorded.
Contract Period	2012-2013
Current Status	100% completed and delivered

E. Nanyang Technological University (NTU)

ITEM	**DESCRIPTION**
Customer Name	**Nanyang Technological University**
Contact Person (s)	Kaleivani d/o Arumugam (Ms)
Email	kalei@ntu.edu.sg
Contact No:	(65) 6790-5811
Nature of Customer's Business	One of the top universities in Singapore, providing higher education and research
Project Description	**LOTM Trail Creation Workshop and Trail Operation for 'An Induction Program with a Difference'**
Nature of LDR's Involvement and Deliverables	LDR conducted a LOTM Trail Creation workshop for NTU HR Office, and now supports the quarterly runs of the NTU Staff Induction trail with a variety of hotspots all across Nanyang Technological University. Each hotspot has interactive quizzes, and activities that get the new staff engaged upon GPS and IR activation.
Contract Period	2012-2014
Current Status	100% completed and delivered

F. GKS Command and Staff College (SAF)

ITEM	DESCRIPTION
Customer Name	**Goh Keng Swee Command and Staff College**
Contact Person (s)	LTC (NS) Terence Goh
Email	Tgkm7@yahoo.com.sg
Contact No:	98184911
Nature of Customer's Business	GKS CSC is the premier training institute of the Singapore Armed Forces. The main thrust of its educational system is directed towards developing the student's professional judgment and intellectual growth, through the creation of an environment that generates innovative and creative thinking.
Project Description	**Outdoor 'Amazing Race' Team-building-team-learning activity for GKS CSC**
Nature of LDR's Involvement and Deliverables	LDR created and has run multiple runs of the "Re-Making of Singapore" outdoor 'Amazing Race' mobile interactive trail in Marina Bay to support the team-building-team-learning activity as part of CSC's end-of-course summary exercise for both local and international officers, fusing LOTM's location-based triggers with video- and photo-taking activities.
Contract Period	2013 - 2014
Current Status	100% completed and delivered

G. NATIONAL CADET CORPS (NCC)

ITEM	DESCRIPTION
Customer Name	**HQ National Cadet Corps (NCC)**
Contact Person (s)	MAJ (NS) Singam Suppiah
Email	suppiah_veerasingam@moe.gov.sg
Contact No:	98578367
Nature of Customer's Business	HQ National Cadet Corps is the Head Quarters for the NCC military cadet corps youth organisation supported by the Singapore Ministry of Defence and the Ministry of Education. The primary mission of the organisation is to develop resourceful, responsible, resilient, loyal leaders and team players through fun and challenging military-related activities.
Project Description	**NAVIGATION TRAIL USING POCKET TRIPS**
Nature of LDR's Involvement and Deliverables	LDR conducted a location-based navigation trail using Pocket Trips for cadets to: • Uncover information and quizzes at the various hotspots • Solve a trail puzzle challenge within the stipulated time using clues given at each hotspot, triggered using on-board Image Recognition
Contract Period	2014
Current Status	100% completed and delivered

H. Ministry of Education (MOE) S1 CLUSTER

ITEM	DESCRIPTION
Customer Name	**MOE S1 CLUSTER (comprising total of 13 primary and secondary schools)**
Contact Person (s)	Mr Steven Wong
Email	wong_chiow_kwei_steven@moe.edu.sg
Contact No:	94791248
Nature of Customer's Business	MOE S1 Cluster's intent is to create a series of heritage trails in various areas including Serangoon, Ang Mo Kio, Hougang and Kovan as part of MOE's SG50 Trails and Exhibition project to celebrate and commemorate Singapore's 50th Anniversary.
Project Description	**COMMUNITY LEARNING TRAILS USING POCKET TRIPS**
Nature of LDR's Involvement and Deliverables	LDR conducted a trail creation workshop attended by 20 teachers on the use of Pocket Trips to create fun and engaging trail experiences for public and students to enjoy: • Uncovering information and quizzes at the various hotspots • Solving trail activities, triggered using GPS and on-board Image Recognition to learn more about each heritage site
Contract Period	2014 - 2015
Current Status	Awarded

ANNEX B Additional Information

Here is a summary of the milestones leading to development of the LOTM Tool:

(a) In Mar 2009, LDR won a 4-year contract to design, develop and operate a series of C2S (Commitment to Singapore) program for **HQ National Cadet Corps (NCC)** to build leadership and learning competencies.

(b) By Apr 2010, LDR Pte Ltd had developed more than **15 highly interactive mobile learning trails** to help students and adults alike to appreciate the rich historical, cultural and natural heritage of Singapore using location-based technology.

(c) In May 2010, LDR was invited to speak on `Singapore's Location-based Mobile Learning Experience' in the **2nd Advanced Distributed Learning Seminar held in UK** through the recommendation of IDA.

(d) In Oct 2010, LDR won the **Call-for-Collaboration LOTM Tool Project initiated by IDA** to develop a software-based tool to enable teachers to create mobile learning trails in order to enhance learning beyond the classroom.

(e) In Feb 2011, CEO COL(Ret) Png Bee Hin was invited to the **2nd International Teachers' Conference in Indonesia** to share on the topic 'The Mobile Learning Wave - Trends & Applications' hosted by the Minister of Education Indonesia and attended by more than 600 over principals and teachers from across Indonesia.

(f) In April 2011, LDR won a contract from MOE to develop more than **32 curriculum-based mobile learning trails for the Ministry of Education, Singapore**.

(g) In Dec 2011, LDR won a contract from **National Heritage Board (NHB)** to develop a **`Battle for Singapore' app** for the iPhone to commemorate the 70th Anniversary of the Fall of Singapore which has been downloaded more than 4,000 times since its launch.

(h) In March 2012, LDR conducted workshops in the **International Conference for Teaching and Learning with Technology (ICTLT) 2012** and organised learning journeys for delegates using the Heritage Trails developed by LDR.

(i) In April 2012, the **interactive Cultural Mapping Trails** developed using the LOTM Tool were launched by the Minister for Transport.

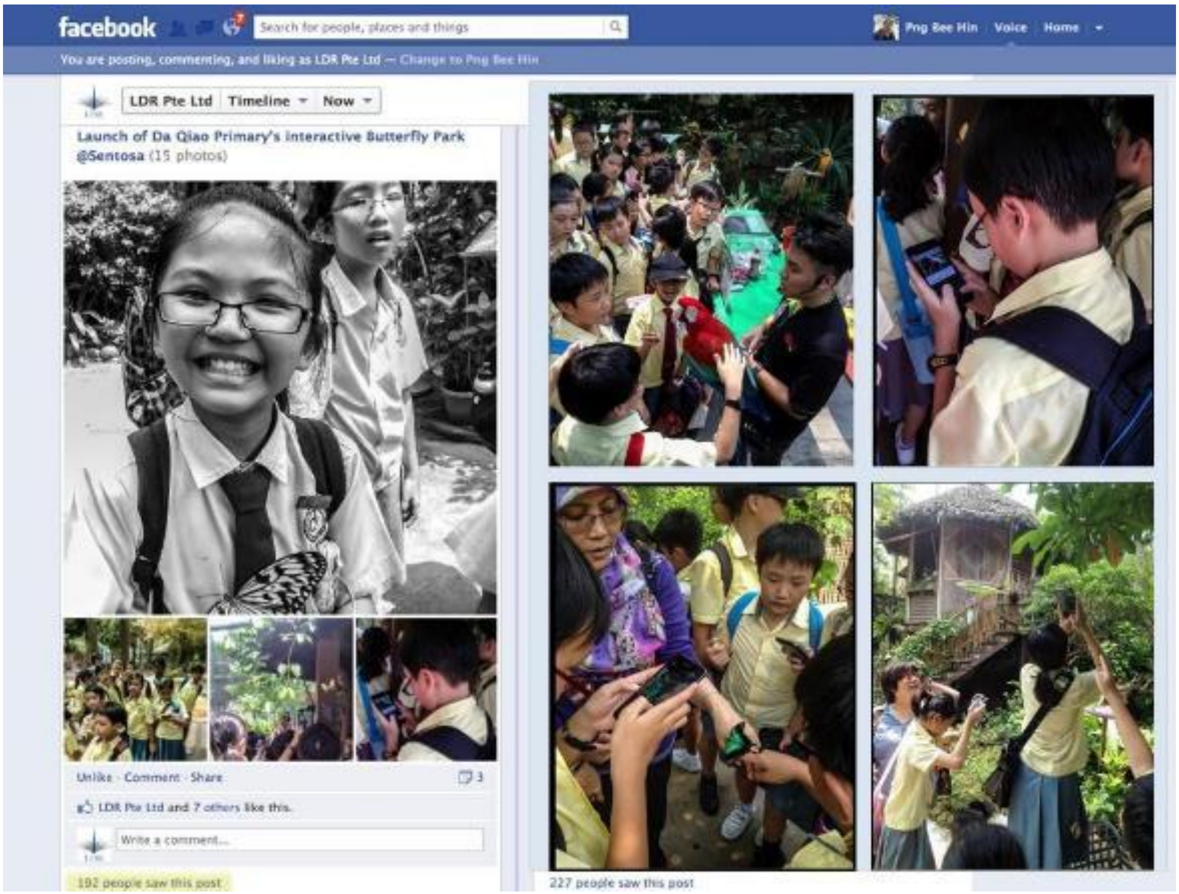
(j) On 30th May 2012, the **interactive Heritage Trails (iHTs)** and **LOTM Tool** were launched by the Minister for Education (Singapore) in the presence of more than 1,000 Humanities teachers. More than a hundred schools have since signed up for the license to book and run the iHTs.

(k) In April - May 2012, LDR was invited by IDA to showcase our LOTM Tool in **COMEX ASIA 12** in **Oman** and also with education counterparts in **Qatar.**

(l) On 24th Oct 12 to 25th Oct 12, LDR participated in the inaugural Mobile Learning Asia Conference.

(m) Between 1st Nov 12 to 31st Jan 13, LDR organised and trained more than 10 MOE schools on the use of the LOTM trail creation module, including Da Qiao Primary School which created the Butterfly Trail in Sentosa Island on Android devices (diagram below).


SAMSUNG
Butterfly Park Entrance
BUTTERFLY PARK
Hello and welcome to the Butterfly Park! Discover more by clicking on any of the buttons below.
Info
Activity
Quiz
DA-QIAO PRI
Butterfly Trail@
Sentosa Island



(n) On 5th December 2012, LDR emerged as the Top Winner of Asia Pacific ICT Award (APICTA) 2012 in the eLearning Category, whereby we showcased the Mobile Learning solutions using both our LOTM mPlayer App and location-based capabilities for GPS and Image Recognition. This was against a total of some 156 nominations from 16 other countries competing in 17 different categories.

(o) Between August to December 2012, LDR has also received two Awards for our Learning-On-The-Move (LOTM) Tool for the **SiTF Awards Competition**, viz for **Mobile App category** (**Silver** –highest in the category) and **eGovernment category** (**Bronze** – only private company to win in this award category). Both IDA and SiTF have also nominated us for the **ASEAN ICT Award 2013**. In addition, SiTF nominated us for the World Summit Award 2014 as the best m-Content example in m-Learning & Education from Singapore.

(p) Today in 2015, we are also beginning to see a new trend of adult learners coming onboard from the corporate world (such as SINGTEL, STENGR, CISCO CERTIS, SAF etc) as well as from the Community Development Groups (such as PA, SINDA, NPPD, NACLI), using our award-winning LOTM Tool and location-based collaborative trails for **social cohesion, team building and leadership development purposes.**

A new wave of innovation using mobile learning analytics for flipped classroom

Gary K. W. Wong

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Flipped classroom is used by many teachers nowadays to enrich students' learning experience through active learning activities in the classroom. To prepare the students for these active learning activities, the teachers typically provide pre-recorded video lectures and various computer-mediated learning activities for the students to go through online before the lessons. This out-of-classroom learning is further facilitated by mobile technology as the students can access these learning materials anytime anywhere on their mobile devices. With such a greater variety of learning activities outside of the classroom, attendance records and homework assignments may not be adequate anymore to formatively assess the students' learning. Instead, the concept of learning analytics may better serve the purpose as it provides rich statistical data on the students' activities in the learning management system, thus facilitating the analysis and evaluation of their participation and learning effectiveness. This paper describes an initiative to use mobile learning analytics to understand the learners' behaviors outside the classroom under flipped learning. Issues and implications for designing flipped learning with mobile technology and learning analytics are discussed. Empirical data on the students' perceptions of this initiative is presented as well to supplement the analysis.

Keywords: mobile learning analytics; flipped classroom; pedagogical design; student engagement; BYOD

Introduction

The use of information and communication technology (ICT) has always been an important factor to impact education. The ultimate goal when using ICT is to enhance teaching and learning through student-centered pedagogy. Many research studies have shown that ICT aided pedagogy should be constructivist, emphasizing collaborative and interactive learning experience (Bishop & Verleger, 2013; Fadel & Lemke, 2009; Roschelle, Pea, & Hoadley, 2000). In this direction, the flipped classroom approach (Jensen, Kummer & Godoy, 2015; Lage, Platt, & Treglia, 2000), in which in-person classroom lectures are flipped with other learning activities at home, offers one possible solution as a way to realize the student-centered pedagogy and the benefits of active learning, which mainly focuses on bringing activities, promoting student engagement in class, and encapsulating the idea of "learning-by-doing" in the pedagogy (Wong & Cheung, 2015). From the perspective of teacher professional development, the flipped learning approach helps transform the pedagogical beliefs of the pre-service and in-service teachers to open up a creative space for innovative pedagogical development beyond the borders of the traditional system, thus echoing with the idea of a transformative learning (Elias, 1997) to develop a community of practice (Wenger, 1998) for these teachers.

One key aspect of flipped learning emphasizes on the pre-class preparation in an asynchronous manner. With the emerging mobile technology, students often bring their mobile devices anywhere any time to access the learning materials through the learning management platform (e.g. Moodle, Schoology) (Wong, 2014). Despite being a defining characteristic of the flipped classroom, this pre-class preparation brings challenges for teaches to assess and evaluate their students' learning progress between two face-to-face lessons. One way to resolve this issue is through learning analytics, which often refers to the collection, analysis and reporting of data about learners in their learning context by using the techniques of data mining (Ali et al., 2012; West, 2012). Learning analytics provides a possible new way of looking into these data and is an emerging research area in educational technology (Kumar et al., 2015; Ma et al., 2015). Besides, the learning analytics has been suggested for an extension to mobile platforms in order to analyze the learning process of students outside of classroom when mobile devices are adopted (Shoukry, Göbel, & Steinmetz, 2014). However, this area of study is very limited and challenging, and how to take the advantage of the learning analytics to cooperate with mobile learning experience and teaching pedagogy is also not well addressed in literature (Fulantelli, Taibi & Arrigo, 2014).

In this study, we aim to investigate how mobile learning analytics can assist educators to understand the learners' behaviors outside of classroom in flipped learning. Our goal is to find out how learning analytics can help educators understand the mobile learning behaviors of students outside of classroom under flipped classroom. More importantly, the ultimate goal is to discuss how teachers can use mobile learning analytics effectively to enhance the quality of formative assessment. Further direction on mobile learning analytics is exemplified through the perceptions of students and teachers in this study.

Conceptual framework

Flipped learning model

In simple terms, the flipped learning model is a teaching arrangement in which didactic lectures are moved outside of the face-to-face teaching sessions to allow more time for active learning in the classroom (Bergmann & Sams, 2012; Bishop & Verleger, 2013). Active learning here involves engaging students in an activity that "forces them to reflect upon ideas and how they are using those ideas" (Collins & O'Brien, 2003, p. 5). This reflection, according to Bonwell and Eison (1991), is associate with higher order thinking tasks including analysis, synthesis, and evaluation. There is empirical evidence suggesting that the flipped learning model leads to better students' engagement and learning outcomes (Bishop & Verleger, 2013).

In practice, swapping in-class learning with out-of-class learning as compared to the traditional model operationalizes the notion of flipped learning. Before the teaching sessions, the students go through out-of-class learning by watching video lectures and completing pre-lesson assignments at home. This leaves more time for in-class active learning activities in the face-to-face sessions since contents have already been delivered in prior. This is in contrary to the traditional teaching model, in which the in-class learning component is dominated by didactic lectures, whereas the students have little chance to actively reflect on the contents until they do the homework or revision at home (Wong & Cheung, 2015). This key difference is tabulated in Table 1.

Table 1: Traditional teaching vs. flipped classroom teaching

	Traditional teaching	**Flipped classroom teaching**
Out-of-class learning	Students complete the homework and make revisions at home.	Students watch the video lectures at home before coming to class.
In-class learning	Students listen to lectures and take part in minimal in-class activities, as time is limited.	Students have more time for active learning activities because contents have been delivered in prior.

There is plenty of empirical literature on how practitioners implement the flipped learning model in their classroom. In an early study of the flipped classroom in an undergraduate economics course, for example, Lage, Platt and Treglia (2000) “inverted” their classroom by providing videotaped lectures and narrated PowerPoint slides for the students to watch at home. The teachers’ talking time in the face-to-face teaching sessions was greatly reduced. Instead, the lessons started with 10-minute mini-lectures in which the teachers answered the students' questions regarding the video or narrated slides. The students then worked together on practical problems for the most of the lesson time. The lessons ended with another question and answer session and a conclusion by the teachers.

With the advancement of communication and information technology (ICT) in decade that followed, researchers and practitioners now have a greater variety of choices on how they deliver the out-of-class learning components. Many teachers prepare their own video lectures and upload to YouTube for sharing with the students. It is also a common practice for teachers to adopt learning management systems (LMS) as online platforms from which students can watch the streamed videos and download other course materials. In addition, modern LMSs are often equipped with a rich set of interactive learning tools such as online discussion forum, online quizzes, instant feedback tools, and functionalities for peer reviewing. Many of them support mobile view so that these learning activities can be performed on mobile devices in addition to desktop computers.

The need for learning analytics in the flipped classroom

The flipped learning model implies that there are now a greater variety of out-of-class learning activities. Similar to the homework assignments in the traditional model, the out-of-class learning activities serve as part of the students' formative assessment, which guides the scaffolding the students' learning. Different from the homework assignments in the traditional model, the participation of out-of-class learning activities represent more of a process than an interim learning outcome. It is a pre-learning process to prepare for the in-class activities, rather than as an evaluation of how well the students learn from the didactic lectures as in the traditional model. The pre-learning process may lead to measurable learning outcomes in a later stage, but until that happens, the teachers may not have any information about the learning progress of the students. For example, active participation in online discussion may reflect that the students are engaged in the learning process, yet if the teachers assess the students merely by the quality of discussion, they may not conclude significant learning outcome because the discussion represents an on-going learning process.

The difficulty in assessing the learning process also leads to another challenge. While the flipped learning model relies on students' preparation outside the class (Herreid & Schiller, 2013), it is a common concern that students do not always complete the pre-learning as instructed (Butt, 2014). One possible reason is that, unlike homework assignments in which non-submission indicates lack of participation, it is not straightforward in the flipped classroom to hold the students accountable for participating in the out-of-class learning. To resolve this, some authors suggest using homework and in-class quizzes appropriately to motivate the students (Butt, 2014; Gilboy, Heinerichs, & Pazzaglia, 2015; Herreid & Schiller, 2013; Tune, Sturek, & Basile, 2013). Others emphasize the importance to continuously monitor the students' progress (Gilboy et al., 2015).

These challenges suggest that a new type of data is needed to formatively assess the students' pre-learning process. Data mining techniques are designed commonly for collecting large-scale of data, extracting actionable patterns, and obtaining insightful knowledge (Gundecha & Liu, 2012). By using these data mining techniques to effectively analyse the interaction data, personal data, systems information and academic information collected from the LMSs, educators can better understand the deep thinking of students during the learning process, as well as capture and visualize their behavioural intention or motivation in learning (Mazza & Milani, 2004; Romero et al., 2008). This information will facilitate the assessment of students through a systematic and real-time approach, to identify effective pedagogic changes for particular students (West, 2012), and to guide them through the learning process with the ultimate goal of optimizing their learning outcome (Ferguson, 2012).

The literature discusses a few examples of how learning analytics can be used to assess or evaluate the students' participation in out-of-class learning:

(1) A low access rate of online materials may indicate dropout, disengagement, or the need for special help by individual students (Deschacht & Goeman, 2015). Low access rate by the whole class may indicate a need for appropriate actions to be taken to motivate the students as a whole or to improve the learning materials.

(2) Textual mining technique can analyze how much the online posts to discussion forum are correlated with other peers (Baker & Inventado, 2014).

(3) The video watching behaviors may reveal information about how students learn while watching the video, e.g., how often they rewind or forward a video lecture and the frequency of students pause at certain scenes (Giannakos, Chorianopoulos & Chrisochoides, 2015).

(4) Learning analytics can capture how active students learn through mobile devices and their mobile social behaviors with other classmates as a new trend for mobile analytics apps (Chen, Chiang & Storey, 2012).

Currently, there are a few available learning analytics tools to visualize the student behaviour and activities, such as Moodle, Schoology, SNAPP (Dawson, Bakharia, & Heathcote, 2010), Student Activity Meter (Govaerts, Verbert, Duval, & Pardo, 2012), GLASS (Leony et al., 2012), LOCO – Analyst (Jovanovic´ et al., 2007), and Cohere (De Liddo et al., 2011). Moreover, with the help of mobile technology, learning analytics can be extended to cover the analysis on mobile platforms known as mobile learning analytics (Aljohani & Davis, 2012). However, analysing mobile data is challenging because of the nature of mobility leading to different social behaviours and interactions, which will require a new way to investigate and solve the issue (Ferguson, 2012). Currently, this area has a very limited contribution in literature, and the pedagogical implementation is not well addressed (Fulantelli, Taibi & Arrigo, 2014).

The pilot study

To investigate the use of learning analytics in flipped classroom, the author conducted a pilot study to analyse the learning analytics collected from two undergraduate courses that used the flipped learning approach. This section documents the setting of the out-of-class learning components of the flipped classroom and the methodology used to collect the data.

Settings of the out-of-class learning components of the flipped classroom

Two undergraduate courses taught by the author were selected for the study. One of the courses was taught in the summer semester and fall semester of the 2014/15 academic years, while the other was taught in the spring semester of the same academic year. The class size was below 40 in all the three teaching sections. Both courses adopted the flipped learning model consisting of out-of-class learning followed by in-class learning activities as descripted above.

The out-of-class learning components consisted of video lectures that were either prepared by the teacher or adopted from existing resources on the web. The videos prepared by the teachers were sliced into short clips and each focused on a particular sub-topic of the lesson. Most video clips were below 10 minutes in length, while the total length of videos to be watched prior to each lesson was maintained below 30 minutes. The adopted videos come in more variety in terms of length and content. The students were asked to watch the videos regularly before the lessons. In one of the courses, the videos taught the concepts and procedures required to complete in-class lab exercise and problem-solving activities. In the other course, the students watched the videos to gain the foundational knowledge of the topics. They then prepared individual presentations on the topics to be delivered in the face-to-face teaching sessions. They were also required to regularly write reflective blogs on the videos and submit them to the online discussion threads.

To facilitate the students to access the videos, the links to the videos were posted to Schoology, a cloud-based LMS service that was free of charge to use. Also available on Schoology were course notes and reference materials. In addition, the teacher set up discussion threads in the built-in discussion forums and asked the students to participate in online discussion with their peers or submit their pre-lesson preparation works.

Schoology was mobile-friendly. Students can access the course materials and take part in the learning activities via its mobile view or the Schoology app installed in their mobile phone. Using mobile devices to engage the students in the flipped classroom could extend their learning experience outside of classroom and afford the reflective engagement (Smith et al., 2015). Mobile technology extends the learning process anywhere at any time. This advantage becomes more obvious for learners living in metropolitan area where people always need to take public transports between locations. During that time, people can find many tasks to do ranging from reading books to playing video games. Mobile technology would help fulfil the goals of this type of learners.

Technical specifications

Technically speaking, Schoology was chosen as the platform to assist the flipped classroom because it provides a mobile learning environment to students and teachers. It supports both browser-based access and mobile native apps option (available to Apple iOS and Android). Schoology offers various educational-based features such as document and multimedia sharing, discussion forum, announcements and updates, assignment and assessment, polling, mobile native apps version, and most importantly the build-in analytic tools. A certain level of security is available to manage the users who could access to the course materials, and prevent outsiders to interfere the learning process by requiring students to register to the course with the access code. The course instructor provided approval after performing crosschecking with the names with the registered list. Figure 2 shows the main page of the course in Schoology and the structures of the course materials organized in a sequential fashion. Figure 3 shows the iOS mobile apps version user interface.

Figure 1. Course main page in Schoology and the structural representation

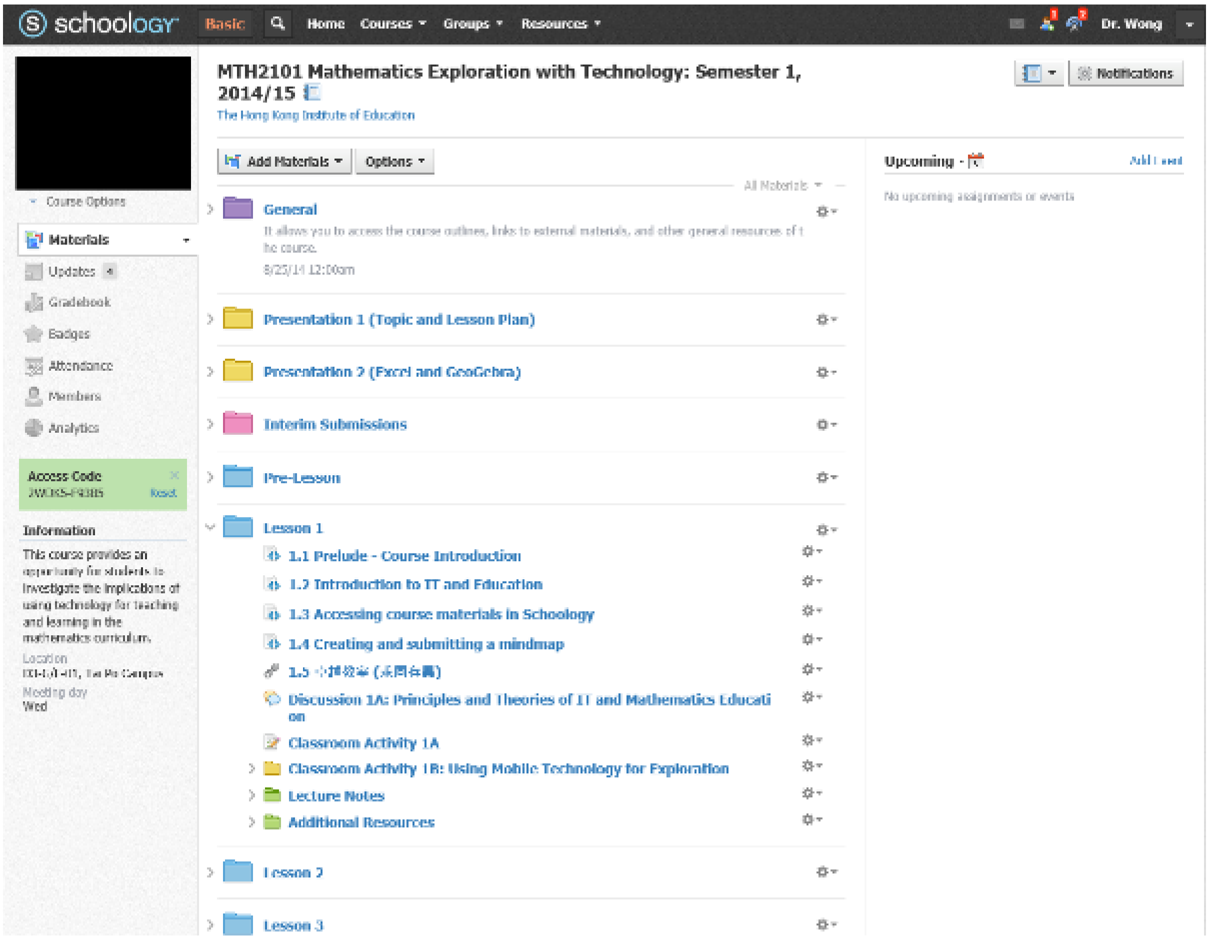


Figure 2. Course main page and lesson materials from iOS Schoology apps

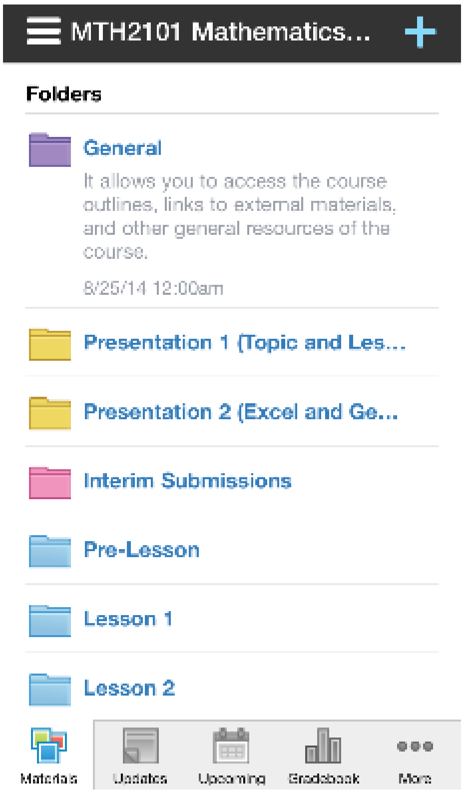


Figure 3. Lesson materials from iOS Schoology apps

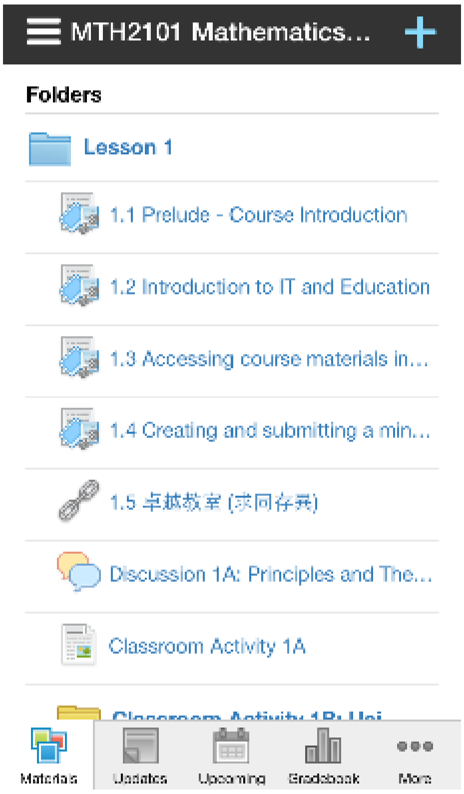
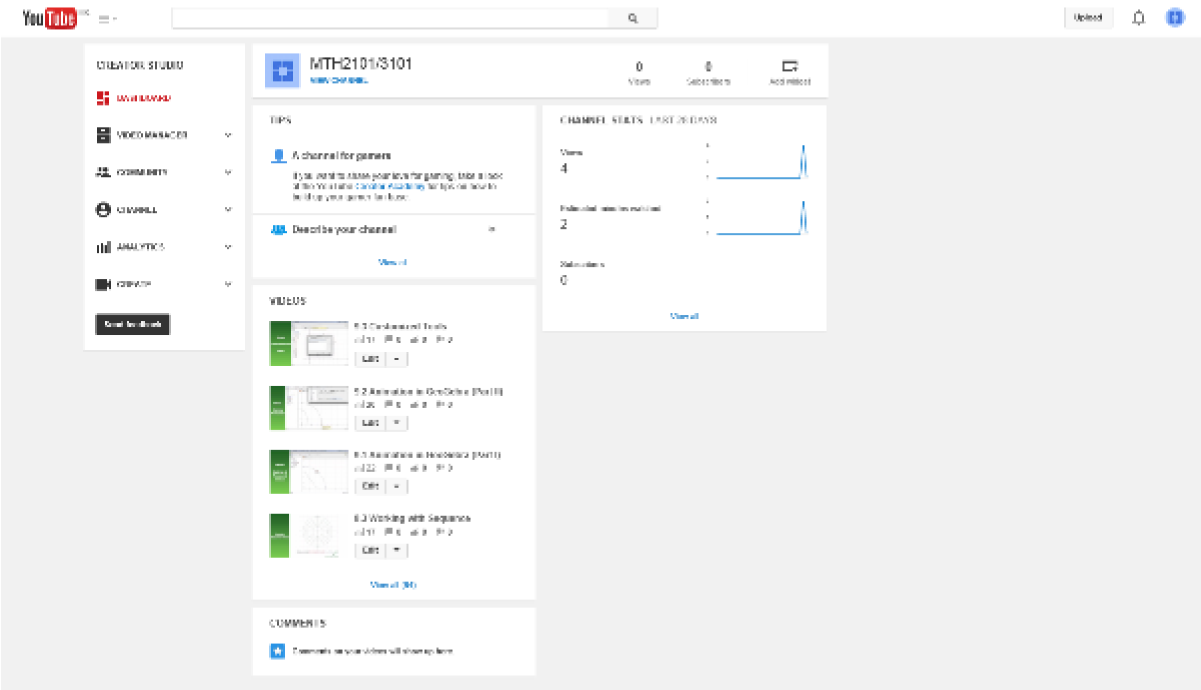


Figure 4. YouTube Creator Studio offers various learning analytics tools to users



YouTube was chosen to host the videos because it offers more features targeting to video sharing, such as high storage volume, various selections on video playback quality, completely available on various mobile operating system platforms, and targeted video learning analytics. Figure 4 shows the Dashboard of YouTube Studio. In the current study, YouTube videos were embedded through adding their links to the Schoology. Students could then link to these videos from Schoology and watch them anytime anywhere.

Methodology

Learning analytics already available in Schoology and YouTube were used for data collection. In Schoology, there are a few built-in analytics such as Course, User, Assignment, Discussion and Links. For example, Figure 5 shows the total hits per day in the course on Course Analytics. The User Analytics captures the “Last logged in”, “Last course access”, “Total time in course”, and “Number posts”. The Assignment Analytics reports the total views on the assignment description; The Discussion

Analytics shows the number of posts in each discussion forum; The Links Analytics provides the count of clicks to the URL provided by the instructors.

While Schoology provides useful access statistics to course materials in general, it does not offer any analytics to monitor the video watching activity because the latter were hosted on YouTube and added to Schoology as hyperlinks. It was therefore necessary to rely on the tools in YouTube to observe access rate of video lectures. Particularly, the Analytics available in the Creator Studio of YouTube offers some sophisticated features to capture the activities of users when watching these video lectures. For example, it tells the numbers views in overall, estimated minutes watched, number of Likes/Dislikes, number of comments, and even their demographics (e.g. playback location and gender). Statistics in each individual video are available as well. Figure 4 shows the Dashboard in the Creator Studio, where the left side bar provides the access to the mentioned analytic tools.

The study was also supplemented by questionnaire data on the student's perceptions of the learning analytics. The questionnaire consisted of the following open-ended questions distributed to the students in one of the courses in the study:

(1) How does the learning analytics affect your learning motivation and learning methods in this course? Why?

(2) Do you think the use of learning analytics by the teacher will be helpful to your learning? Why or why not?

(3) What is your feeling about the teacher's use of learning analytics to analyze the process of your learning?

(4) How will it change your learning if the learning analytics data is available to you as students instead of only being available to teachers?

(5) What other analytics data should be introduced to help understand better the student learning?

The questionnaire was made using online Google Form available through embedding to the Schoology. The students were invited via the Schoology where they could indicate their voluntariness in the questionnaire. These students were from different major departments, and their biographic data were not collected, as they are not of concern in this study. All student participants were assured of the confidentiality of their identity in data reporting based on the consent form they submitted before the beginning of the questionnaire. Each participant was expected to complete the questionnaire in approximately 10 minutes. The data collection took two weeks since the invitation until the deadline.

The questions are all open-ended and therefore the answers are qualitative and unstructured. The responses were mainly in Cantonese while some were written in English. The author translated them into English before analysing it qualitatively using the iterative coding process in Creswell (2002) to identify the categories, themes, and patterns that emerged from the data.

Results and analysis

Access to course notes and learning activities

The following online viewable analytics data were collected from the course during fall semester 2014/15. The teacher checked the analytics regularly and observed the behaviour of students outside of the classroom. The different types of statistical analysis shown in the following figures highlight the participation and learning process of the class and the individual students. Figure 5 to 6 show the students' frequency of access to the materials in Schoology and their activeness in participating all the tasks assigned outside of classroom. Specifically, Figure 5 shows that students usually had a high peak participation rate in Schoology around the time for face-to-face lessons. A similar pattern is observed from other activities such as online discussion (see Figure 6).

Figure 5. Course analytics with total hits per day and overall summary

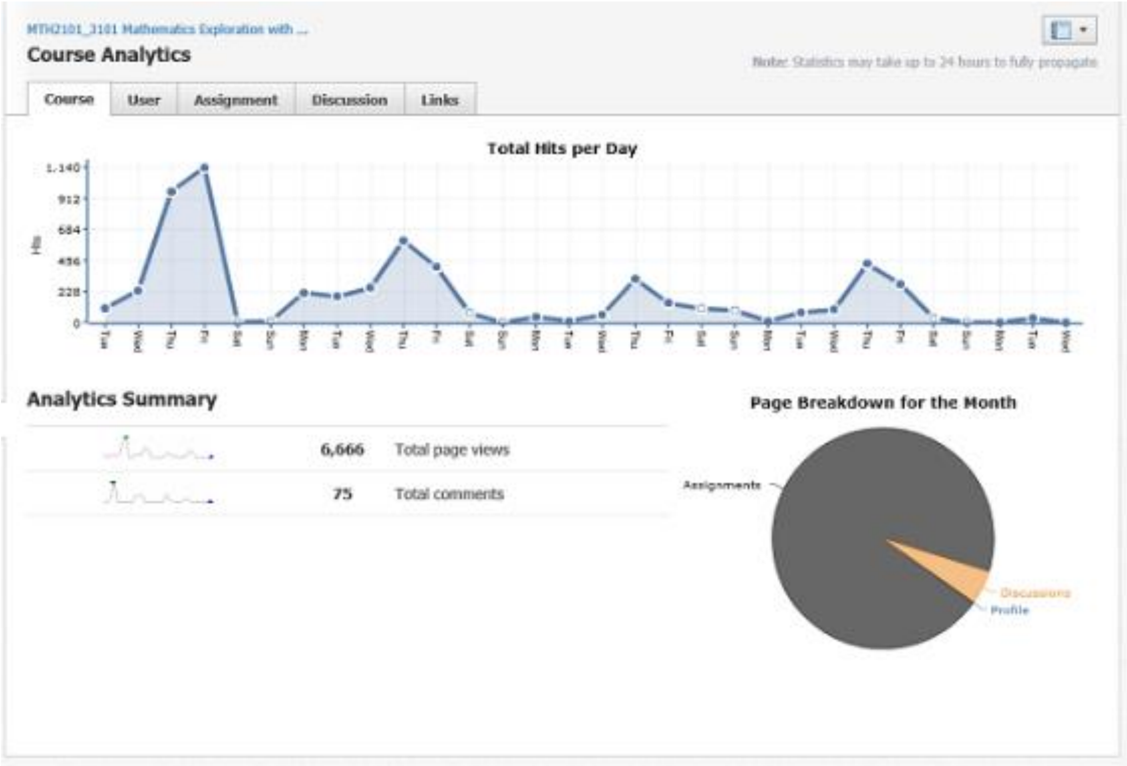
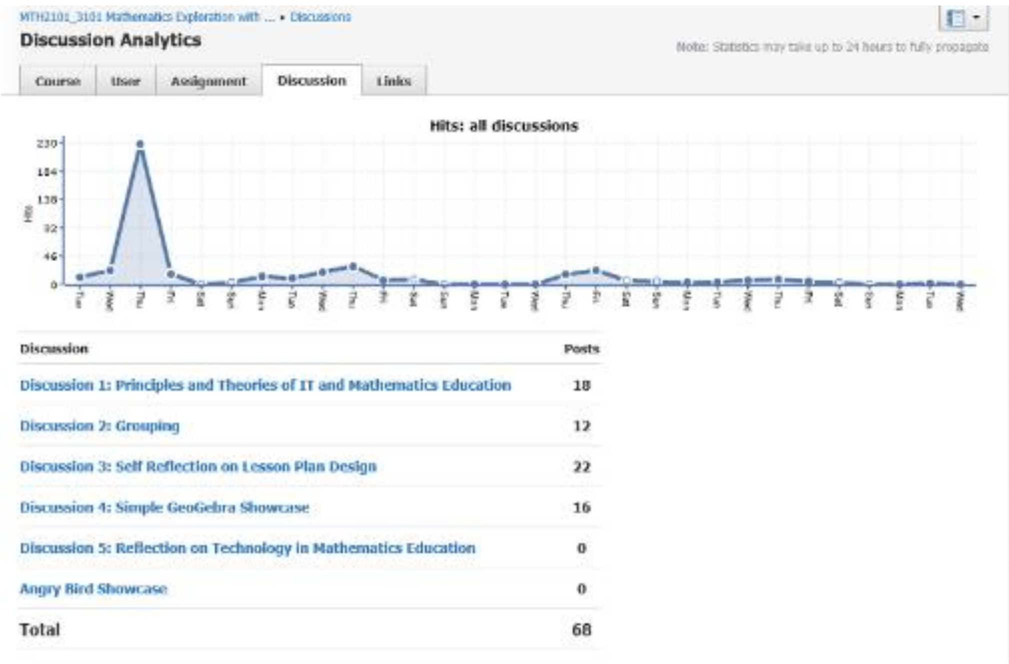


Figure 6. Discussion analytics and summary of post frequency



Indeed, this learning analytics could provide instant insights to teachers about how active students are participating in the learning process, and if they are making progress on a daily basis. For example, in the current study, emails were regularly sent by the teacher to bring up on-going issues and remind students to keep up the pace of learning. There were also occasionally postings of motivating newspaper articles to stimulate the students’ learning in times of low login rate to encourage their participation.

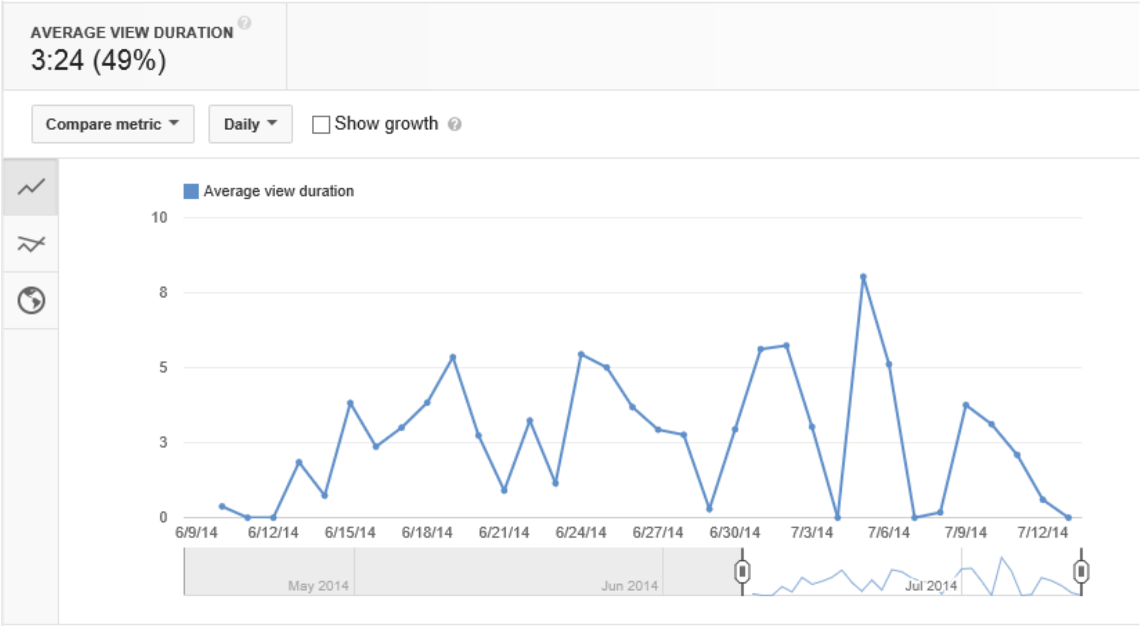
Access to video lectures

Figures 7 to 9 show general statistic about viewing frequency and estimated minute watched by the students. By aligning the YouTube statistics with Schoology statistics by date, we learn that students could be focusing on learning through watching video before attempting to complete assignments or respond to comments in Schoology. This shows that students relied on the video watching as a preparation for further learning activities including face-to-face classroom participation.

Figure 7. Summary page of video watching analytics in YouTube

Figure 8. Number of view vs. date in YouTube

Figure 9. Average view duration (minutes) vs. date in YouTube



Mobile learning

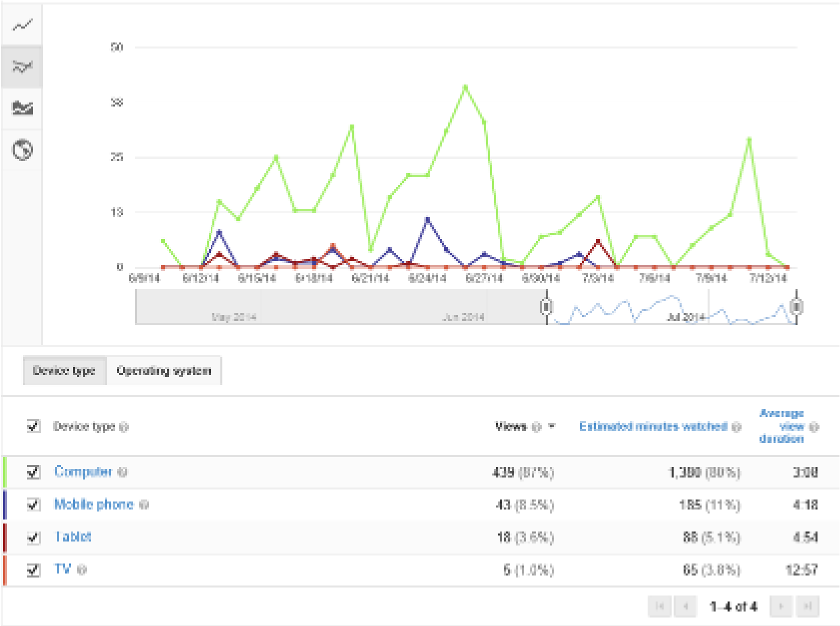
In addition, Figure 10 and 11 show the statistics related to mobile learning in particular. From the analysis we can see that roles of mobile devices served as complimentary extension to the stationary learning. The statistic shows that 83% of the views were through Windows/Macintosh, which is assumed to be relatively stationary than iOS and Android. But it is hard to conclude whether students were not carrying their laptops with the operating systems above. Surprisingly, on the other hand, the average time spent on watching video with mobile devices is 3:46 minutes, which is slightly more compared with 3:39 minutes on Windows and 2:19 minutes on Macintosh. That means students tend to spend a little longer on watching video through mobile devices, and perhaps it is very likely that the students were on taking public transportation where they had less choices to be distracted by walking away from the video compared to home environment.

Besides, it was interesting to see that some students accessed the videos from outside of Hong Kong (see Figure 12). It could be considered as mobile learning too when students travelled to other locations and continued the learning activities, even though there were only 4% of the total view outside of Hong Kong. Undoubtedly, this is one key characteristic of flipped learning model to provide with mobility feature, which also leads to the demands of requiring analytics on mobile learning as well, especially about the video watching related activity. To make good use of this information, we could ask students to share their observation from their visiting countries related to the course, and write some insights while they were away from home to keep up the learning process. In brief, teaching in flipped classroom can be further enhanced when we consider the information from learning analytics, and learning can be meaningful when teachers can closely observe their progress.

Students' perceptions

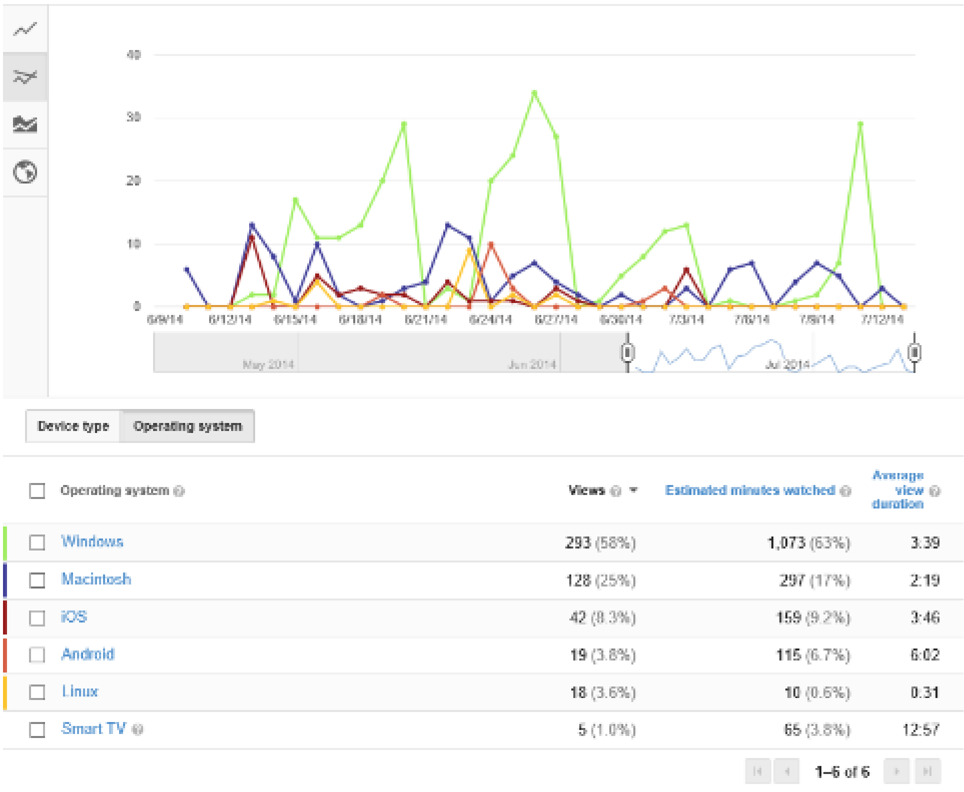
There were 36 students from the spring semester 2014/15 being invited to participate in the questionnaire, 19 students responded completely to the questionnaire. These students were assigned sequence numbers of 1-19. Selected excerpts are translated to English (wherever necessary) and tabulated in Table 2. Each excerpt is marked with a [#n] in the end where n is the sequence number of the student who submitted the questionnaire with responses. Descriptions of the results are given in the paragraphs that follow.

Figure 10. Mobile device types vs. date in YouTube



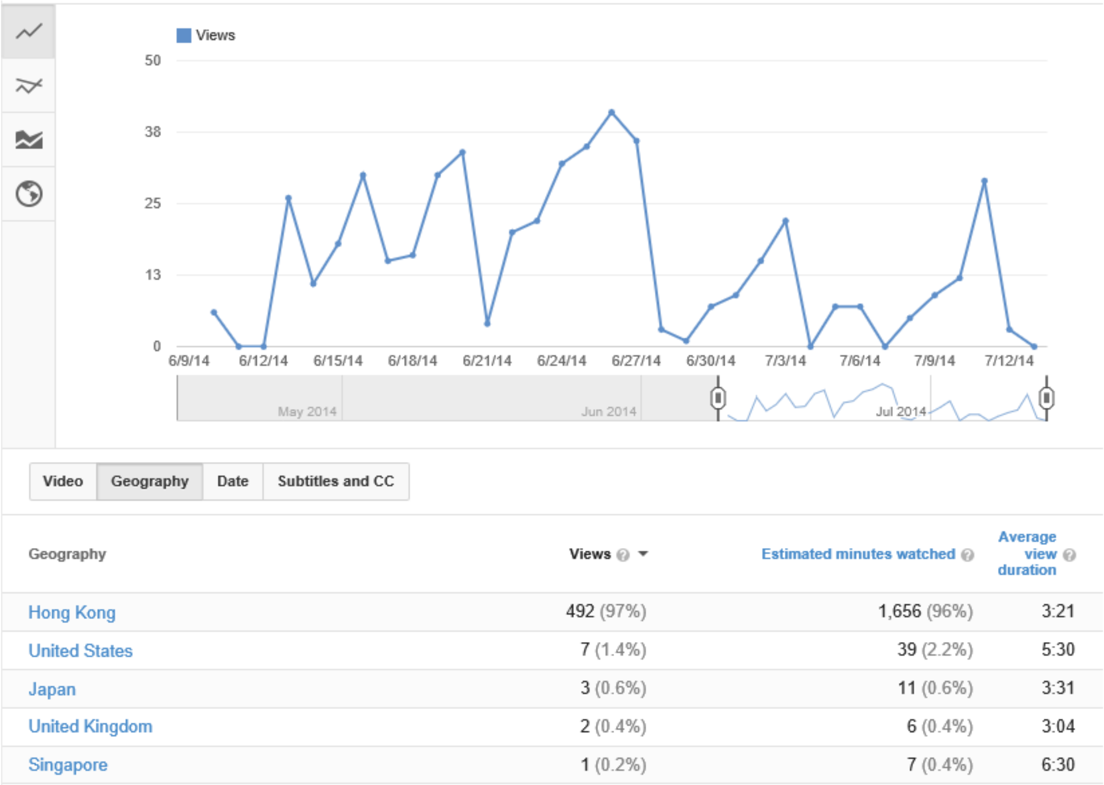
Device type	Views	Estimated minutes watched	Average view duration
Computer	439 (87%)	1,390 (80%)	3:08
Mobile phone	43 (8.5%)	185 (11%)	4:18
Tablet	18 (3.6%)	88 (5.1%)	4:54
TV	5 (1.0%)	65 (3.8%)	12:57

Figure 11. Mobile device operating systems vs. date in YouTube



Operating system	Views	Estimated minutes watched	Average view duration
Windows	293 (58%)	1,073 (63%)	3:39
Macintosh	128 (25%)	297 (17%)	2:19
iOS	42 (8.3%)	159 (9.2%)	3:46
Android	19 (3.8%)	115 (6.7%)	6:02
Linux	18 (3.6%)	10 (0.6%)	0:31
Smart TV	5 (1.0%)	65 (3.8%)	12:57

Figure 12. Access location by countries vs. date in YouTube



Geography	Views	Estimated minutes watched	Average view duration
Hong Kong	492 (97%)	1,656 (96%)	3:21
United States	7 (1.4%)	39 (2.2%)	5:30
Japan	3 (0.6%)	11 (0.6%)	3:31
United Kingdom	2 (0.4%)	6 (0.4%)	3:04
Singapore	1 (0.2%)	7 (0.4%)	6:30

Table 2: Selected excerpts from the questionnaire of students' perceptions

Theme	Sub-theme	Selected response
Perceived Influence	**Positive**	*(a) "…the teacher can pay attention to our paid effort with the evidence of [learning analytics] data" [#06]* *(b) "It can help identify the level of learning activeness among the students." [#08]* *(c) "… these [learning analytics] data can help improve the content taught in classroom and encourage us to use this [Schoology] platform" [#09]* *(d) "…the teacher can know our learning progress through reading these [analytics] data so as to adjust the teaching strategies." [#12]* *(e) "I think…[learning analytics] makes an positive impact to my learning effectiveness. The existence of these learning analytics data allows us to be more mindful about our own performance. It encourages us to place more time to complete the planned activities by the teachers and hope to do a better job." [#17]* *(f) "It increases the competitiveness [among the students]." [#19]*
	Negative	*(g) "I think the teacher can track when I login, when I finish [the discussion post or assignment], it creates an intangible pressure psychologically. Facing unfinished assignment, I really don't know what to do." [#7]*

	Neutral	*(h) "…[it] neither creates a negative influence nor a positive influence to my learning effectiveness. Because I think learning effectiveness is really based on the teaching quality and the desire or learning motivation of students." [#02]* *(i) "I do not have access to these data; only the teacher can read them, and use them to improve his or her teaching, which may have influence on our study accordingly." [#14]*
	Mixed	*(j) "I think it will have positive influence, but it depends on whether the teacher will really analyze the data after collecting them…it takes time to analyze these data and even change the lesson plan and strategies based on the needs of the students. It will increase the workload of the teacher. But if the teacher is willing to spend time to analyze, it will enhance the learning effectiveness of students." [#01]* *(k) "In the perspective of the teacher, because the teacher can base on our usage of different learning resources [on Schoology] to understand our needs, and then change the teaching plan and approach in order to improve our learning effectiveness. But, in the perspective of students, these data may not clearly help us realize our learning effectiveness." [#3]* *(l) "…if the teacher can make use of the mobile data to make a revolution and development on the related contents in the curriculum for learning and teaching as well as the students, it will have a positive influence to the learning effecriveness." [#05]*
Learning Motivation	**Positive**	*(m) "…when we know that the teacher will know what learning resources we have viewed or what [online] activity we have participated, we will be more active and enthusiastic to use the resources and participate in discussion [forum] on Schoology…also worry if we do not participate will cause a bad influence, such as course grade or the impression to the teacher." [#03]* *(n) "I will spend longer time to browse [on the Schoology], including the contributions by other students or posting more [on discussion forum]." [#07]* *(o) "Yes because [learning analytics data] can reflect an individual learning motivation. Online assignment [i.e. positing reflection in discussion forum] is a part of the course assessment, this will cause me to access to Schoology to see the peers submission and their thinking before posting my own." [#08]* *(p) " It motivates me to complete some assignments like the video reviews far more days before the deadline. Previously, I was kind of the deadline fighter [i.e. a person who has habit to complete a task in the last minute] who complete[s] the tasks on or few days before*

		the deadline. But now, I know the teacher can know the exact time of when I complete the task, which in term provides me the incentive to complete the assignment as earlier as possible." [#14] *(q) "Knowing the teacher will collect the [learning analytics] data…I will spend more time to complete the [learning] activity, and constantly check if there is any updated information, so from this I know I have more motivation to learn." [#17]*
	Negative	*(r) "When I know the teacher can see the frequency of student login and time, it does increase my frequency to login to Schoology, however, it is not because I want to learn, it is just because I am afraid Schoology has no record of my login." [#01]*
	Neutral	*(s) "It may help make a small increase [of my learning motivation, but it is not obvious." [#02]* *(t) "Most of the [learning analytics] data [available in Schoology] is about the browsing time and posting date…to college students, this data has no relationship to the course grade." [#05]* *(u) "No…because most of the time I will use only Schoology when I need to complete assignment or classroom activity or feel interested in the lesson. So the collected data [currently available in Schoology] does not impact my learning motivation." [#09]*
Learning Methods	**Traditional learning**	*(v) "Learning methods depend on personal habit, and it is hard to be changed unless being trained from the early beginning or by requirement." [#01]* *(w) "I think the collected data has nothing to do with my learning methods." [#06]* *(x) "I believe my learning methods is to follow the teacher's particular instructions to complete the assignments to learn different knowledge." [#07]*
	New learning	*(y) "Learning with Schoology can change the way we learn but not because of whether the teacher will collect the [learning analytics] data." [#03]* *(z) "Yes…it has positive effects on my way of study, mostly due to the increase in my learning motivation. As I mentioned, it motivates me to finish the assignment many more days or even weeks before the deadline. I have learned to organize my time better." [#14]* *(aa) "[Learning analytics] can help me make better use of technology and multimedia to learn, and [learning] is no longer bounded by paper and pencil." [#15]* *(bb) "…it will affect my learning methods. Previously, even the teacher uploads the materials to Moodle, we may still not read them. But now with the learning analytics, we are more motivated to browse the materials by the teachers and use them to learn." [#17]*

Attitude	**Teacher's companion**	*(cc) "If it is helpful to the teacher, I am quite happy because it can indirectly help solve educational issues. Knowing that collecting these data only because the teacher want to get to know us and compensate for our learning concern, so the feeling is quite good." [#01]* *(dd) "I like to let the teacher knows my effort and have appreciation through this interaction." [#02]* *(ee) "If we do not have any particular extra effort to pay, and can help the teacher provide data [for learning analytics] or even for research purpose, I am very excited." [#05]* *(ff) "I think it is a way that the teacher shows his or her care for students. Unlike the teachers who finish the lectures and leave and wait for our submission of the final assignment, I think the teachers who spend time to improve his teaching by looking at our records of study are better. They can know how the students are going, and for students who never go to Schoology, the teacher can provide some reminder…The students ultimately have their own choice of study or not, or ways of study; the teacher is just the facilitator, rendering some assistance and reminder." [#14]*
	Monitoring	*(gg) "At the beginning, I feel being monitored that I must use Schoology more. But later on I find that I should just use it when I need it. Because the current collected data does not reflect how serious we learn, it is only used to reflect whether the learning resources are suitable for us." [#03]*
	Threat	*(hh) "Honestly, it is a pressure [to learn that the teacher uses learning analytics], but I am still welcome for the teacher to collect [data for learning analytics]." [#07]* *(ii) "A bit frightening at the beginning, it is getting better gradually." [#16]*
	Miscellaneous	*(jj) "I hope the teacher can mention [about the use of learning analytics] at the beginning of the course, and should be advised not to use the browsing time to determine if the students are working hard." [#05]* *(kk) "It is a bit surprising because no teacher has done it previously." [#12]*
Student Access	**General Usefulness**	*(ll) "It would be useful for online learning outside of classroom. Because resources accessed by most people may indicate the usefulness of the resources. I may first take a reference to the highly accessed resources." [#3]* *(mm) "…[It] seems a bit far from us, we cannot take the advantage [of the current learning analytics data available from Schoology] to decide our methods of learning." [#13]* *(nn) "It is no doubt that teachers should collect*

		such data, but it should let student take reference [or to access] to the data too." [#15]
	Individual level	*(oo) "When I can access to my own [learning analytics] data, it can help me appreciate my own effort more, or remind myself to work hard to learn." [#02]* *(pp) "…[It] can further promote self learning [or active learning]. Because we can know the browsing history or how many comments we have posted [in discussion group], which can analyze our learning ability and engage in learning more." [#09]* *(qq) "I think if students can take a reference to the data anytime, it will help us become more active in online learning outside of classroom. Because we can see our own [learning analytics] data, we can see which parts we have not participated enough so that we can make an improvement. It is better to have the personal learning analytics." [#17]*
	Peer level	*(rr) "There should be no interest to see others' students login data unless it shows their grade, otherwise no one wants to spend time to find out more about the frequency of login and posting in Schoology." [#01]* *(ss) "It will become a competition and mutual monitoring [if we can see others' analytics data]." [#06]* *(tt) "…[It] will lead to a negative effect…and the effect is that [this data] can be related to students' privacy issue." [#07]* *(uu) "[It] can let me see when others finish their assignment or how long they spend on a course. This can let me know more about my and others learning attitude, performance grade, and learning motivation as well as their difference, that way we can adjust our learning methods in the course." [#13]* *(vv) " If I am able to see other students' records of using Schoology, I may change a bit of my study in term since I am the kind of person who can be easily influenced by others. Thus, I may study harder if I see some students who study harder than me; I may not study harder if I see no one is studying hard." [#14]*

Results from the questionnaire show that students have various perspectives concerning the influence of learning analytics. Some of the potential influences perceived by the students indicated from responses (a) to (f) including learning effectiveness, student' activeness and engagement, learning progress tracking, increase of competitiveness among students, formative assessment for better improvement in classroom teaching, and evidence of students performance. Yet, some students may not have seen the possibilities with the learning analytics because they do not think it poses any impact on their learning with merely the data itself exemplified by the responses (s) to (u). Learning is directly related to the teacher's performance and quality according to the students' understanding as shown by response (h). Nevertheless, they may not acknowledge that teachers can improve their teaching with the extra information about the students through the learning analytics. If teachers are willing to put extra time to analyse these data, it may be able to provide further positive influence to students. Despite these positive perspectives, the response (g) demonstrates that students can have more pressure when they know the teacher can gather extra information.

In terms of learning motivation, students find that learning analytics can serve as motivating factor exemplified in responses (m) to (q). Students may see it as a tracking tool so that every task they perform on Schoology is recorded. Although it seems to only develop their extrinsic motivation with a fear not to participate to cause penalty, some students (e.g. response (p)) believe that teachers can learn more about the effort students have paid to complete each task. Thus, they can be motivated to do better performance in the online learning (either through mobile access or not). Yet, some students exemplified in responses (r) to (u) demonstrate their neutral/negative impact in motivation because they think the existing collected data cannot reflect their actual performance (e.g. login frequency) and pose issues on their grade. In this sense, it does not matter if they work hard for the "statistical numbers".

Meanwhile, students in responses (v) to (x) illustrate their ways of learning through their developed habit in traditional learning without the cause from the learning analytics, and some indicate their new ways of learning and perspective in changing their learning methods because of the extra information collected and analysed by the teachers, exemplified in responses (y) to (bb). Particularly, the response (aa) shows that technology and multimedia are encouraged to use more frequent in learning with analytics because the tracking record on using traditional methods cannot be achieved. Thus, technology can be the complementary aspect that students can appreciate more in their learning experience.

Generally, students are found to have various feeling toward the use of learning analytics. Some believe that it is a good companion tool to the teachers because they can improve their teaching quality through a better understanding of their students indicated in the responses (cc) to (ff). The use of learning analytics can also show the care about the students' learning experience. However, some see it as a monitoring purpose, which can generate extra pressure and threat to the students showing in the responses (gg) to (ii). They may worry that the teacher can use it wrongly to misinterpret their learning effort. Nevertheless, some suggest that the teachers should inform the students earlier about the use of it so they will not feel surprised being monitored outside of classroom in online learning environment.

On the other hands, students suggest that a similar learning analytics should be available to the individual level because of the usefulness, showed from the responses (ll) to (qq) although some students do not see its usefulness to make it accessible to students. Some even oppose it to be available publicly at the peer level because they may be afraid of the privacy issues or being monitored by their peers in the online environment, indicated in the responses (rr) to (vv). Yet, some students believe that sharing it to the peers can increase the learning motivation and learning attitude due to the influence among the peers.

In the responses, students seem to have a very limited idea of how to extend the existing tools. Yet, some students have suggested several additional tools in learning analytics (either for teachers or students) which may be helpful to their learning effectiveness, including:

(1) Names of students in their browsing history record;
(2) Personal browsing time in each learning page/materials;
(3) Records showing a list of activities each student performed after login;
(4) Learning progress of each student in assigned tasks;
(5) More descriptive/qualitative analytics information other than statistical information; and
(6) Highlight of questions/concerns/inquiry in each lesson based on students' responses.

Discussion

The affordance of learning analytics in flipped classroom

The findings exemplify how the learning analytics can be used to reveal the students' access patterns of the learning materials as well as their mobile learning behaviours. It helps the teachers to determine the activeness of participation before each lesson, partly addressing the issue raised by Butt (2014) in which the students tend not to prepare for the lessons. With the feedback from the analytic tools, the teachers could gain insights and adjust the planned agenda in each upcoming lesson to accommodate the needs of students, i.e. giving a mini lecture to recap some of the important skills in the video.

The statistics provided by YouTube provide hints on when and where the students access the video lectures. Previous literature relies on the students' self-reported data to conclude about their completion rate of the watching the videos. The YouTube statistics, on the other hand, provides more objective measures of the frequency of access of the videos and the duration for which the students stay with the videos on average. A duration shorting than the total length of the videos, for example, indicates that the students may quit watching the videos in the middle. In contrast, duration longer than the total length of the videos may indicate that the students on average re-watching the videos several times.

Learning analytic is a mandatory affordance to sustain flipped classroom teaching and learning, and it is needed in order to capture the whole learning process of each student for continual monitoring purposes (Gilboy, Heinerichs & Pazzaglia, 2015). The students' perceptions seem to indicate about the potential influence on learning effectiveness, motivation, learning methods as well as their attitude toward this new way of learning. Students show their limited understanding of what tools can assist better their learning, yet, they believe that teachers should make use of the learning analytics data and provide an authentic interpretation concerning their learning. As of now, limited tools from Schoology or existing LMSs (e.g. Moodle) offer ready-to-use learning analytics to support mobile learning. Even students may participate intensively using their mobile devices in learning; this information needs to be inquired through external survey.

With the flipped learning approach, students could review some video lectures before attending to each lesson. When they came, we would expect that they had some knowledge in mind and be ready to extend their skills to construct further knowledge. Students could review as many times as possible at home until they learned the knowledge as a prerequisite to the class learning activities. Details of analysing the learning and teaching particular aspects of flipped classroom are to be studied in the future.

The need for new learning analytics tools tailored for the flipped classroom

There are limitations on the existing analytical tools in Schoology for mobile learning

(Aljohani & Davis, 2012). For instance, Schoology could not distinguish if students spent more time on mobile access or not; it could not help students reflect upon their own learning behaviour with individual learning analytics; it did not provide its customized analytics to analyse the data about the video watching. In terms of evaluating the writing of students on discussion forum, Schoology could not help understand whether the words were correlated to other peers' comments, nor it could automatically send a reminder to students if they were absent from the system for too long. These limitations exist in other LMSs as well such as Moodle, which offers no deep insight unless more customized tools are developed (Retalis et al., 2006; Petropoulou et al., 2014). In addition, YouTube does not allow tracking of individual viewers. Nevertheless, further analysis could be conducted through in-class interactive activities or online quiz to find out if the students were making any progress after watching the video. To further enhance this idea, we could make use of the quiz to provide instant feedback to students so that students are able to learn some of the information again and review it, which might be neglected during the video watching.

To address these limitations, learning analytics should be redesigned for flipped classroom purpose so that deeper insights can be gained. Some of the required features are adding questions to videos (like TED-Ed); Logging the video watching behaviour such as fast forward, pause, rewind, etc.; Text-mining functionality on the discussion posts and other textual submission. Some of these features already exist in individual tools. For example, TED-Ed allows the teachers to insert questions and discussions into the videos for students to active reflect on what they learn during video watching. Yet these tools are not well integrated with the commercial or free LMSs (Friesen, 2013). However, very limited research work seems to address the needs of learning analytics in flipped classroom research (Giannakos & Chrisochoides, 2014), and more research works need to be done in this area (O'Flaherty & Phillips, 2015).

Conclusion

In conclusion, the model of flipped classroom can become an excellent approach when the affordances are magnified through a careful learning activity design. But without learning analytics, students' learning cannot be monitored outside of classroom to better engage them in face-to-face contact hours in class. Indeed, teachers and students are required to have more interactions under this model to maximize the effectiveness of this learning approach. It would not be suitable to assume students to learn effectively with "extra resources" at home; rather teachers need to find a new way to obtain recursive feedbacks, e.g. learning analytics and formative assessments, so that the learning process of each student is clearly captured. Especially in this new mobile world, students should be encouraged to take the advantages of ubiquitous learning to maximize their learning anywhere at any time. This way teacher can extend their teaching and reach out to students without the boundary of the classroom walls.

Flipped classroom provides a digital ecology under the technology-mediated environment, where learning analytics offer a necessary affordance to extend the flipped learning model to mobile learning. This case study emphasizes the needs of mobile learning analytics and has identified the opportunities and challenges in flipped classroom teaching. From the experience, both students and teachers need to continue to interact and communicate with each other to refine the flipped learning model. More importantly, learning activities including the video lectures/tutorials need to be redesigned to help students find a better connection among these activities. For example, teachers can try to bring up more critical discussions and stimulate their thoughts during the face-to-face lesson. Students can also offer on-going suggestions to teachers through weekly forum discussion on their challenges and new findings through their own inquiry learning. If students find that their learning experience is enhanced with the affordances, they will become more accepted to the new learning approach. However, the teachers cannot control the development of tools for learning analytics because they cannot simply redesign those tools available to the LMSs. It will take a lot of effort to design a customizable platform to meet the needs in learning analytics. If possible, teachers could use the existing tools first and focus on more interactive activities in class and outside of class.

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Developing a Teacher Resource Kit on Using Mobile Technology and Social Media to Promote Higher Order Thinking Skills and Personal Learning Networks

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The penetration of mobile technologies is breaching the traditional digital divides among countries in Southeast Asia. However, recent studies and applications are focused on the use of mobile technologies by students and comparatively fewer resources are available for the teachers.

The Mobile Technology for Teachers (MT4T) Resource Kit is designed to address this concern. Primary and secondary school teachers are provided with a multimedia and multi-technology material on using mobile technology in a Southeast Asian context. The Kit is a set of guides in the form of an eBook consisting of instructions and resources on social media applications like Facebook, LinkedIn and Edmodo. Embedded in each eBook are seven themes—inquiry, initiation, creation, collaboration, conversation, critical analysis and synthesis to promote Higher Order Thinking Skills. In addition, the Kit presents how mobile technologies and social media can facilitate personal and professional development, including optimizing the personal learning network.

Keywords: mobile technology; teachers; higher order thinking skills; personal growth; professional development; teacher personal learning network; eReader; eBook

Introduction

Whereas access to traditional computer-based internet services continues to be out of reach for many teachers in Southeast Asia, penetration by mobile technologies is breaching the traditional digital divides in even the lesser developed countries of the Region. In fact, recent statistics show that Southeast Asian countries are among the top ranking mobile users in the world. While access to mobile devices is increasing at a dramatic rate, the use of such mobile technologies for educational purposes is still in its infancy in most countries. Given the broad reach of these mobile technologies, there are enormous opportunities for exploring their possible application in education such as in improving instructional delivery, allowing access to relevant and updated content, and connecting with other education providers worldwide, among others. Such usage of mobile technologies in education is now being categorized under mobile learning (m-learning), which is defined by MoleNet as the use of "ubiquitous handheld technologies, together with wireless and mobile phone networks, to facilitate, support, enhance, and extend the reach of teaching and learning."

Many recent studies, researches, projects and applications have focused on the use of mobile technologies by students and noted that teachers were being left behind. In fact, there is now viewed to be an emerging divide between students as "digital natives" and teachers as "digital migrants." This is because students are prolific users of mobile technologies and as these mobile technologies become cheaper and easily accessible, the number of students using mobile technologies is increasing rapidly. It can be said that more and more students are more adept and skilful in using these variety of mobile technologies, not just for communication and entertainment, but also for accessing information and knowledge especially from the web. Through their informal networks many students are already using mobile devices and social networking sites to share opinions, organize group activities, discuss ideas, share photos, news, etc. Moreover, teachers are not well prepared to suitably guide, mentor and coach their students to use these new technologies in ways which are productive and embedded with appropriate values.

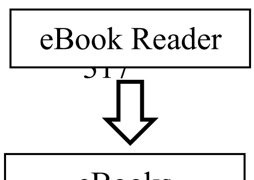
Given this current educational scenario, there is a real need for teachers to be equipped with knowledge and skills for them to effectively use mobile technologies, not just in the classroom as pedagogical tools, but also for their own personal and career growth. This need compliments fully to their desire to become teachers of the 21st century.

Methods

Developing the MT4T Resource Kit

With the increasing population of young mobile users in Southeast Asia, teachers in the Region have to be at the same pace as their students. Enhancing their competencies in digital literacies and social media to make learning more engaging and effective was the primary intention of the MT4T project. Simultaneously, teachers would learn how to connect and collaborate with colleagues, enhance their own professional capacities and access educational opportunities thereby building a better personal learning network. In order to achieve these objectives, a conceptual framework needed to be constructed. A consultation workshop with ICT content experts from Ministries of Education in Southeast Asia and SEAMOLEC (Southeast Asian Ministers of Education Organization Regional Open Learning Centre) resulted to developing a teacher resource kit, called Mobile Technology for Teachers (MT4T) Resource Kit and the conceptual framework (Figure 1) which later defined the content, delivery and material of the MT4T Resource Kit.

Figure 1. Conceptual Framework of the MT4T Resource Kit



The Kit is a compendium of web resources for teaching and learning focused on enhancing teacher's and learner's higher order thinking skills (HOTS). In addition, it aims to enrich the perspectives of teachers on the many uses and possibilities of mobile technology for enhancing their own 21^{st} century skills, their adeptness in using mobile technologies for their own personal needs as well as using it as a basic tool for communicating. The Kit will help teachers create activities and learning experiences that will enhance student's critical and creative thinking through the use of mobile technologies such as mobile applications, and social media.

Capitalizing on the wide reach and ease of use of mobile applications, social media and social networking sites, the Kit was created to be delivered in the form of eBooks (PDF and ePublication formats) through the use of an eReader. In order for teachers to easily access and utilize the Kit without compromising the format and style of the eBooks, a universal eReader named as INNOTECH Reader was developed. The application is available for Android, iOS and Windows users. Note that at the time of writing, the INNOTECH Reader was available for devices with at least Android Jellybean 4.1 operating system and in iPads with iOS version 7. The eReader is a free application that can be conveniently downloaded into smartphones and tablets.

Seven (7) eBooks were developed, namely, (1) *Main eBook* which gives an introduction to the Resource Kit, highlighting the teacher personal and professional learning network; (2) *Uses and Functionalities of Mobile Devices* which presents the various features of a mobile device and the mobile applications for classroom instruction as well as personal development; (3) *Facebook for Teachers* which explores the collaborative mechanisms in Facebook for knowledge exchange, networking and promotion of HOTS; (4) *Edmodo* which explains how this learning management system can be used in the schools and with parents; (5) *Twitter for Teachers* which gives guidelines in using this application for teacher's professional development and student engagement; (6) *Teacher's Use of Blogs (LinkedIn)* which explores the blogging features of LinkedIn for establishing teacher networks; and (7) *Annotated Resources for Teachers* which lists useful web resources in the promotion of HOTS. Several of the mobile applications mentioned in the eBooks are games, chat facilities, storage facilities, drawing tools, and video and audio tools which students can easily learn and use.

The sub-eBooks were identified as the priority topics during the consultative workshop as these were the more popular and well-established social networking sites and social media for communication, collaboration, and knowledge exchange. These also had the potential of extending opportunities for teacher's personal and professional growth by creating networks and space for teamwork or partnerships with fellow educators, parents, and significant organizations. In addition, these are capable of providing the platforms for students to be engaged and participative in learning activities, to be connected with other students or teachers for group-based school projects, and to enhance their creativity and critical thinking skills. The social process of learning offered by these platforms is widely explored and taken advantage of. Thus, seven key concepts and themes have been embedded in each of the seven eBooks. These are initiation, conversation, inquiry, collaboration, critical analysis, synthesis, and creation.

In *Facebook for Teachers*, for example, are instructions on creating groups that teachers may do for particular classes and how a Facebook group can be used for posting of announcements, sharing of information or files, or promoting and moderating the discussion of relevant topics, while the teacher and students are inside the classroom, at home or in some other place. There are even additional web links that discusses the many more uses of Facebook groups.

A section in the *Teacher's Use of Blogs (LinkedIn)* presents examples on how teachers, professors, academic staff, students, and graduates can take advantage of LinkedIn. While many may know of the basic features of LinkedIn, the eBook shows the more advanced uses of LinkedIn and how these can be employed for school activities, school-community partnerships, expanding opportunities for career and student internships, keeping the communication between teachers and students open and accessible, etc.

The eBooks are downloadable from the web portal, www.seameo-innotech.org/MT4T. The web portal is the online repository of all the eBooks (PDF and ePublication formats); User Guides on the eReader, eBooks, and web portal; tutorial videos; and other information about the MT4T project. User registration is required before one can download the eBooks or tutorial videos. Once this is done, users can go to their INNOTECH Reader, download the materials and enjoy the full features of the eBooks through the INNOTECH Reader. Inside each ePublication, a user can browse through various content, connect to web links, watch online or tutorial videos, write notes, make doodles, highlight texts, bookmark pages, search for particular words, or change the book appearance. To maximize the resources suggested in the Resource Kit, it is best if one is online. However, the eBook content or videos can still be accessed offline.

The eBook content is classified according to four levels of users—Basic, Intermediate, Advanced, and Experts—as adopted from the UNESCO ICT Model on ICT integration in Education (Emerging, Applying, Transforming and Infusing). Basic users are those who have little knowledge in using mobile technology for their personal and professional activities. Intermediate users are those who are using mobile devices for internet browsing, sending emails and using social networking. Advanced users are those who use word processors, spreadsheets, presentation tools, and other mobile applications to teach, collaborate, connect with friends or colleagues online. The Experts users are those who are very adept at using mobile devices as instructional tools where they create content and teaching-learning materials.

The content was organized as such to provide appropriate instructions and guidance to users with different levels of understanding and experience in mobile technology. Under Basic and Intermediate Users, content is focused more on using basic functions and features of the mobile device or social networking applications. For Advanced and Experts Users, there is more discussion and web resources on advanced level applications of said features to introduce netiquette, promote HOTS and enrich experiences and know-how for professional and personal development.

Pilot Testing of the MT4T Resource Kit

The MT4T Resource Kit is being tried out in six countries from October 2014 to March 2015. During this pilot testing period, users are expected to gain full understanding and appreciation of the MT4T Resource Kit, utilize the material to enhance their personal and professional learning networks & facilitate the promotion of HOTS in themselves and in their learners, expand their personal & professional networks through social networking sites, coach & guide their learners in the responsible use of mobile technologies by modelling, evaluate the MT4T Resource Kit, provide feedback for the improvement of the MT4T Resource Kit, and encourage other teachers to use the Resource Kit. The teachers will assess the usability of the Kit, user-friendliness of the web portal and eBooks, and relevance and organization of the eBook content. Initial feedback were gathered during the orientation-workshop conducted to familiarize the teacher-users, school principals, and Ministry of Education officers relative to the pilot test. One main activity during the orientation conducted was the simulation of the eReader and eBook installation in the mobile devices. This was done to allow the orientation participants to experience the initial processes of using the Resource Kit such as navigating through the web portal and getting familiar with the features and content of the web portal and eBooks.

In the implementation of this pilot test, six SEAMEO-member countries were identified—Brunei Darussalam, Indonesia, Malaysia, Philippines, Thailand, and Vietnam. These were the countries that participated in the consultative workshop and agreed to do a pilot in their schools. The selection of teachers from one primary and one secondary school were conducted by the Ministries of Education based on the primary criteria of the teacher's knowledge, ranging from basic to experts level, and experience in the use of mobile devices and social media applications in teaching and learning. It was also observed that these schools were technology-ready schools and are implementing ICT-aided education programs. In total, there are eighty (80) teachers participating in the tryout (Table 1).

Table 1. Participating Teachers

Country	No. of Teachers	Schools

Brunei Darussalam	10	• Sekolah Menengah Sultan Muhmmad Jamalul Alam • Sekolah Rendah Katok "A" Brunei III
Indonesia	9	• SMP Negeri 19 Jakarta • SDN Gunang 05 • SDN Menteng 01
Malaysia	21	• SK Putrajaya Presinct 8(1) • SMK PP8(1)
Philippines	16	• Tinajeros National High School • GSIS Village Elementary School
Thailand	14	• Rachawinit Primary School • Rachawinit Secondary School
Vietnam	10	• Nguyen Sieu Primary School • Thic Ngihiem Primary School • Vietnam Angieri School • Ngia Gia Tu School • Ly Thai To Primary School
TOTAL	80	16

Through the orientation, initial feedback (Table 2) was gathered from the participants during presentations, hands-on sessions and open discussions. However, to collect more in-depth comments, learning experiences and suggestions, Feedback Instruments have been distributed to the teachers for this purpose.

Results

Results from the tryout are still being gathered. However, initial feedback are available and will be discussed in this paper.

Tryout (Initial Feedback)

During the orientation-workshop, participants shared their comments and observations on the MT4T Resource Kit, eReader and web portal. These are complied below:

Table 2. Initial Feedback from Orientation-Workshop

Country	Feedback
Brunei Darussalam • Ministry of Education • Schools	• Can be a reference material for the new national ICT program • Wifi connectivity provided by the Government (i.e., connectivity at the venue, schools) employs a filtering system that limits access to the App Store (iOS) and some social networking sites • Technical errors/ problems: - Difficulty in finding the header in eBooks in iPad mini - Non-availability of a download progress indicator for eBooks in iPads - Erratic behaviour of eReader when tabs/ topics in Table of Contents in all eBooks are tapped in iPad mini
Indonesia • Ministry of Education and Culture • Schools	• Can be useful in integrating ICT in the classrooms • Compatibility issues of the eReader app with some of the mobile devices used by the participants (iOS & Android platforms) • Difficulty in accessing the portal and downloading the eBooks
Malaysia • Ministry of Education • Schools	• Problem in logging in to the accounts created in the web portal • Difficulty in adding the eBooks to the device and downloading from the INNOTECH Reader • Compatibility issues of the eReader app in the Android devices, particularly Samsung smartphones • Students are not allowed access to social

	networking sites while in school
Philippines • Department of Education • Schools	• Compatibility issues of the eReader with old operating systems in mobile devices • Large file sizes of eBooks may be an issue for mobile devices with low storage capacity
Thailand • Ministry of Education • Schools	• Need to create a *Delete* function in the *Download List* in the eReader (Android mobile devices)
• SEAMES (Southeast Asian Ministers of Education Secretariat) • UNESCO	• Impressive potential for mobile technology utilization in the schools and professional growth • There should be smaller fields for web portal tabs in smaller phones (i.e., phones with 4" screen) • Android mobile devices should be given priority since there are more Android users in Southeast Asia than Apple or Windows users
Vietnam • Ministry of Education and Training • Schools	• Difficulty in video playback due to blocking of videos from the internet

Discussion

Teachers from the pilot sites have been open to this new material and took note of its value given their feedback on its usefulness in integrating with and complementing national ICT programs, and potential of maximizing the availability of mobile technology for instruction. In Brunei Darussalam, the MT4T Resource Kit may provide good reference materials in the implementation of their Whole School ICT Development Program and so with the m-edukasi program of Indonesia.

The first-hand experience of the participants have shown that the MT4T Resource Kit is easy to follow, and get hold of teacher materials in the web and be introduced to interesting mobile applications. The content which is organized according to basic, intermediate, advanced and experts users has been interesting and novel to the users. Moreover, the web resources are conveniently organized according to its relevance in the promotion of HOTS, netiquettes, digital citizenship and professional/ personal growth.

The initial feedback have also given the research and development team of SEAMEO INNOTECH a glimpse of how the Kit, particularly the technical side of it, is experienced in various Southeast Asian countries. Internet connectivity (wifi/ 3G/ 4G/ LTE) differs across countries and such has effect on the accessibility and download/ upload time with regard to storing the eBooks to the mobile devices and connecting to online resource materials. Compatibility issues of the eReader and personal mobile devices of the teachers have also been observed a number of times. These may be viewed as limitations in utilizing the MT4T Kit, web portal and eReader, along with restrictions imposed on students by the schools or Ministries in accessing social networking sites inside school premises or during school hours.

Users have also encountered technical problems related to web server operations, web portal accessibility, eReader functionality, and user interface in desktop and mobile views. Much of these have been addressed after the orientation-workshop. The INNOTECH Reader, following several updates of Android and iOS, since the launching of the Kit, have also been updated. While the pilot stage is still ongoing, there is more space for user feedback and improvements on the technical aspect of the MT4T tools.

Conclusions

There is much potential in utilizing the MT4T Resource Kit for enhancing learning experiences as the rich resources found in the Kit cater to both teacher and learner. User-friendliness and relevance of content to 21st century skills have been major considerations in the development of the Kit.

The tryout period offers the time for the users to fully appreciate the eBooks and its usefulness in promoting higher order thinking skills and strengthening teacher's professional and personal learning networks. The familiarity and eventual integration of the many applications specified in the eBooks with learning activities is expected.

The platform by which the MT4T Kit is delivered is easily available. With many teachers having their own mobile devices, the MT4T eBook can be accessed and used as a supplementary resource material. Countless more will benefit from this Kit if teachers and other educators will recommend the material to other colleagues. The opportunities for collaborative and creative work is huge especially in this well-connected world.

Acknowledgements

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An Investigation of the Effects of Mobile Augmented-Reality-Facilitated English Vocabulary Learning

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Vocabulary learning is the key to laying a solid foundation for the acquisition of a foreign language. However, traditional vocabulary learning emphasizes memorization by rote, which is decontextualized, indirect, abstract, and confined in classroom context. As the learning paradigm has shifted from behaviorism to constructivism, strategies for vocabulary learning have also made gradual shifts from traditional rote tactics to more contextualized, situated approaches. Taking the advantage of technological advancements, mobile-based augmented reality (MAR) techniques provide a feasible solution to facilitating situated learning by offering virtual information on top of the real contextual images. The proposed study intends to investigate the effects of MAR facilitated English vocabulary learning on learning outcome and learning motivation. The effect of learning styles will also be discussed. An experiment is designed for collecting quantitative and quantitative data. The results of the study could provide practitioners a technology-supported alternative in teaching English vocabulary.

Keywords: English vocabulary learning; mobile; augmented reality; learning styles

Introduction

Motivation and Background

The importance of vocabulary learning

As one of the most common languages, English is significant when it comes to cross-cultural, international exchanges, ranging from political, business, scientific, communications, and academic issues (Chang, 2011). Accordingly, learning English as a foreign language (EFL) has become a critical matter for both educators and learners.

Vocabulary learning, in particular, has always played an important role in laying a solid foundation for the acquisition of a foreign language (Beck, McKeown, & Kucan, 2002; Bormuth, 1966; Davis, 1944, 1968). As the basic building blocks of English sentences, vocabulary acquisition is necessary for second language (L2) learners to make correct inferences or to understand the content (Gu, 2003; Huang, 2007; Nation, 2001). Furthermore, as Wilkins (1972) noted, “without vocabulary nothing can be conveyed” (p.111). Thus, constant, numerous researches into vocabulary learning for English as a foreign language have been conducted, showing a keen, urgent interest in finding out how words can best be learned.

Current situation and problems in English vocabulary learning

As mentioned in the previous paragraph, vocabulary learning is crucial for EFL learners to master English; however, both instructors and L2 learners are now encountering difficulties among English vocabulary learning. Aside from the problems of formal English education in Taiwan, such as lack of teaching hours, teacher shortage, and different required vocabulary size resulting a huge gap between learners’ English proficiency (Chang, 2011), Barab (2002) stated the main problems in traditional schooling practices are that information becomes decontextualized, knowledge appears to be more indirect, abstract, and experiences are second-handed confined in classroom context. That is, instructions tend to be more fragmented, teacher-centered and irrelevant to students’ needs and interests (Cullen, 1994). To be more specific, acquiring vocabulary from abstract, textual definitions from a dictionary results in problems when using language in real situations (Brown, Collins & Duguid, 1989).

Aside from the abovementioned problems in vocabulary learning for EFL learners, Oxford and Anderson (1995) also suggests that there is a need for language instructors to understand students' learning style to achieve optimal language progress. Furthermore, in the field of learning styles, field independence/dependence (FI/D), in particular, has been considered potentially important in second language acquisition (Chapelle & Green, 1992).

Technology, AR as a solution to support situated learning

To solve the problems of traditional formal learning within the classroom setting, it is noticeable that there has been a gradual shift of learning approach from behaviorist to contextualized, situated approaches (Chuo, 2004). Situated learning theory, proposed by Lave and Wenger in the 90s, posits that knowledge should be constructed in an authentic context and that learning requires social interaction and collaboration (1990). As technology advances, augmented reality (AR) incorporating with the use of mobile devices then provides a solution to support situated learning theory, since AR has the affordances of the real world setting by offering additional and contextual information to support learning, blending learner's learning environment into their real-life contexts (Squire & Klopfer, 2007). That is, with mobile devices, wireless connection and location-based technology, a mobile-AR learning system then enables and enhances learning by making it ubiquitous, collaborative, personalized and situated while at the same time bridging formal and informal learning (Wu et al., 2013).

With the aid of mobile technology, this present study will allow students of different learning style, field independent and field dependent to learn English vocabulary in a real setting outside of the classroom by using handheld AR-facilitated devices.

Research Objectives and Questions

This study aims to describe early research into augmented-reality-based mobile learning that attempts to assess its effect on students of different learning styles' learning outcome and perceived motivation in English vocabulary learning of elementary students, by enabling students to actually see, touch and interact with the "vocabulary" in a real setting. The research objective of this study is to investigate whether there is a difference among learning motivation and learning outcome of students of different learning styles exposed to a mobile-based AR simulations learning system proposed in this study. Accordingly, the three primary research questions are:

(1) Is there a significant difference between learners of different learning styles (field independence/dependence) on learning outcome while mobile AR-facilitated instruction is applied?

(2) Is there a significant difference between learners of different learning styles on learning motivation while mobile AR-facilitated instruction is applied?

(3) What are learners' perceived attitude, learning interest and challenges after receiving the mobile AR-facilitated instruction? And how do FI and FD learners' attitude differ?

Limitations

The target words for this present study are "context-free words/vocabulary," namely, *nouns*, due to the importance of 'nouns' and the design of this learning activity. While this learning activity, which takes place in a real setting, incorporates context-aware technology into vocabulary learning, and thus enables learners to retrieve additional information of the specific object's name (vocabulary), sound clips and explanation, the target words have to be something 'existing,' seeable, touchable, and can stand by themselves without relying on sentence context, such as nouns (Elliot & Zhang, 1998). In contrast, "context-dependent vocabulary," such as prepositions, which are not rich in meaning and should be better learned through reading activities, will not be included.

The participants for this present study are third graders, aged between 8-9 year-old. They are chosen particularly in accordance with the policy of formal implementation of English education starting from the third grade in elementary school (Ministry of Education, 2005) and that tackling English learning problems at an early age is considered critical to prevent widening gap in the future (Chang, 2011). Accordingly, the results may not apply to students of different age groups.

Literature Review

The present study attempts to explore the effectiveness of the proposed mobile-AR learning system in English vocabulary learning at elementary level in Taiwan. This chapter begins with the introduction of English vocabulary learning with a focus on vocabulary learning methods, challenges English as foreign language (EFL) learners encounter, and its relationship with learning styles. Next, section 2 delineated situated learning theory, followed by the review of empirical studies that support the situated, contextualized approach with the aid of technologies such as augmented reality, mobile devices, and location positioning.

English vocabulary learning

"Without vocabulary nothing can be conveyed" (Wilkins, 1972).

Vocabulary learning is a primary, endless and indispensable task for English learners (Schmitt, 2008). To master a second language, it is generally agreed that vocabulary acquisition is the foundation to achieve successful written and spoken communication.

English vocabulary learning methods and strategies

When it comes to the acquisition of L2 vocabulary, Nation (2001) categorized the methods of learning and teaching high frequency words as four main approaches, "direct teaching," "direct learning," "incidental learning," and "planned encounters," see Table 2.1. To be more specific, "high frequency words" with a commonly agreed coverage of 2,000 English words, refer to vocabulary other that academic, technical, and low-frequency words (Nation, 2001).

Table 2.1 *Ways of learning and teaching high-frequency words*

Direct teaching	Teacher explanation
	Peer teaching
Direct learning	Study from word cards
	Dictionary use
Incidental learning	Guessing from context in extensive reading
	Use in communication activities
Planned encounters	Graded reading
	Vocabulary exercises

Note. Adapted from *Learning Vocabulary in Another Language,* p. 16, by I. S. P. Nation, 2001, Cambridge: Cambridge University Press.

As for the learning strategies which learners use to acquire vocabulary, Gu and Johnson (1996) listed six major strategies commonly employed by EFL learners – guessing, dictionary, note-taking, rehearsal, encoding and activation strategies, see Table 2.2 for detail description of each strategy.

Table 2.2 *Vocabulary learning strategies*

Guessing strategies	Wider context
	Immediate context
Dictionary strategies	Comprehension
	Extended dictionary strategies
	Looking-up strategies
Note-taking strategies	Meaning-oriented note-taking
	Usage-oriented note-taking
Rehearsal strategies	Using word lists
	Oral repetition

	Visual repetition
Encoding strategies	Association/elaboration
	Imagery
	Visual encoding
	Auditory encoding
	Using word-structure
	Semantic encoding
	Contextual encoding
Activation strategies	Usage of the words

Note. Adapted from "Vocabulary learning strategies and learning outcomes," by Y. Gu & R. K. Johnson, 1996, *Language learning*, *46*(4), p. 653.

According to the study conducted by Gu & Johnson (1996) which aims to explore the relationship between Chinese EFL learners' use of vocabulary learning strategies and their learning outcome, "guessing strategies" and "dictionary strategies" are positively correlated with students' learning outcome in both vocabulary size and English proficiency. Furthermore, imagery, visual and auditory encoding relate more to vocabulary size rather than English proficiency; while contextual encoding, on the other hand, correlate significantly with both vocabulary size and English proficiency, showing the importance of "recognizing a word automatically in natural contexts" (Gu & Johnson, 1996, p. 660).

Challenges learners encounter in English vocabulary learning

Among the abovementioned four ways of learning/teaching high-frequency words and six vocabulary learning strategies, incidental learning, or the "guessing strategies," which means to guess word meanings from context, has been acknowledged to result in vocabulary growth (Krashen, 1989). However, drawbacks of incidental vocabulary learning are also addressed. According to Hunt and Beglar (2002), guessing strategies may only be more beneficial to learners of higher proficiency and it may also be time-consuming. Furthermore, there are risks that learner take wrong guesses or make incorrect inference resulted from the ambiguous information presented in contexts (Shahrokni, 2009; Yoshii & Flaitz, 2002).

Aside from the drawbacks such as wrong guessing and incorrect inferences, there is a certain degree of difficulty to practice incidental vocabulary learning, since many learners do not have the environment that are needed for this kind of learning to happen (Nation, 2001). And while incidental vocabulary learning is often regarded as opposed to the direct intentional learning and teaching, Nation (2001) proposed that the two should be complementary activities, enhancing each other simultaneously, and that a well-designed language learning program should have a proper balance between meaning-focused activities (e.g., incidental learning through reading and speaking activities) and language-focused activities (e.g., the direct study of language items).

As for "dictionary strategies," Brown, Collins, and Duguid (1989) pointed out that dictionary-based learning might result in problems when learners try to use the language in real situations. Barab also argued that the main problems while practicing traditional teaching methods are that information becomes decontextualized, knowledge becomes more indirect, abstract, and experience are second-handed confined in classroom context.

Thus, the present study proposes a learning system that aims to realize the idea of "recognizing a word automatically in natural contexts" (Gu & Johnson, 1996, p. 660) by enabling learners to learn from context, which is the actual environment, and by providing glosses (i.e., the direct study of language items) through the aid of augmented reality technology.

English vocabulary learning and learning styles, FI/D

As Oxford and Anderson (1995) stated, it is necessary for language instructors to understand how students perceive and approach learning tasks, that is, students' distinct learning styles, in order to achieve optimal language learning progress. Among different classifications of learning styles, field independence/dependence (FI/D) in particular, has been extensively investigated and acknowledged to be potentially important in second language acquisition (Alptekin & Atakan, 1990; Chapelle & Green, 1992; Dornyei & Skehan, 2003).

Nonetheless, the results of the empirical studies motivated by the FI/D conducted in the field of second language acquisition showed that the correlation between FI/D and language learning achievement is usually low, and that the FI/D interpretation is simply a measure of intelligence in disguise (Dornyei & Skehan, 2003).

Regardless of the criticisms, Chapelle and Green (1992) provided a powerful defense that knowing learners' FI/D is still significant to offer a better L2 learning experience, since the measure of FI/D of previous studies only tackles one of the three major constructs, the "cognitive restructuring skills," and ignoring the two other components- "interpersonal competencies" and "reliance on internal versus external referents" (Witkin & Goodenough, 1981, p. 54).

The success of second language acquisition is associated with both ends of the FI/D continuum. For instance, FI learners are claimed to be more intense in focusing "on the language stimuli relevant to the language learning task at hand" (Naiman et al., 1978, p.30) and thus exceed in tracking grammatical correctness, acquiring linguistic rules, and scoring better on classroom-oriented language tests like cloze test (Chapelle & Green, 1992). In terms of the personality dimension, Seliger (1977) and Day (1984) denoted that FI learners tend to be the more confident language learner as they depend more on internal reference, and thus may speak out actively and take risks in class. As for FD learners, Chapelle and Roberts (1986) and Brown (1987) suggested that the preference for social interaction of field dependents assists them to acquire language through contextualized practice with native speakers.

The theory of FI/D, as described by Witkin, is "an ever-changing framework, continuously incorporating new discoveries and new insights about the nature of the dimension" (Goodenough, 1986, p.6). Accordingly, the present study, based on situated learning theory, aims at investigating how FI/FD learners differ in learning performance and motivation when vocabulary is acquired in a real setting.

Situated learning

Situated learning theory, or situated cognition, which has a significant impact on educational thinking, was first proposed by Brown, Collins and Duguid in 1989, asserting that knowledge is constructed in an authentic context requiring social interaction and collaboration and that learning is the outcome of interactions among the people, places, objects, processes and culture within the given context (Brown, Collins, & Duguid, 1989; Lave & Wenger, 1990).

Critical characteristics of situated learning for instructional design

While the theory itself is relatively easy to explain, implementing these ideas in instructional design can cause difficulties as the model of situated learning continue to evolve and develop with new research and technology (Herrington & Oliver, 1995). In order to incorporate new technology into situated instructional design, it is necessary to pay careful attention to some of the critical characteristics listed as follows.

- Provide authentic context that reflect the way the knowledge will be used in real-life;
- Provide authentic activities;
- Provide access to expert performances and the modeling of processes;
- Provide multiple roles and perspectives;
- Support collaborative construction of knowledge;

- Provide coaching and scaffolding at critical times;
- Promote reflection to enable abstractions to be formed;
- Promote articulation to enable tacit knowledge to be made explicit;
- Provide for integrated assessment of learning within the tasks (Herrington & Oliver, 1995, p. 3).

Augmented reality to support situated learning

Augmented reality, AR, refers to the concept to augment virtual information to the reality. Azuma (1997) defined AR to be able to reveal the three following features: a combination of real and virtual world, real-time interaction, and accurate 3D registration of virtual and real objects. As for the implementation of AR, varied technologies can be used, such as PC, handheld devices, head-mounted computers and so on. According to Squire and Klopfer (2007), AR has the affordances of the real world setting by offering additional and contextual information to support situated learning.

Empirical studies on technology-supported situated learning in language acquisition

A number of empirical studies have implemented AR in educational settings and have been proved to enable situated learning. However, most of the proposed AR-facilitated learning systems to date are developed for science and mathematics education, because learning such subjects require visualization of abstract concepts (Wu et al., 2013). Still, there are a few learning systems that incorporated AR or other contextual technology (e.g., mobile technology, RFID, GPS) to support situated learning for other disciplines like language education. The following are three empirical studies of context-aware learning applied specifically in vocabulary acquisition (Wong & Looi, 2010; Chen & Li, 2010; Ogata & Yano, 2004).

Wong and Looi (2010) conducted a learner-created, design-oriented mobile-assisted language learning (MALL) study that required primary students to take photos outside the classroom using mobile devices to demonstrate their knowledge of English prepositions (in, on, over, under, in front and behind), and were subsequent asked to share, describe their photos in the classroom to illustrate the spatial relationship of the prepositions by making sentences. The researchers discovered students were excited, engaged, and became "active knowledge builders" rather than passively receiving knowledge in a formal learning setting during the activities (Wong & Looi, 2010). According to the teachers, the photo-taking and sentence-making activity helped student "internalize and enhance the ability to apply the prepositions" with the aid of mobile technology that made learning seamless and thus bridging the gap between formal and informal learning (Wong & Looi, 2010).

Chen and Li (2010) proposed the idea that 'context' is an essential factor in vocabulary learning which also enhances learners' learning interest and efficiency, and thus came up with an English vocabulary learning system call PCULS (personalized context-aware ubiquitous learning system) that personalizes learning by sending learners location-based English vocabulary through positioning techniques. The results indicated that incorporating context-awareness into the learning system increases learning performance.

One of the studies conducted by Ogata and Yano (2004) used a system called TANGO (Tag Added learNinG Objects) that enables learners to acquire vocabulary through authentic objects in the environment with their mobile devices and with the aid of RFID (Radio Frequency Identification) technology. Learners were asked to complete tasks assigned by the system through scanning the RFID tag attached to a specific object, and they reported that relating vocabulary to authentic objects helps them understand the words with greater ease, interest and engagement. The significance of Ogata and Yano's study lies in its corporation of context-awareness and self-paced-ness into vocabulary learning.

The present study

Vocabulary learning has always played a significant role in SLA. Accordingly, numerous vocabulary learning methods and strategies are constantly tested to evaluate its effect on learning performance. Incidental vocabulary learning, which means to guess word meanings from context, are commonly practiced by L2 learners and are closely related to learners' L2 proficiency, denoting the importance of "recognizing a word automatically in natural contexts" (Gu & Johnson, 1996, p. 660).

Aside from the strategy which the learner adopts to acquire vocabulary, individual difference, especially different learning styles such as field independence/dependence may also impact one's learning performance and motivation.

Based on the theoretical foundation of situated learning, the present study proposes a learning system that incorporates the technology of augmented reality into English vocabulary learning with the use of mobile devices, enabling learners to acquire vocabulary in an authentic context by actually seeing and interacting with the environment. Learning motivation and learning outcome will then be measured and analyzed to find out whether there is a difference between FI and FD learners.

Methodology

Method

As shown in Table 4, this study will employ a quasi-experimental design, a one-group pretest-posttest design, to examine the difference in learning motivation and outcome of participants of two different learning styles (field independence/dependence). Before the experiment, a pilot test will be conducted to discover problems before the main experiment and thus to ensure the validity of the experimental design. Then, all the participants will take the Group Embedded Figures Test to distinguish field independent and field dependent learners, followed by a pre-test to measure their motivation and learning outcome. After the pre-test, participants will use mobile devices to learn vocabulary in a real setting. Finally, they will then be given questionnaires and vocabulary tests to measure their learning motivation and learning outcome respectively.

Aside from the experimental design, 10 min, semi-structured individual student interviews will also be conducted at the end of the experiment in order to provide an in-depth understanding of the lived experience of the third graders regarding their opinions and learning attitude toward the usage of the proposed learning system.

Table 3.1 *Design of the study*

One-group pretest-posttest design			
R	O_1	X	O_2

R = Randomization

O_1 = Pretest

X_1 = Treatment 1 (mobile-based AR simulations learning)

O_2 = Posttest

Participants

In order to align the learning system with the existing curriculum guidelines, the participants in this study will be 50 third-grade students, from two different classes at an elementary school in Da-an District, Taipei. Students from both classes will be using the mobile-based AR simulations learning system in a real setting. As for the participants in the pilot test, a total of 50 third-grade students from a nearby elementary will be randomly assigned.

Mobile-based AR Simulations Learning System Overview

The mobile-based AR simulations learning system requires learners to collaborate with teammates to complete the assigned task using an augmented reality platform called *Aurasma*, a free mobile application enabling users to generate their own augmented reality content and is available for both iPhones and Android phones. With wireless Internet connection and the built-in video camera on, additional information in the form of graphic, animations, and audio can be shown on users' screen when recognizing the objects one wishes to augment more information to, see figure 1 for a demonstration of this concept. The theme of the learning system will be about items one encounters in a supermarket.

Figure 1 The concept of the proposed learning system

Procedure

Before the activity using the proposed mobile-AR English vocabulary learning system, students will be given pretests on learning motivation and learning outcome. They will also take a Group Embedded Figures Test (GEFT) to measure field dependence/independence.

The activity begins with the anticipatory set, where students will be asked if they have the experience of shopping in a supermarket, and to contribute to a discussion about their personal experiences and knowledge of a supermarket.

After a pre-information and instruction of the activity explaining what they need to do in the supermarket, students will be divided into 5 sub groups, given a mobile device, and brought to a nearby supermarket. In the supermarket, they will be assigned to a task: First, they'll be given a clue for the first item. Second, when they successfully find out the first item, information of the clue for the next item will appear on their screen when scanning the right item. Then, they need to complete the task by collecting every required item. After all groups have finished the task, the group who spend the least time possible will be awarded back at school.

Finally, after the course/activity, they will be asked to answer questions on the motivation questionnaire and English test to gauge their learning outcome.

Dependent Variables and Instruments

Two dependent variables will be examined in this study: learning outcome and learning motivation. To measure participants' learning outcome, an English vocabulary test will be used, while a motivation survey will be conducted to measure learning motivation. As for the measure of their learning style, field dependence/independence, the Group Embedded Figures Test (GEFT) will be used.

Group Embedded Figures Test

The Group Embedded Figures Test (GEFT), developed by Witkin and his associates in 1971, is one of the most widely used measures of field independence/dependence (FI/D), especially in second language acquisition research (Khatib & Hosseinpur, 2011). The test requires subjects to locate simple geometric figures embedded in a more complex figure. For example, the participants are asked to identify the simple figure labeled "x" (see figure 2) from a more complex one below, and outlined the shape out of it. In general, FI/D is determined by the numbers of the correct answers given by the test takers. That is, those who scored higher are labeled as FI, while those who score lower are branded as FD cognitive stylists.

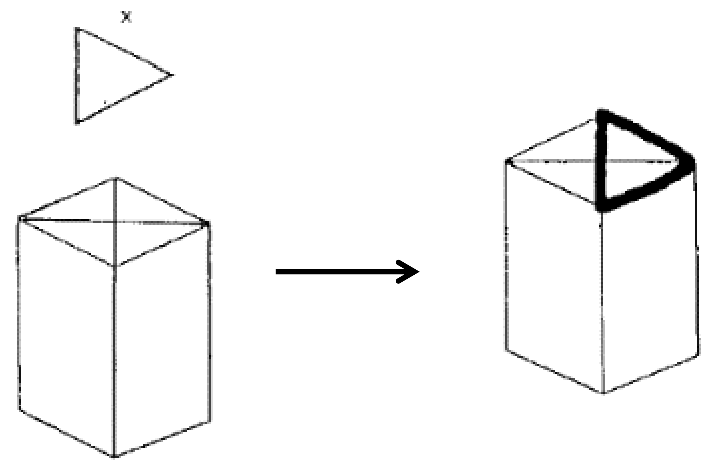

Figure 2 An example of the inquiries in the GEFT

The motivation survey

The survey (see Table 3.2) used in this study to measure English learning motivation of students from the two classes receiving different treatments after the experiment is adopted from the questionnaire developed by Liu (2007), which she had adopted from Gardner and Clėment *et al* (1994) and used to investigate Chinese students' motivation to learn English. Thus, this motivation scale is best suited for this study since participants of both studies share the same target language, English, and native language. However, several modifications are made considering the present situation. For example, questions asking whether participants learn English in order to know more about American or Britain culture and figures, such as "The more I learn about the British, the more I like them," are omitted, considering participants English proficiency level, age limitations and lack of actual contact with native English speakers. What's more, the "travel orientation" part of the original questionnaire consisting of 6 questions is omitted due to the age of the participants, who may not be able to either plan or actually travel abroad through their own will.

Level of motivation will be indicated on a 5-point Likert scale from (1) *strongly disagree*, to (5) *strongly agree*. The modified survey has three main sections: attitudes, integrative motivation, and instrumental orientation. Attitude toward learning English, according to Clėment *et al*. (1994), refers to the assessment of student's affective reaction toward learning a second language. Integrative motivation, on the other hand, refers to the desire to communicate with and become similar to members of the second language community. Finally, instrumental orientation is associated with learners' yearnings to learning the second language for pragmatic gains, such as for the good of one's future studies or career.

Table 3.2 *English learning motivation scale*

Attitude toward learning English
1. Studying English is an enjoyable experience.
2. I really enjoy learning English.
3. I plan to learn as much English as possible.
4. I hate English.
5. I would rather spend my time on subjects other than English.
6. Learning English is a waste of time.
7. I think that learning English is dull.

8. When I leave school, I shall give up the study of English entirely because I am not interested in it.

Integrative Motivation

9. Studying English can be important for me because I would like to meet foreigners with whom I can speak English.
10. Studying English can be important for me because I will be able to participate more freely in the activities of English groups.
11. It is important for me to know English in order to know the life of the English-speaking nations.
12. Studying English is important to me because it will enable me to get to know various cultures and peoples.
13. Studying English is important to me so that I can keep in touch with foreign friends and acquaintances.

Instrumental Orientation

14. Studying English can be important for me because it will make me a more knowledgeable person.
15. Studying English can be important for me because I may need it later (e.g., for job, future studies).
16. Studying English can be important for me because other people will respect me more if I have knowledge of a foreign language.
17. Studying English can be important for me because I will be able to search for information and materials in English on the Internet.
18. Studying English can be important for me because I will learn more about what’s happening in the world.
19. Studying English can be important for me because language learning often gives me a feeling of success.
20. Studying English can be important for me because language learning often makes me happy.
21. Studying English is important to me because it provides an interesting intellectual activity.
22. Studying English is important to me because it offers a new challenge in my life, which has otherwise become a bit monotonous.
23. Studying English is important to me because an educated person is supposed to be able to speak English.
24. Studying English is important to me so that I can understand English-speaking films, videos, TV or radio.
25. Studying English is important to me because without it one cannot be successful in any field.
26. Studying English is important to me because it will enable me to get to know new people from different parts of the world.
27. Studying English is important to me so that I can read English books.
28. Studying English is important to me because it will enable me to learn more

about the English world.

English vocabulary test

English vocabulary test used to examine students after the experiment will be designed with a focus on word production and word recognition. In the word production section, students are asked to fill in the Chinese equivalents of the target words. For the second section, word recognition, match questions are asked to test whether students can match the target words with the Chinese equivalents.

Interview

At the end of the experiment, 10 min, semi-structured individual interviews with the students will be conducted in order to gain in-depth understanding of the participants' lived experience in using the proposed mobile-AR vocabulary learning system. The interviews contain a pre-determined set of questions as follows:

1. "Do you think the method of English learning employed in this course is interesting? Why or Why not?"
2. "Do you think the method of English learning employed in this course is attractive? Why or Why not?"
3. "Do you think the method of English learning employed in this course is useful? Why or Why not?"
4. "Do you think this course improved your confidence in learning English? Why or Why not?"
5. "Are you satisfied with your English learning achievement? Why or Why not?"

Data Analysis

The overall performance, students' English vocabulary test scores and scores of the questionnaire used to measure learning motivation will be collected and analyzed using independent T-test to identify any significant differences between the two different learning styles, field independence and field dependence.

As for the qualitative data, all interviews will be audio-taped and transcribed by the researcher and analyzed with the procedure by first - organize the data, generate categories, themes and patterns; search for alternative explanation for the data and write the report, as proposed by Marshall and Rossman (1989).

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A Paradigm Shift in Culture of Learning via Mobile Learning and Flipped Classroom: Hybrid E-Learning Framework for Management Studies in Higher Education

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This study examines the design of a blended flipped classroom approach through a hybrid e-learning framework for undergraduate management modules. The rapid evolution of technology has facilitated the ease of the information availability and connectivity to learning sources. Hence, the role of teachers in higher education, being subject experts and a central source of knowledge/information is transformed to being adept facilitators and orchestrators of andragogical and autonomous learning. This enables the face-to-face seminar session to take a further well-blended instructional strategy of an extended level of interactive lecture (shifting towards a certain degree of flipped-classroom concept) by incorporating experiential, participative, social and collaborative learning through active-learning approaches. This involves the design, development and production of e-learning platforms, where e-simulation activities and gamification (hands-on activities), subject resources, support mechanisms (pre-seminar) and subject resources that addresses informative learning, collaborative and reflective learning (post-seminar) that enhance and extend the engagement, interactivity and agency in the context of e-learning environments. The proposed framework embeds a more holistic learning with providing students some excitement on the topic to be learned prior to the seminar and the post e-learning platform serves to facilitate student involvement in applying the knowledge acquired with self-assessment practices at their own pace and time anywhere. This largely means that the 4 hour per week face-to-face session can now be extended further from interactive instructional delivery to deeper learning in terms of students' understanding and focus more on the selective key pillars by showing the link through relatedness of being more effective.

Keywords: Hybrid E-Learning, Blended Learning, Collaborative Learning, Reflective Learning, Business Education, E-Learning Environments, Flipped Classroom

Article Type: Conceptual Research Paper

Introduction

This applied research project aims to develop mobile learning and incorporate a flipped classroom through embedding a blended/hybrid e-learning framework for the pre-and-post 4 hour seminar session for undergraduate management modules *(i.e. to be piloted in BE2601 module)*. As the first phase of implementation of this pre-and-post blending e-learning framework, the e-simulation activities and gamification are proposed to be incorporated in the pre-seminar session.

The rapid evolution of technology has facilitated the ease of the information availability and connectivity to learning sources. Hence, the role of teachers in higher education, being subject experts and a central source of knowledge/information is transformed to being adept facilitators and orchestrators of andragogical and autonomous learning. This enables the face-to-face seminar session to take a further well-blended instructional strategy of an extended level of interactive lecture *(shifting towards a certain degree of flipped-classroom concept)* by incorporating experiential, participative, social and collaborative learning through active-learning approaches. This involves the design, development and production of e-learning platforms, where e-simulation *(hands-on activities)*, subject resources, support mechanisms *(pre-seminar)* and subject resources that addresses informative learning, collaborative and reflective learning *(post-seminar)* that enhance and extend the engagement, interactivity and agency in the context of e-learning environments. The pre-post e-learning framework embeds a more holistic learning with providing students some excitement on the topic to be learned prior to the seminar and the post e-learning platform serves to facilitate student involvement in applying the knowledge acquired with self-assessment practices at their own pace and time anywhere. This largely means that the 4 hour per week face-to-face session can now be extended further from interactive instructional delivery to deeper learning in terms of students' understanding and focus more on the selective key pillars by showing the link through relatedness of being more effective. As the first stage of this implementation of this hybrid e-learning framework, the e-simulation business activities and gamification aspects are proposed to be implemented as one of the pre-seminar learning task which facilitates the students to have a deeper comprehension and ability to relate to the logicality of the theoretical concepts and frameworks.

To improve understanding of concepts with application context, encourage deep learning and enable accessibility of information on a global scale which enhances diversity and broad training;

- To achieve learning effectiveness in terms of enhanced performance in students' course assessments and final examination. This will be measured in comparison with their past performance in students' assessment results as well as from qualitative and quantitative inputs from the students, instructors and administrators perspectives, taking reference from prior implementation of the pre and post e-learning models.

- To free up face-to-face teacher-student time for a higher and deeper level of interaction, discussion and collaborative learning, rather than using it to cover merely information;
- To facilitate students' formative feedback throughout the course which will be done through the online assessment quizzes, other online tasks and self-reflection tests which will be useful in providing students with a clearer picture of their learning progress;
- To incorporate higher level of collaborative learning beyond the classroom;
- To facilitate interactivity among learners where learning by sharing through diverse thinking in a group setting as well as individually where self-assessment of learning can be made immediate and autonomous;
- To reinforce and extend classroom-based learning through a creative manner via e-contents and activities (for example, students getting hands-on experience via the e-simulated scenarios/activities, gamifications, mini virtual reality scenarios, etc.);
- To motivate, enhance and sustain interest, getting them 'excited' and making learning fun;

To facilitate learning to take place anytime, anyplace, however shifting the mindset of *"real value"* of coming to seminar to gain tacit knowledge and experiences which may not necessarily be fully obtained from textbooks alone.

Learning Pedagogies

Flipped Classroom

In a flipped classroom approach, the activities which are usually performed within the class and those tasks which are performed outside the class are switched or flipped.

Generally, in such an approach, instead of students listening to the a lecture, they are tasked to some assigned series of recorded lectures, video clips, assigned problems and reading materials before coming to the class to be engaged through in class active and experimental learning using case-studies, problem-based activities, simulations, games and experiments. The key guiding notion of flipped classroom is performing the "hands-on" and problem solving within the class period with the guidance of the tutor.

Table 1 reports the advantages of the flipped classroom advocated by Kathleen Fulton (2012):

Flip Classroom	Advantages
	(1) The flexibility for students to learn at their own pace
	(2) Performing the solving of problems/issues in class provides tutors better insight into student difficulties and learning styles
	(3) The ease of more easily customizing and updating of the curriculum providing it to students 24/7, i.e. anytime (4) Usage of the classroom time more effectively and creatively (5) Reports by teachers who have adopted this approach show that ther are increased levels of student achievement, interest and engagement (6) The new approaches are supported by the learning theory (7) Flexibility and appropriateness of the use of technology for "21st century learning"

Table 1: Advantages of Flipped Classroom

E-Learning

E-Learning is learning that takes place in the context of using the internet and associated web-based applications as the delivery medium for the learning experience (e-learning advisory group, 2002). E-learning is also defined as learning facilitated and supported through the use of information and communications technology (ICT). The potential advantages of e-learning include the opportunity to learn anytime, anywhere, to communicate and collaborate virtually across countries. E-learning is viewed as an opportunity in offering better flexible learning opportunities for students, reaching out to new student markets, facilitating the tracking of students' progress and activities and providing an opportunity for developing new and innovative learning environments. E-learning is pervading in higher education, not just as an effective infrastructure for distance learning on-line courses but blended with more traditional approaches on campus. Carr-Chellman & Duchastel (2000) state the new online paradigm emerges not so much for providing instruction at a distance but rather to facilitate the access to learning resources and instructional activities to students. The teacher is to take on the role of a coach and facilitator in the potentially rich learning environment where students are typically engaged in multiple activities in pursuit of multiple learning goals (Wilson, 1996).

Hybrid/Blended Learning

Rajaram (2013) reports that effective learning and optimal knowledge acquisition cannot be guaranteed by any fixed type of instructional strategy. Instructors should have a thorough comprehension of students' learning attitudes, behavioural aspects and students' profile so as to adopt a well-blended mixture of instructional techniques to achieve optimal learning effectiveness (Rajaram, 2013).

Hybrid or blended learning is a term that means a well-blended combination of online and conventional face-to-face classroom-based teaching and learning (Darby, 2002; Proctor, 2003). This means the design of curriculum incorporates suitable replacement of equal quality/standard e-learning materials and activities which students worked through their own time and pace. However, students continue to attend the seminar session where more value is placed /is given in terms of focusing on collaborative and active learning, enhancing their understanding of concept and its applicability to the industry context. Collins and Moonen (2001) report "flexible learning" as referring to learner's choice, learners being able to make decisions about when, how, in what order, for how long, and where they will study. The ultimate intention of hybrid/blended e-learning is to provide learners with choices as to what they learn, how they want to learn and at what pace they wish to learn. E-Learning also facilitates the opening-up of different avenues for formative assessment which helps to review the course materials again that can be taken by learners when they feel that they are ready or want further practice. This model also allows them to quickly move through the modules they are comfortable with, and spend longer time on the areas of difficulty. Siemens (2004) in his theory of connectivism defines that (a) capacity to know is more critical than what is currently known; (b) learning may reside in non-human appliances; (c) decision-making is itself a learning process. Choosing what to learn and the meaning of incoming information is seen through the lens of a shifting reality, while there is a right answer now, it may be wrong tomorrow due to alternatives in the information climate affecting the decision. This clearly emphasizes the shift in the design and incorporating the pre-and-post hybrid/blended e-learning platform. This implementation facilitates students to achieve deeper level of learning with more collaboration, cooperative and participative context through higher emphasis beyond just merely information delivery during the seminar sessions.

Learning through e-simulation activities and gamification

An activity is thus a game when it comprises of the attributes within a predefined framework. Through numerous studies on games, five attributes have emerged that encapsulate the concept of "game" (Sauve et. al., 2005): player or players, conflict, rules, predetermined goal of the game, and its artificial nature. A game is for fun if it is not used in an educational or didactic context (De Grandmont, 2004). To understand the definitive aspect of games, the definition of educational and didactic games should be examined. Sauve et. al. (2007) states that the "purpose of an educational game is only implicitly centred on learning since the purpose is hidden from the player and the notion of pleasure which it engenders is rather extrinsic. In contrast, the purpose of a didactic game is clearly focused on the task of learning and that is explicitly identified, appealing to the intrinsic pleasure of performance" (p. 250). In both cases, the contributions towards learning from the games are achieved through the influence of interaction with one's environment which is defined as a process of new behaviour or knowledge acquisition.

Salopek (1999) and Dickey (2005) claims that the predetermined goal of a game refers to the end of the game and to the notion of winning, victory or reward. It indicates how the game ends for educational games, it includes the objectives which the player(s) seek to attain (Sauve et. al., 2007). Learning by games enables transfer of learning, creation and acquisition of new knowledge, nurturing of expected attitudes and behaviours and development of intellectual skills (problem-solving, anticipation, function-movement relationships, abstraction, spatial representation, strategy-building, and lateralization) (Whelan, 2005). The games must comprise of appropriate tools (or mechanisms) incorporated for such types of learning to materialize. Scholars (Barnet at. al., 2005; Griffin & Butler, 2005; Schwabe & Goth, 2005; Shreve, 2005; Virvou et. al., 2005' Ward & O'Brlen, 2005) highlight that all educational games should comprise tools such as interactivity channels, instant feedback, active participation by the learner, communication between players, challenge, motivation, repeated practice, player control of their learning and teamwork. These mechanisms allow the use of socio constructivist pedagogy inherent in games that respond to the needs of the new generation of learners. This is exactly what is required to tackle the current issue of engaging new generation of business students to have the knowledge transfer optimized.

"Gamers" comprises a large majority in the new generation. This group has an exploratory approach and short attention span during learning, which could be referred to having a cognitive style characterized by multi-tasking while learning (Asakawa &

Gilbert, 2003; Bain & Newton, 2003; Prenskv, 2005). Shaffer et. al. (2004) reports that during the game, the learner plays first, understands after, and then generalizes in order to apply this learning in a new situation. Drawing from a constructivist approach, the authors affirm that the learner becomes active during the game and participates in the construction of his/her knowledge. Today's adolescents have a profile as communicators - intuitive and visual who responds and relates to games (Oblinger & Oblinger, 2005). These learners prefer to learn through experimentation rather than by direct instruction. As their interest span is short, they easily and quickly move from one setting or activity to another. They also tend to expect a quick response similarly to how they respond rapidly to questions (Sauve, et. al, 2007). In summary these new generation learners expect interactivity, interaction, kinesthesis, active visualization and immediacy.

Simulations offer a miniature version of a sphere of concrete activities in real life (Cioffi et.al., 2005). Educational simulation offers a type of controlled reality and is similar to real life where learners can explore with elements of reality (Martin, 2003; Swanson & Ornelas, 2001). Effective simulation places learners in real situations in which they can act and make decisions with the aim of obtaining real-time feedback (Maier & Grobler, 2000; Goldenberg et. al., 2005).

Though it is to be clear that games and simulations are distinctive concepts. A game is developed without any reference to reality, which is never the case for simulation or a simulation game (Sauve, et. al., 2007). Simulation is not necessarily a competition or conflict and the individual who uses it, is not desiring to win, whereas it is such in the case of a game (Sauve, et.al, 2007)

LAMs (Learning Activity Management System)

LAMs (Learning Activity Management System) is a learning design system with a particular focus on sequencing of collaborative learning activities. LAMs guides practitioners through the process of learning design (Dalziel, 2003). Users can pick and mix different types of learning activities using a ‘drag and drop interface’. LAMs is an integrated system for authoring, running and monitoring learning designs.

To achieve a well-blended, holistic and practice-oriented business education, more interactive, experiential, dialogue and action-learning pedagogical approaches, together with a well-blended e-learning platform are encouraged. This shift in the approach of instruction will enable more holistic and practice-grounded oriented management skills to be ingrained into students. Moreover, this enables developing students’ key essential skills and abilities to perform/manage business globally, gain competitive advantage, maximize profits as well as serve community and human needs by helping to create a world that is more equitable, just and ecologically sustainable. By shifting the learning to students, it deepens their ability to develop self-awareness and relate the practicality in applying the concepts acquired. By facilitating a caring, supportive and encouraging learning environment, students are encouraged to learn from making mistakes, sharing their failures openly, taking risks and gaining valuable insights with open debates/dialogues with those with differing views/perspectives. This interactive and reflective learning framework embedded with the pre and post e-learning model is crucial to facilitate the shift in holistically achieving an optimal learning process.

The proposed framework allows the face-to-face seminar to be shifted to emphasize more (with the 50% to approximately 80%) on how deeper learning on key essentials can be examined through various approaches of active learning.

The pre-seminar *(before attending the face-to-face seminar session)* e-learning activities allow learners to get some hands-on feel on the topic through the e-simulation activities and gamification, get them started thinking about the contextual part of contents and having them excited on what they could expect to learn in the class. There would be varying e-activities having students to hands-on the management concepts through platforms, for example e-games, e-simulating management activities, viewing some short-videos, having to read short magazine/newspaper articles, some debate discussions via face book, twitter or via other social media platforms, reflection journals, posting a blog, etc. to relate to the topic which will be covered. For a few selected topics, students will also be asked to view a series of recorded lectures, broken down to separate segments *(max of 7-8 minutes)* with a quick reflective quiz to answer. For these topics, the flipped-classroom concept will be brought in to facilitate the sessions. However, this applies to only 25% of the topics covered. The remaining 75% of the syllabus will have designated pre-learning activities which gets the students have some ideas on the topics before the face-to-face interactive seminars where no one way lecture is adopted. Instead, key concepts will be delivered in a more interactive manner, where deep learning occurs. However, the post e-learning platforms will facilitate a series of short e-recorded lectures which facilitate as a refresher and further extend beyond classroom learning which can be viewed at students' own time and pace. Moreover, there will also be other e-learning activities *(example: discussion forums, case-study debate with question and answer sessions, etc.)* to facilitate collaborative learning with formative self-assessment *(for example: quizzes, self-tests, etc.).*

As the first phase of implementation, in this project, the concept of gamification and e-simulation business management activities are focused to be designed to be incorporated as part of the pre-seminar session. The e-simulation activities/games that are proposed to be included as part of the pre-seminar activity serves as a platform for the students to learn and acquire key concepts effectively through a fun and yet interesting manner. This makes their interest in the topic deepens and wanting them to find out more during the face-to-face seminars. From a learning perspective, this platform would engage them largely because they are able to hands-on and acquire knowledge in a manner that would easily engage them.

Below is the conceptual framework *(hybrid e-learning model)* that embeds the e-learning pedagogical strategies for pre-and-post seminars to achieve effective learning for business students in higher education. For this project, as the phase one implementation, the design and implementation of the **e-simulation activities and gamification** is proposed to be incorporated as part of the pre seminar e-learning platform.

Flipped Classroom:
Hybrid E-Learning Framework

Pre Seminar E-Learning Platform

LAMs (Learning Activity Management System)
Informative learning *(Short video clips, recent articles, noticeboards, resource sharing, image gallery)* [To be developed in-house]

AcuStudioDuo
A series of e-recorded lectures [To be developed in-house]

Social Media

4 hours face-to-face seminars

Pedagogical strategy
Interactive Lecture (with the adoption of a certain degree of flipped classroom concept)
With Active Learning Approaches

Exper iential

Participative, Social & Collaborative Learning

Gamification and E-Simulation Management Activities
(getting students involved through hands-on) [To be developed by vendor, outsourced]

Post Seminar E-Learning Platform

LAMs (Learning Activity Management System)
- Collaborative learning *(Discussion Forum)*
- Reflective Learning *(Question and Answer Session; e-assessment, Quizzes, mind maps)* [To be developed in-house]

The project aims to achieve the following key outcomes by enhancing the learning experience of students pursuing business management modules *(across all schools in NTU)*:

For this Project (Phase 1):

Phase 1 (Design of e-simulation of business management activities/games)

- To engage and "excite" students on the contents to be learned through e-learning "hands-on" experience
- To facilitate a e-platform to make them understand difficult concepts much easier through simulated activities and games
- To enable students to learn through a "fun" and interesting manner which enables them to be deeply involved in learning the concepts

Plus beyond this Project (Phase 2):

Phase 2 (Design of other Pre-and-Post e-activities through LAMs and series of e-lectures through AcuStudioDuo)

Hybrid e-Learning Model (Phase 1 + Phase 2)

- To equip students with pre-learning, preparation and reflection time so that their class time is driven towards more value-adding activities, for example, more discussions on areas that needs to be related to more explicit practical examples, experiences and the tacit knowledge which may not be found in the textbooks or reading materials;

- To ensure more experiential, collaborative, social and interactive learning that enhances deeper learning through higher involvement of active learning activities during the face-to-face seminar sessions.

- To train and nurture students to become better problem solvers and independent thinkers by enabling more engagement and participation by challenging norms. This enables them to develop their confidence and ability to become critical thinkers and problem solvers instead of just merely acquiring the theoretical without much deep learning.

- To train students to come prepared and ready to optimise their classroom time with their professors. The discussions are then extended beyond textbook knowledge where tacit knowledge and experiences would then be shared to achieve the true value-add in learning.

To encourage students to go through, reflect and assess their acquired knowledge. This also enables students to self-practice through these interactive e-activities (for example, discussion board, assessment quizzes, etc.)

The proposed project is essential and timely (due to students' changing learning behavioural traits and easy information availability) to address the rapid changing needs and requirements of students' learning style (example: students expect beyond the basic of contents delivery on a topic as they could read the textbooks and the theoretical information is readily available via Internet; the behavioural traits of today's students are shifting towards more participation and them wanting to be involved in the class discussions, etc.) as well as to nurture them holistically. As a business school, providing students the knowledge and skills to become future managers and business leaders is crucial to enhance how knowledge can be delivered more effectively through re-designing the pedagogical approaches embedded with technology. Learning happens only when students are placed out of their comfort zones where they are made to think, examine and question the unknown. By doing so, they are made to go through the rationale and reasons behind the answers to the questions that they want to find out eventually. This project enabling the design and development of the e-simulation activities/games (phase 1 of the e-hybrid model) comprising the pre/post e-learning platforms achieves the shift in students' learning styles and how they acquire knowledge. The shift is in having the basic information learned beyond the classroom (having the students to get enthusiastic in learning) as well as preparing before the seminar session and having post-seminar activities serve as a refresher and self-assessment tool. Moreover, implementation of the project enables more valuable time within the classroom for students to perform deep learning through active, collaborative, experimental and social learning – this enhances the learning process for students as they are able to apply, be engaged and enable to reflect deeply what they have been taught. To address the amount of pre and post time allocated for the e-learning platforms, the design of the e-learning platforms will be carefully thought through so that it does not contain too much information and is not too time consuming, but rather having the students to be "excited" and "experience" relevant concepts through virtual reality games/activities. This should also facilitate them to find out more before attending seminars with some basic knowledge as well as to motivate the use the post e-platforms largely as a formative assessment platform where it serves to measure of their understanding of concepts learned.

- The progressive enhancements and new incorporations will be developed while having them included as deemed appropriate. This is also encouraged as implementing the model in phases across the varying topics progressively, enables seeking of feedback from students, experiencing the practical implementation concerns/ limitations, having them addressed so as to develop a workable yet effective model;
- A feasible timeline schedule with a detailed action-plan with intended activities has been planned to ensure the project progresses well and achieves the intended project outcomes;
- Post implementation:
- Annual review on the contents of e-simulation business activities/games under the pre and post e-learning model will be performed to ensure the currency and updateness is under consistent monitoring;
- The design of the e-simulation activities/games under the pre and post e-learning model will be made user-friendly and easy to perform these changes/improvements (if any).

Conclusion

To achieve a well-blended, holistic and practice-oriented business education, more interactive, experiential, dialogue and action-learning pedagogical approaches together with a well-blended e-learning platform are encouraged. This shift in the approach of instruction will enable more holistic and practice-grounded oriented management skills to be ingrained into students. Moreover, this enables developing participants' key essential skills and abilities to serve human needs by helping to create a world that is more equitable, just and ecologically sustainable. By shifting the responsibility of learning to participants, it deepens their ability to develop self-awareness and relate the practicality in applying the concepts acquired. By facilitating a caring, supportive and encouraging learning environment, students are encouraged to learn from making mistakes, sharing their failures openly, taking risks and gaining valuable insights with open debates/dialogues with those with differing views/perspectives. This interactive and reflective learning framework embedded with the pre and post e-learning model is crucial to facilitate the shift in holistically achieving an optimal learning process.

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Conceptualising Authentic Mobile Learning

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Conventional accounts of authentic learning focus on contextual factors: tasks, processes, how situated the learning is and the extent to which learners engage in simulated or participative real-world activities. This paper theorises how ubiquitous mobile technologies are fracturing the boundaries that demarcate traditional accounts of authentic learning affording new opportunities to reconceptualise what authenticity means for learners when they use a boundary object such as a mobile device. Whilst some of this has been captured previously with terms like 'seamless', 'contextualised' and 'agile' learning this paper argues that the concept of authentic mobile learning is a highly fluid construct which will continue to change as the technologies develop and as the pedagogical affordances become better understood by educators and end-users. The paper offers a three-dimensional model of authentic mobile learning and argues that further empirical research is required to understand what is authentic mobile learning from the perception of learners.

Keywords: authentic learning; mobile learning; situated learning

Introduction

> 'authenticity remains a concept that is referred to by many, yet poorly defined'
>
> (Barab, Squire, and Dueber, 2000, p.38)

Contemporary endeavours to understand and define mobile learning (m-learning) draw attention to the situated and seamless nature of activities that are mediated through the affordances of mobile technologies, describing these as authentic learning (Herrington & Kervin, 2007; Herrington, Mantei, Herrington, Olney & Ferry, 2008). Learners are considered to be more engaged in contexts which offer high levels of personal significance and cultural relevance. In terms of personal significance they act as a bridge linking new information and theories to learners' life worlds outside of formal education and in terms of cultural relevance they enculturate the learner into the practices of the community helping them to think like a member of the discipline (Lombardi, 2007; Meyers & Nulty, 2009; Stein, Isaacs & Andrews, 2004). Despite considerable research associated with authentic learning (Barab, Squire & Dueber, 1989; Browns, Collins and Duguid, 1989; CTVG, 1990; Petraglia, 1998; Radinsky, Bouillion, Lento & Gomez, 2001), there are to date relatively few studies which have analysed how mobile technologies support and enhance authentic learning and reciprocally how far authenticity is an inherent characteristic of mobile learning itself (Herrington & Kervin, 2007; Herrington, et al 2008; Kearney, Schuck, Burden & Aubusson, 2012; Kearney, Burden & Rai, 2015).

Recent data, collected by the authors from an international survey of educators using mobile technologies in their teaching and learning, highlights one of many confusions associated with the twin concepts of authenticity and mobile learning. Participants consistently ranked the construct of authenticity as 'high', with a mean average of 2.4 on a scale of 1 (low) to 3 (high), when describing a learning scenario where they had used mobile technologies for pedagogical purposes. This high ranking of authenticity by the teachers was despite the fact that 82% of their self-reported scenarios were situated in formal institutional settings such as schools and universities which might normally be considered rather inauthentic settings (Kearney, et al, 2015). This paradox forms the focus for this article which seeks to theorise the concept of authentic learning with mobile technologies. Although authenticity and the learning theories associated with it are often described alongside mobile learning many of the underlying concepts and approaches which have been adopted to enact them as pedagogy are based on a range of assumptions about learning which are rarely articulated or fully explained (Radinsky, et al, 2001, p. 406; Selwyn, 2014).

The paper is structured as follows. Section 1 outlines the background for the paper by exploring why authentic learning is considered important. Section 2 seeks to define the term authentic learning identifying two interpretations which are evident in authentic mobile learning. The main body of the paper (Section 3) brings together existing research about authentic learning to facilitate and support mobile learning. In so doing it identifies three distinct and recurring definitions. These are subsequently presented as vectors in a 3 dimensional orthogonal model which is offered as an original way to conceptualise authentic mobile learning (Section 4). In this final section we discuss the implications of these theorisations and consider the utility of the proposed model for better understanding the phenomenon of mobile learning and authenticity.

Why is authentic learning important?

The concept of authentic learning is not new and may have reached its zenith in Europe during the Middle Ages when it functioned as the primary mode of instruction in the craft guilds where apprentices honed their skills vicariously alongside a master craftsman (Lombardi, 2007, p.6). The advent of industrialisation brought about the need to train a mass labour force meaning the apprenticeship model of learning declined and was supplanted by less direct but more cost-efficient institutional systems of mass education (Klopfer, Yoon & Rivas, 2004). Only in recent years has interest in more authentic, real-world learning resurfaced alongside theories of situated learning (Brown, Collins, & Duguid, 1989) and cognitive apprenticeships (Collins, 1988; Collins, Brown & Newman, 1989). Much of this renewed interest can be traced to economic and technological imperatives which have combined to make authentic learning both economically viable and pedagogically appealing.

The economic drivers stem from the structural shifts in post-Fordist capitalism which have seen the decline in traditional labour intensive industries and the emergence of new forms of production which are largely ‘immaterial’ in nature, based on the manipulation of networked knowledge and ideas (Lazzarato, 1996; Selwyn, 2014). These structural shifts demand a new set of skills and dispositions for a largely immaterial workforce which include creativity, networking, cooperation and autonomy (Selwyn, 2014).

Technology is also an important driver in the renewed popularity of authentic learning since computers, and more lately mobile technologies have matured to the point at which previously inefficient models of learning are once again feasible. Mobile technologies are relatively ubiquitous, small and discreet making them ideal for many work-based learning tasks such as capturing images, notes and reflections in situ (Burden, Schuck & Aubusson, 2010). Today’s mobile devices are invariably networked which allow learners to participate in real communities of practice such as Science Citizen projects where they are supported by genuine professionals, akin to the traditional apprenticeship model, although at a greatly reduced cost.

Given this resurgence of interest in models of authentic learning and the world-wide technological shift to post PC devices (PPD) such as mobile phones and tablet computers, it is timely and important to better understand the assumptions which underpin the concepts of authenticity and mobile learning. Therefore this article addresses the following research questions:

- what assumptions underpin the concept of authentic learning with mobile technologies?
- what functional value do these conceptualisations serve for educators and the wider academic community seeking to further exploit the potential of mobile technologies?

Defining authenticity

The Oxford dictionary definition of the term authentic reveals two etymological strands upon which similar but significantly different interpretations of the phrase have gradually emerged. In its original form, deriving from the Greek term ‘authentikos’, authentic is defined as meaning of ‘undisputed origin’, ‘not a copy’ or ‘replica’ and this interpretation has been appropriated into the legal lexicon where synonyms like ‘genuineness’, ‘bona fide’ and ‘veritable’ are used to imply the integrity and originality of a person, object or act.

The second etymological derivation, which has become the more commonly used (at least since the 18th century) stems from a more representative understanding of the term associated with secondary rather than direct experience. An account of an eye witness is described as authentic if it is accurate in its representation of the facts. Authenticity, in this second sense of the term is a measure of reliability and correspondence between the original artefact (e.g. an accident in the street) and its secondary representation (e.g. by an eye-witness). In this secondary interpretation various proxies such as trustworthiness and authoritative certification replace the certainty afforded by direct sensory first-hand presence (Russell, 1959) and in this sense authenticity is a measure of fidelity and correspondence between the primary account and its second-hand re-presentation.

When the term authentic is used in association with learning both the direct and representative etymological definitions are invoked but until recently with the emergence of ubiquitous ownership of mobile devices authenticity has most commonly referred to the representative interpretation whereby students tackle real-world problems and challenges through a simulated, rather than a direct participatory interface. Technology and he affordances of mobile technologies, challenge these traditions as will be discussed later in the article.

Authentic learning and mobile technologies

The term authentic learning is used in various different ways in the field of educational technology and this section explores three different descriptions based on studies of mobile technology use reported in the research literature.

In the first of these authenticity describes the context of the learning activity and the extent to which this is participative or simulated. In these descriptions authenticity is judged by the extent to which students engage in activities and tasks like those undertaken by professional communities of practice in so called 'real world' settings. The second definition relates more to the nature of the tasks and activities undertaken. In these cases authenticity is a measure of the degree of agency granted to students which is also correlated with the extent to which the learning activity is predefined or emergent, planned or unplanned. The third definition of authenticity is embedded within the student's personal goal structures and emotional engagement with the learning activity. From this perspective authenticity is a measure of how far learning activities 'engage students' lived experience, enabling students to find meaningful connections with their current views, understandings and experiences' (Stein, et al, 2004, p. 240).

Unpacking authentic learning

It is generally agreed that authentic learning ideally requires students to tackle real-world problems located in contexts that mimic the work of professionals and discipline experts (Collins, 1988; Herrington, et al 2008; Lombardi, 2007; Maina, 2004; Renzulli, Gentry, & Reis, 2004)

> 'In general, learning environments are considered authentic when there is a similarity between the structured learning activities and some meaningful context for that activity' (Barab, et al, 2000 p.38)

In traditional educational paradigms participative authenticity requires learners to be physically located in the community of practice or professional setting itself as in the apprenticeship model, whereas simulated authenticity allows learners to be located in their normal spaces and contexts where the conditions of the real-world contexts are replicated. Technology blurs these distinctions and mobile technologies are causing them to fracture in ways which are not yet fully understood or appreciated.

Participatory contexts

In participative authentic contexts learners participate in genuine real-life communities as 'legitimate peripheral' members (Lave and Wenger, 1991) gradually learning the practices, stories and languages of the community or what has been described as "the ordinary practices of th[at] culture" (Brown, Collins, & Duguid, 1989, p. 34). In effect learning is a socio-cultural process of identity formation as novices are enculturated into the dominant practices of the community gradually gaining status as experts. Learning is considered to be highly authentic because it is situated in the same context that it will be used making it personally meaningful for the learner.

A practical example using mobile technologies would be use of the *sense-it* ® app which supports learners in measuring and investigating real-world phenomena. It is based on the principles of Citizen Science whereby members of the public use the app on their mobile device to collaborate with professional scientists, contributing to observation and measurement data such as species identification and air / water pollution monitoring (Henerodotou, Villasclaras-Fernández, & Sharples, 2014). A similar participative project using mobile devices was reported by Scanlon, Woods and Clow (2014) who explain how users of the iSpot application were able to participate in location-based science activities based on the local environment, sharing their findings and data with professional scientists and other activists in an online community of practice.

A simple but highly effective example of participative authenticity is reported by Ebner (2009) who undertook a study of academics using Twitter on their mobile phones as a back channel at an academic conference. Delegates tweeted their responses and impressions of each presentation and these tweets were simultaneously projected on a large screen behind the presenter. In this respect delegates where physically situated in a highly authentic context (the conference) and were also participating in a genuine community of academic practice, as were those lurkers who could not attend the conference directly but could follow and participate online.

In these examples of participative authenticity mobile technologies mediate how learners work alongside professionals gradually acquiring the habits and cultural trappings of the community as in a traditional apprenticeship model. However, in many of these examples the learner does not need to be physically located in the actual community since this can now be achieved through virtual participation even from within a formal setting such as a classroom or conference venue. In this sense mobile technologies are blurring the boundaries or seams between formal and informal learning contexts enabling learners to work in ways which are often described as seamless and unbounded (Looi, Seow, Zhang, So, Chen & Wong, 2009).

Simulated contexts

Previoulsy most authentic learning activities have been simulated in a 'practice field' (Brown, et al, 1989; Collins, et al, 1989) such as the classroom due to the logistical problems associated with direct participation including costs, time and concerns about personal safety. In these benign spaces learners simulate the tasks and processes of real-world contexts. Many apps and tools are now available which mimic the tools and processes used by professionals in the real-world such as measurement tools (e.g. virtual wind tunnels, oscilloscopes and laminators) in science. Where these have been used effectively, such as the 'connected classroom' project (Foley & Reveles, 2014), they use real-world online resources to engage students in authentic but simulated science inquiry. In this example students used handheld devices within the classroom to share data from their own experiments with other students and schools allowing them to compare and analyse across larger data sets and collaboratively identify trends as a community of science learners (Burden and Kearney, 2015).

In a similar case study Jones, Scanlon and Clough (2013) discussed how their nQuire software tool was used on mobile devices to enable science students to take greater responsibility for their own inquiries without adult help. These inquiries were engaging and personally relevant and allowed students to continue their inquiry seamlessly across different contexts such as an after school club and home. These tools and apps have the potential to support highly authentic forms of simulated learning both in formal and hybrid spaces (see below) but empirical research to date suggests they are often used by teachers for low level, unrealistic tasks which bear few resemblances to authentic practices (Kearney, et al, 2012; Kearney et al, 2015).

Hybrid contexts

Current advances in mobile technologies have fractured the traditional boundaries between participative and simulated contexts. In some cases this has seen students participating virtually from within formal contexts in genuine and real communities such as the nQuire project described above (Jones, Scalon & Clough, 2013). In these contexts learning takes on a hybrid complexion which combines features of both a direct, participative and indirect simulated model of authentic learning, and many of the technology projects which have explored these spaces report that they combine all of the best qualities of simulations with the additional benefits of high ecological validity acquired through participation in a genuine community.

The combination of Augmented Reality (AR) applications and mobile devices frequently results in hybrid models of authenticity referred to as 'participatory simulations' (Barab & Dede, 2007). Wong and Looi (2011), for example, documented a series of games played in a physical environment but augmented by virtual artefacts through the mediation of a mobile device (they called this 'mixed reality learning'). Mobile devices with location-based sensors allowed users in the study to interact with explorations, experiments and challenges for inquiry and games-based learning. Lui, Kuhn, Acosta, Niño-Soto, Quintana and Slotta (2014) described an immersive, cave-like rainforest simulation (called EvoRoom) and a mobile inquiry platform (called Zyeco) that enabled users to collect and share data. Students were co-located in an immersive and physical digital space, collecting observational data from both the classroom itself (Evoroom) and out-of-class settings (such as parks or museums), and exploring peers' data using large visualisations displayed at front of room.

Is authentic mobile learning predefined or emergent?

Despite advances in mobile technologies which have afforded learners greater agency in how they access information, where they situate their learning and how they present the outcomes of this as assessment artefacts, some authors have noted the reluctance of educators to cede significant control of learning to students (Kearney et al., 2015). This is reflected in the extent to which learning is predefined or is left more open ended and emergent in design.

Williams, Karousou and Mackness (2011) define emergent learning as "learning which arises out of the interaction between a number of people and resources, in which the learners organise and determine both the process and to some extent the learning destinations, both of which are unpredictable" (p.3). There is an implicit assumption in many of the studies on authenticity that learning is likely to be more unplanned and emergent than predefined or prescribed when students tackle ill-defined, problems that defy simplistic or quick solutions.

Over prescription and unnecessary intervention by educators is included as one of Herrington et al's list of inauthentic strategies for mobile learning (2008).

Some researchers have identified planning related to learner generated contexts as a significant vector in understanding how mobile technologies can make learning more authentic (Toh, So, Seow, Chen, & Looi, 2013). These studies show how students spontaneously used their mobile devices to capture and share images or video clips related to a personal interest or hobby (e.g. bird watching) without the direction or prescription of a teacher or adult (Jones et al, 2013). These examples often occur in informal settings outside of institutional control but there is no reason to suppose this kind of incidental learning with mobile technologies, could not, and is not taking place within formal settings in the form of serendipitous learning (e.g. where a learner uses their mobile device to capture an idea or inspirational thought) (Toh, et al, 2014; Williams, et al 2013).

One area where emergent learning is more evident is in mobile games based applications where players can engage in highly realistic simulations and problem solving exercises that mimic many of the tasks undertaken by real professionals. Gwee, Chee and Tan (2010) reported one such mobile simulation which featured year 9 social studies students using the game *Statecraft X* on their iPhones to learn about the concept of governance through role play. What distinguishes the game is the amount of spontaneity and lack of planning. Students worked largely at their own pace without interventions or schedules to regulate them.

These discussions then invite questions as to the extent to which authenticity can or should be designed into the learning experiences of students when they use mobile technologies (Barab, et al, 2000; Petraglia, 1998). This raises an obvious tension as it is difficult to visualise how instructors can design learning activities that are entirely emergent since the very act itself assumes a degree of deliberate intent.

For some researchers the solution is to 'deny the legitimacy of preauthentication' altogether by which they mean they reject the notion that designers or teachers can construct predefined authentic tasks, even if these have real and practical use to a genuine community of practice (Barab, et al, 2000). They argue that these elements of authentic learning cannot be predefined because they do not guarantee 'buy in' from learners. If the learner does not personally perceive the context to be authentic it cannot be 'preauthenticated' or designed by some other person. In this sense authenticity "is manifest in the flow itself, and is not an objective feature of any one component in isolation" (Barab, et al, 2000, p. 38).

Personal commitment of learners

In considering the nature of authentic learning it is important to identify for whom the learning will be authentic (Barab and Duffy, 2000). Most descriptions of authentic learning describe it from the privileged perspective of the instructor or designer and it difficult to appreciate to what extent learners themselves perceive a learning practice to authentic, or what indeed learners think authentic means. However, ultimately authenticity "lies in the learner perceived relations between the practices they are carrying out and the use value of these practices" (Barab, et al, 2000, p. 38).

This is partly a methodological concern and there is an urgent need for researchers to design more authentic methods and tools which will gain access to this largely missing learner perspective. This is a genuine concern since designing realistic, real world tasks or contexts and processes that mimic or place learners in actual professional communities may count for little if the learner does not perceive these artefacts to have personal significance and meaning in relation to their desired learning objective

> "It is very important to consider what is meant by authenticity and to whom - who is the judge (the educator; the learner or the community upon which they try to emulate?)"
> (Barab & Duffy, 2000)

Indeed there is a concern amongst some that what constitute genuine real world communities of practice for adults may be far from authentic from the perspective of learners who may speak an entirely separate discourse based on the 'curricular language' with which they are familiar (Heath and McLaughlin, 1994). These critics argue that teachers should attempt to locate authentic learning in what they term 'institutions of curricular authenticity' where familiar curricular practices, languages, norms and traditions are the Lingua franca. This position is further supported by Hiebert et al (1996) who argue that students can be engaged in deeply contextualised and authentic tasks within the curriculum as long as they are personally challenged to engage with the underlying concepts and deep structures of the discipline itself.

These considerations therefore foreground a critical third constituent in authentic learning which is the emotional and extra-rational dimension of learning and the commitment of the learner whilst also highlighting one of the more substantial epistemological challenges in the field of authentic learning: how can we capture and understand the learner's emotional sense of engagement and commitment?

> "This definition of authenticity correlates how well a learning activity matches a student's personal goal structures (Heath and McLaughlin, 1994) or the extent to which learners themselves problematize the elements that make up the context" (Stein, et al, 2004, p. 240)

In many of the case studies reported in this paper we can infer that learners were highly motivated and engaged in the mobile learning activities which are described but meaningfulness is a difficult construct to capture and few of the studies detail to what extent the mobile activity enabled learners to develop personal meanings, or indeed why. One exception is the pilot study for the Ecomobile project (Kamarainen et al, 2013). This project explored how the use of a mobile AR application (FreshAIR) could be combined with probeware tools and software to enable students to understand the ecosystem of a pond in ways which resembled real scientific practice. Feedback and video evidence from students undertaking the project indicate that it was highly engaging and had considerable personal significance for students working in their local environment. They appear to have engaged with the topic on a highly personal level despite the fact it did not feature a genuine professional community of scientists as such.

Discussion and implications

Derived from the above definitions and examples we propose the following orthogonal model as a means of further conceptualising authentic mobile learning (see figure 1). We identify *Context* as a critical vector in understanding how and where the learning activity is situated and use the terms 'simulated' and 'participative' as the binaries for this continuum. These are not proposed as normative labels since there is no implication here that either form of authenticity is necessarily more desirable than the other.

The second axis called *Planning Design* measures the extent to which the learning activity is planned or unplanned in a similar way to the model developed by Toh et al (2013). However, given the emerging affordances of mobile technologies we place greater emphasis on the agency of the learner in co-negotiating and designing these contexts. Hence this vector is used to measure both the degree of agency granted to the learner and the extent to which the learning activity as a whole is preplanned or emergent.

Thirdly we include a vector capturing the personal relevance and consequent engagement of the learner since this has emerged across many studies as a highly significant but often neglected element of authentic learning. Unlike the other two vectors which are not normative this vector is more judgemental since it is recognised that learners will elect to disengage from learning which holds little or no personal significance or meaning for them.

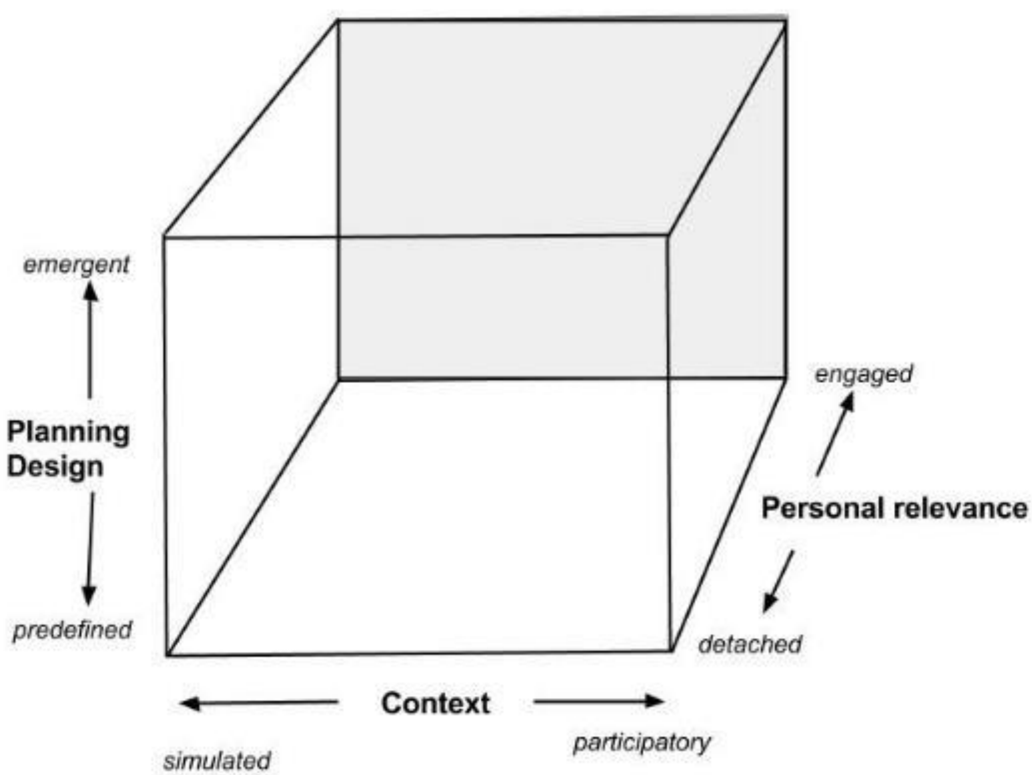

Figure 1. A conceptual model of authentic mobile learning

How does the model work?

To illustrate how this three dimensional model might further support the conceptualisation of authentic mobile learning we have populated it with the three mobile learning scenarios described earlier in the paper represented by the letters A, B and C (see Figure 2 and Table 1).

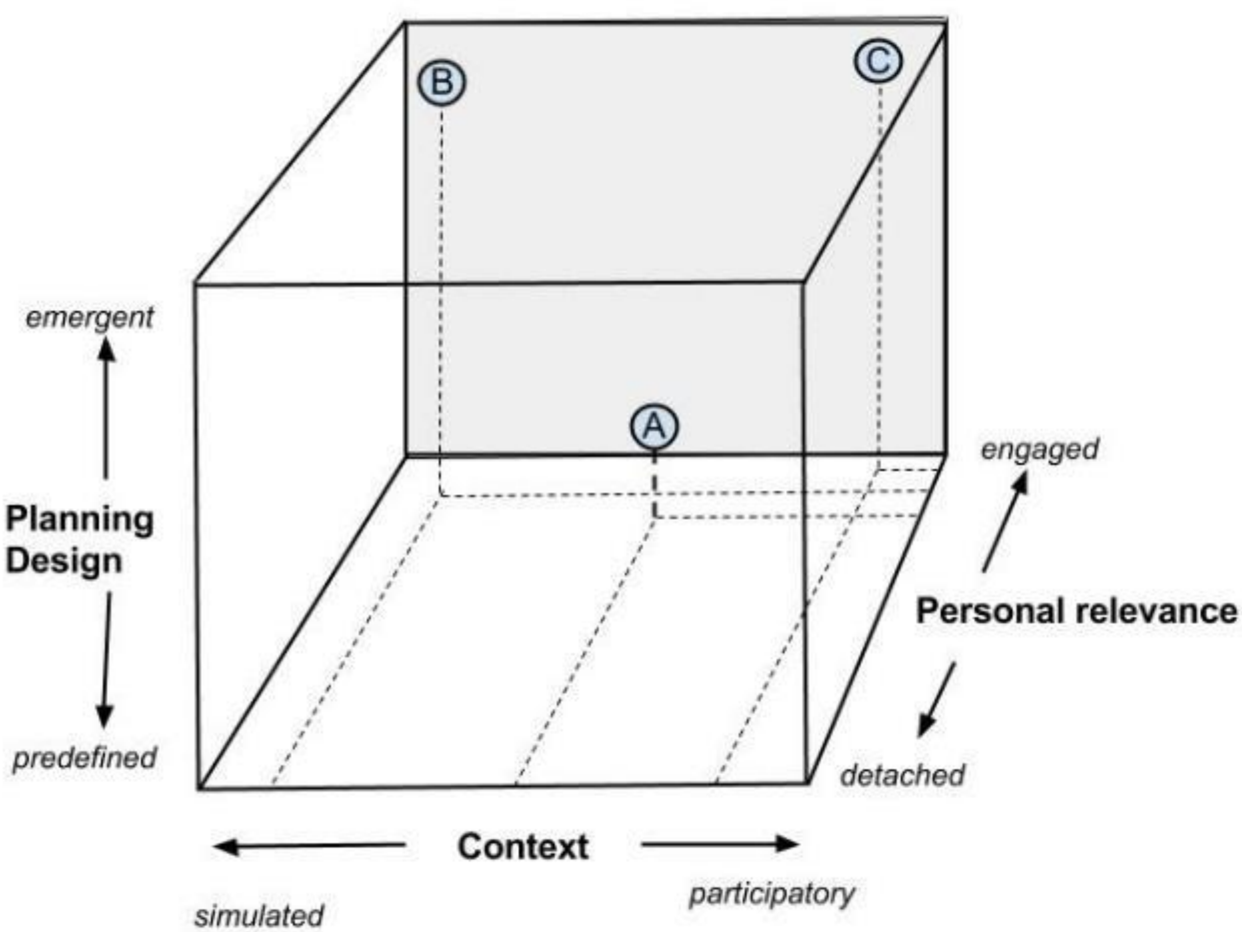

Figure 2. Authentic mobile learning examples

	Exemplar	Context	Planning Design	Personal Relevance
A	Ecomobile project (Kamarainen et al, 2013	Hybrid	Predefined	High
B	*Statecraft X* mobile learning game (Gwee, Chee, and Tan, 2010)	Simulated	Emergent	High
C	Twitter back channel in an academic conference (Ebner, 2009)	Participative	Emergent	High

Table 1. Characteristics of exemplar authentic mobile learning scenarios

In terms of the context vector only the Twitter example (C) was classed as participative since it was set in a genuine real world context in this professional learning scenario (an academic conference) accessible in both a physical and virtual manner through the mobile device. In the Ecomobile example (A) students participated in real world tasks and processes using tools in a real-life way and in relevant informal settings but they did not engage with a real community of practice, even though this might have been feasible with the mediation of mobile technology. Therefore the context was identified as a hybrid. The mobile game example (C) was entirely simulated in terms of context since there was little attempt to involve students in a genuine governance community.

Both examples B and C were classed towards the emergent end of the *Planning Design* spectrum since neither was heavily predefined or structured. In the case of the mobile game (B) students were not restricted by fixed schedules and could engage at their own pace. This was also true in the case of the Twitter example where participants were left to determine how and when they would structure their responses (if at all). The Ecomobile example (A) was more predefined by the teacher who had devised many of the tasks in advance even though most if it occurred in an informal setting outside of school.

Finally, although students were not directly questioned about their levels of personal engagement in any of these three exemplars, we might infer that motivation and engagement was high judging by the amount of activity which occurred, often unsolicited as in the mobile games example, and this suggests all three examples had high personal meaning and significance from the perspective of learners themselves.

Returning to research questions

As shown in even these few examples understanding what is authentic about mobile learning is not straightforward or unproblematic. Therefore this model offers a novel way of conceptualising these issues which rejects simplistic solutions that frame authentic mobile learning in terms of mutually exclusive binaries. Traditionally this is how authentic learning has been framed epitomised by the dictionary definition duality between first-hand direct experience which equates with the participatory model of authentic learning, and indirect, second-hand experience which equates to the simulated model of authenticity. This article has argued that this traditional duality is no longer valid when students have access to and use mobile devices, blurring the boundaries between simulated and participative forms of real-world learning, between predefined and emergent models of learning and between high or low levels of personal engagement and meaning making.

The concepts of boundary crossing and boundary objects which are inherent features of Activity theory (Engeström, Engeström & Kärkkäinen, 1995) are useful ways of thinking about authenticity and mobile learning because they focus on learning which transcends conventional boundaries such as home/school, formal/informal, physical/virtual using mobile devices as cultural objects which mediate these crossings. Here, "boundaries are understood as a social cultural difference between systems, practices, or social worlds, leading to a discontinuity in action or interaction between these systems" (Snoek, 2013, p.309). In effect mobile devices fulfil a bridging action since they enable learners to cross traditional boundaries such as the student who joins an authentic community of scientists on Twitter posting and following tweets as a legitimate member of the community, but from within a formal classroom setting which would traditionally be bounded both physically and culturally in such a manner that this was not feasible. Whilst the mobile device acts as a boundary crossing object in these cases it does so within culturally defined boundaries and practices of the traditional classroom setting. If the teacher, and indeed the institution, prohibit the use of technology across contexts in this seamless fashion (Jones, et al, 2013; Wong, Milrad & Specht 2015), or if they attempt to pre authenticate or overly predefine the learning outcomes, it is unlikely these opportunities to cross boundaries will be ceased upon, or alternatively they become a form of subversive activity undertaken by students looking to escape the rigidity and sterility of learning.

What this paper has also attempted to highlight is the primacy of affective factors such as perceptions of personal relevance on the part of the learner which is so critical in authentic learning. Research in the pre-mobile era already suggested that authenticity was not a commodity which could be objectified and designed into the context or tasks itself (Barab, et al, 2000) but rather it was highly ephemeral and closely associated with the personal perceptions of the individual learner. Current research into authentic mobile learning has identified a significant list of characteristics that are deemed to make learning more authentic (Herrington et al, 2008) but there is little empirical evidence of what these factors mean from the perspective of learners themselves. There is an urgent need, therefore, for the mobile learning research community to better understand how this kind of data might be elicited and how it would then be used to support in the design of more meaningful and engaging authentic mobile learning scenarios. In this respect we still face the same epistemological and methodological challenges that were highlighted by researchers investigating the potential of first generation computers to enhance authentic learning:

> "A major challenge for instructional designers is to develop learning environments that incorporate authentic tasks in realistic contexts" (Barab, et al, 2000, p.60)

Conclusion

At the beginning of this paper we identified a conundrum which questioned why educators associate mobile learning so closely with authenticity if most of their learning tasks are situated in formal settings such as schools and universities? The paper has posited that no single criteria or characteristic makes a learning activity authentic (Banas & York, 2014) and it has also argued that traditional definitions of authenticity are in need of revision and upgrade to better reflect the boundary crossing potential mediated by mobile devices. Although formal settings such as schools and universities might once have been considered contrived contexts for learning compared to genuine real world-settings such as work placements or apprenticeship this definition is rooted in pre-mobile notions of space and time (Traxler, 2009) which are no longer as applicable as they were previously. Future research is required to investigate to what extent educators and learners are reconceptualising their thinking about authentic learning when mobile devices are used seamlessly cross the traditional boundaries between formal and informal contexts, virtual and physical worlds and planned and emergent spaces. This paper offers a model to initiate and support this process.

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"We found the 'black spots' on campus on our own": Development of inquiry skills in primary science learning with BYOD (Bring Your Own Device)

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This paper reports on a study aiming at investigating into how students developed their inquiry skills in science learning in BYOD (Bring Your Own Device)-supported learning environment. Student perceptions of the BYOD-supported inquiry experience were also examined. A science learning topic of "black spots" in the Unit of "Safety Is Fortune" was chosen as an example of the collaborative inquiry to examine how students' inquiry skills were developed. Data collection included class videos, student focus group discussions, field notes, student artefacts, and student perception questionnaire. Process-oriented analysis was adopted in the data analysis as evidence of students' developmental process on inquiry skills. Quantitative analysis was used to understand student perceptions of the learning experience. The research findings show that the students advanced their inquiry skills, and perceived the learning experience positively.

Keywords: inquiry skills, science inquiry, BYOD, primary school education

Introduction

Inquiry-based learning has been advocated in science pedagogical practices for a few decades (Hakkarainen et al. 2002; Krajcik & Blumenfeld 2006, Marshall, Horton & White, 2009). A large body of literature in K-12 science research has provided evidence of positive impact of inquiry pedagogical practices on student learning through the use of inquiry pedagogical strategies (e.g., Donovan & Bransford, 2005; Jaworski, 2006; Marshall, et al., 2009). Despite positive impacts of the practices on student learning, it is reported that implementing inquiry pedagogical practices is challenging for students, especially for young learners due to various issues. One major issue is that students are lack of meta-cognitive skills and inquiry approaches in their inquiry process, and need considerable support in the practices of inquiry and collaboration with other learners (Krajcik, et al., 2000; Koksal & Berberoglu, 2014; Lakkala et al, 2005; Järvelä, Veermans, & Leinonen, 2008).

In addition, with the development of digital technologies, more and more studies have been carried out to explore science inquiry across formal and informal learning spaces, individual and social spaces, physical and social spaces, and different times supported by mobile devices or BYOD (Bring Your Own Device) (e.g., Jones, Scanlon, & Clough, 2013; Song, 2014). BYOD refers to a technology model where students bring a personally owned device to school for the purpose of learning (Alberta Education, 2012). However, rarely addressed are the questions regarding how BYOD can better support student science inquiry skills and whether students like the science inquiry with BYOD or not in primary school education.

This study attempts to address the above issues by examining how students develop their inquiry skills in science learning and what student perceptions are in the inquiry learning experience supported by BYOD. The rest of the paper first presents the relevant literature, followed by a description of the research design. Then the results are presented, followed by discussions. Finally, conclusions are drawn and future work is implored.

Relevant literature

Science inquiry skills

Inquiry-based learning can be characterized as a process of posing questions, gathering and analysing data, and constructing evidence-based explanations and arguments by collaboratively engaging in investigations to advance knowledge and develop higher-order think skills (Järvelä et al., 2008; Jaworski, 2006; Marshall & Horton, 2011).

However, relevant literature shows that students are lack of meta-cognitive skills in their inquiry process, and need considerable support in the practices of inquiry and collaboration with other learners (Järvelä et al., 2008; Krajcik et al, 2000). De Jong (2006) posits that students need support when engaging with inquiry learning in terms of designing appropriate experiments (e.g. what variables to choose, how many variables to change, how to state and test hypotheses), implementing experiments (e.g. make predictions, avoid being fixated with achieving particular results rather than testing hypotheses), and interpreting and presenting results (e.g. compare and visualize data, then present these appropriately). Jones et al. (2013), based on inquiry learning literature in a mobile learning environment, summarize four aspects that can help support scientific process skills: (a) regulatory processes such as planning, monitoring and evaluation process with inquiry; (b) transformative processes such as sense making and articulation; (c) collaboration, and (d) mobility. However, in practice, how can primary school students develop their inquiry skills supported by BYOD has rarely been reported.

Guided science inquiry

To guide young learners in science inquiry, it is suggested that guided inquiry be adopted in the pedagogical design (Hakkarainen, 2003). Support for inquiry processes typically takes the form of scaffolds (Van Joolingen, De Jong, & Dimitrakopoulou, 2007). However, it is important to balance the two aspects in the support: on the one kind, the scaffolds should function as stimulating factors for effective inquiry; on the other hand, the scaffolds should not function as a "cookbook", which constraints learners' inquiry processes. This is to say that the guidance needs to leave room for learner freedom in their inquiry (Van Joolingen et al., 2007).

Science inquiry supported by Bring Your Own Device (BYOD)

In recent years, more and more studies have attempted to investigate how mobile learning can be leveraged to increase student engagement and teacher productivity through the Bring Your Own Device (BYOD) model (e.g., McCrea, 2015; Song, 2014). Song (2014) reported a study of improving students' science knowledge supported by BYOD. Findings of the study show that students' domain knowledge was significantly improved by making use of the affordances of BYOD. Although BYOD is generally considered to help promote better learning outcomes via more personalized learning and an enhanced engagement between home, school and other spaces, BYOD-supported science learning is still in its infancy. How student science inquiry skills can be improved in BYOD-supported learning environment and whether students are keen on the learning experience has rarely been studied.

The research questions were: (1) How did students advance their inquiry skills in BYOD-supported science learning environment? (2) What were student perceptions of the BYOD-supported science inquiry learning experience?

This study

Context

This study took place in a one-year project of "Bring Your Own Device (BYOD) for seamless science inquiry" in a primary school in Hong Kong, adopting a mixed research method (Creswell, 2013). The study involved five science units with twelve topics to investigate how students developed their inquiry skills in science learning. In this paper, the topic of "black spots" in the Unit of "Safety Is Fortune" was chosen as an example to examine the students' development of inquiry skills in science.

Participants

Participants were twenty-eight Grade six students who were divided into five groups with five to six members. The teacher had around eight years of working experience and had participated in the professional development of innovative practices with technologies using the inquiry-based approach. He had good understanding of the social constructivist principles gained in teacher professional development such as "working on real problems, encouraging diverse ideas, providing collaborative opportunities, and doing formative assessment (Song & Looi, 2012). In the students' science inquiry process, the teacher acted as a facilitator to guide the students' inquiry process, and encouraged the students to use the mobile apps to facilitate their inquiry.

BYOD and mobile apps

"BYOD" in this study refers to "the technology model where students bring a personally owned mobile device with various apps and embedded features to use anywhere, anytime for the purpose of learning" (Song, 2014, p. 52). Of the twenty-eight students, twenty-four used mobile devices brought by them from home. These were ten iPads, eleven Android tablets or smartphones, two iPhones and one iPod. Four students did not own a device, so the school lent them iPads to use.

Four mobile apps were used in the science inquiry, namely Edmodo, Comic Maker HD iPhone App, Photo Comics Android App and embedded camera/video app. Edmodo, a free social network platform, was used by students to access learning resources, communicate, and share information and work. Comic Maker and Photo Comics are apps used for creating comics easily and quickly with various layouts, characters or images. In this study, students were asked to make "four-panel comics" using the apps. Students could use the mobile devices to take photos, and videos for their own learning needs. They could also access the internet via WiFi in school.

Guided science inquiry model

To support young learners in their inquiry process, two scaffolds were provided: (a) guided science inquiry model was adopted in the pedagogical design in BYOD-supported learning environment premised on previous work (Hakkarainen, 2003; de Jone, 2006; Jones et al., 2013; Van Joolingen, 2007); and (b) a PowerPoint (PPT) template as a prompt was provided for the students to report their inquiry process and outcomes. The guided science inquiry model consists of six elements, namely: (a) "engage" in hypotheses of inquiry; (b) "explore" the methods and processes of inquiry; (c) "observe" the phenomena in the experiment; (d) "explain" the analysis method and outcomes of inquiry; (e) "reflect" the processes and outcomes of inquiry; and (f) "share" the findings and reflections. The inquiry process is cyclic and progressive in BYOD-supported learning environment, but not linear, and may not involve all the components in each learning cycle. The model is shown in Figure 1. The learning activities were carried out in a ubiquitous learning environment across class, school campus, teacher offices and online learning spaces.

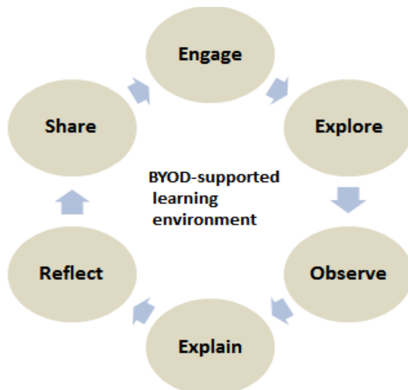


Figure 1. Guided science inquiry in BYOD-supported learning environment

The PPT template consists of the guiding slides of "make your hypotheses", "explore 'black spots' by teacher interviews (add your video clips) and present initial findings", "present your observation results in diagrams and use pictures to support your views", "explain your findings", "make four-panel comics to support your views", "propose your suggestions", and "make reflections". Students did not have to follow the order of the guiding slides. It was up to them to decide their inquiry process.

Pedagogical design of student inquiry into "black spots" on campus

The two-week learning activities for inquiry into "black spots" on campus are presented in Table 1.

Table 1. The science learning activities on inquiry into "black spots" on campus.

Activities	Description
Engage (in class)	Based on past experiences, discuss in groups what "black spot" means and what places are likely to be the "black spots" and make hypotheses. Online resources about "traffic black spots" (http://zh.wikipedia.org/wiki/%E4%BA%A4%E9%80%9A%E9%BB%91%E9%BB%9E) are

	provided on Edmodo.
Explore (on campus)	Students interview teachers about the places where accidents are likely to happen and prove whether their initial hypotheses are correct.
Observe (on campus)	Students conduct observations at the places on campus during breaks where they hypothesize that accidents are likely to occur, and collect data (statistics and photos) as evidence.
Explain (online)	Students analyse the data collected to support their hypotheses using statistics; and make a PPT in groups to present their findings.
Reflect (on line)	Students reflect what they have learned and propose suggestions for improvement.
Share (in class & on line)	Students share their findings by making presentations and share the findings on Edmodo. They also use Comic Maker HD or Photo Comics to make "four - panel comics" using the photos taken in order to cause students' awareness of safety issues caused by "black spots", learn how to provide "first aids".

Data collection and analysis

Data collection included class videos, student focus group discussions, field notes, and student artefacts. Student artefacts were collected from their postings on Edmodo that can be categorized into five types: (1) photos (n = 68) including photos of school students' activities during the breaks, and group students' observation and data collection; (2) video clips (n = 38) including students' interviews with the teachers about "black spots", and school students' activities during the breaks; (3) 5 group PPTs (G1, G2, G3, G4, and G5) used to present each group's inquiry process and outcome into "black spots" on campus; (4) student reflections (n = 28); and (5) "four-panel comics" pictures (n = 6) including group work on using the comics-making app to do four-panel comics with the photos taken on campus to support their findings and arouse students' awareness of the safety issues.

In addition, two student focus group discussions were conducted to understand student perceptions about the inquiry learning, other resources such as teaching plans, and online resources such as the PPT template provided by the teacher as a scaffold for students to make their group PPTs as a final product of the inquiry process. Further, to identify student perceptions on the BYOD-supported science inquiry learning experience, a self-reported questionnaire was carried out immediately after the completion of this study. The questionnaire consisted of twelve statements in a 5-point Likert scale (from 1 strongly disagree to 5 strongly agree).

Data analysis adopted quantitative analysis, and qualitative “process-oriented analysis” in a natural context (Järvelä et al., 2008, p. 305) including on-task analysis and content analysis to understand the phenomena of the case holistically. In particular, process-oriented analysis using a multiple-methodological qualitative approach via overlapping and interactive analysis of data between on-task analysis and content analysis offered a more profound understanding of the case (see Figure 2).

On-task analysis in this study focused on the analysis of student activities on inquiry tasks consisting of “engage, explore, observe, explain, reflect and share”. Content analysis was used to code the data on the coding scheme of “engage, explore, observe, explain, reflect and share”. Quantitative analysis was conducted with the assistance of SPSS software.

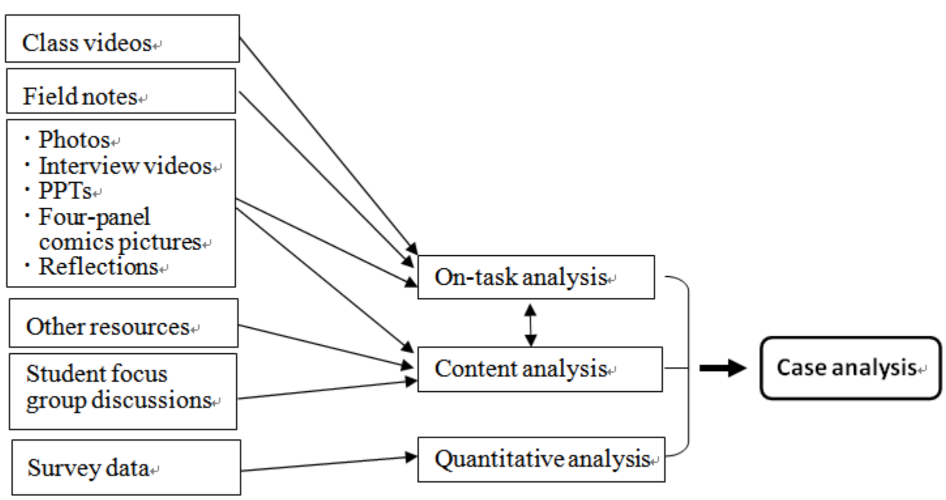


Figure 2. Process-oriented analysis of the case study

Results

This section reports the results in addressing the two research questions regarding students' advancement of inquiry skills and their perceptions of science inquiry experience with BYOD.

Advancement of inquiry-based learning skills

To understand how students advanced their inquiry-based learning skills in BYOD-supported science learning environment, the inquiry process was traced and the results were reported as follows.

Engage: Student hypotheses of "black spots" on campus

Students in groups made their hypotheses based on their prior knowledge (e.g., daily observation of students on campus). Their hypotheses are presented in Table 2. It is noted that the hypotheses proposed by each group was different. G5 students, instead of proposing specific areas as "black spots", included broader scope of "black spots" on campus based on their understanding of the concept.

Table 2. Student descriptions of the hypotheses of "black spots"

Group	Hypothesis: places where accidents are likely to happen
G1	• The game zone: Many students, especially Grade 1 students play around during the breaks here. In addition, it is next to the sports zone. • The back staircase on the 4th floor: Many students come and go from here every day, and the up and down staircases are too close, thus students are easily to stumble;
G2	• The corner of the 2nd floor: The garden is wet and slippery.
G3	• The garden of the 2nd floor: Did not mention the reasons.
G4	• The game zone: Students play around this area and are easy to bump into each other and fall.
G5	• Around the corner of staircases and the staircases with big steps: To us, "black spots" mean the places where accidents are likely to happen such as the corners and stairs with big steps; we also search the information about "black spots" on the internet to support our views.

Explore: Initial findings

The initial findings of the "black spots" that G 1 to G4 explored resulted from teacher interviews. They interviewed 2 to 4 teachers during their breaks. While, G5, instead of interviewing teachers, they made observations first followed by 3 teacher interviews which will be reported later. Table 3 shows the initial results reported by the G 1 to G4.

Table 3. Explore: Initial findings

Group	Initial findings
G1	• Our initial hypotheses were not accurate. The teachers told us that accidents frequently happened to boys in upper grades and the accidents such as bruises caused by bumping and bleeding.
G2	• No report.
G3	• Our initial hypotheses were correct. Accidents were likely to happen on the 2nd and the 4th floor.
G4	• Our initial hypotheses were correct. The accidents often happened near the staircase on the 4th floor. The most frequently happened accidents were tripping, bruising and bumping.
G5	Not applicable

Observational results

Students worked in groups to conduct observations during their breaks. G 1 to G4 made 3 observations each; while G5 made 4 observations. Their findings are presented in Table 4.

Table 4. Observational results

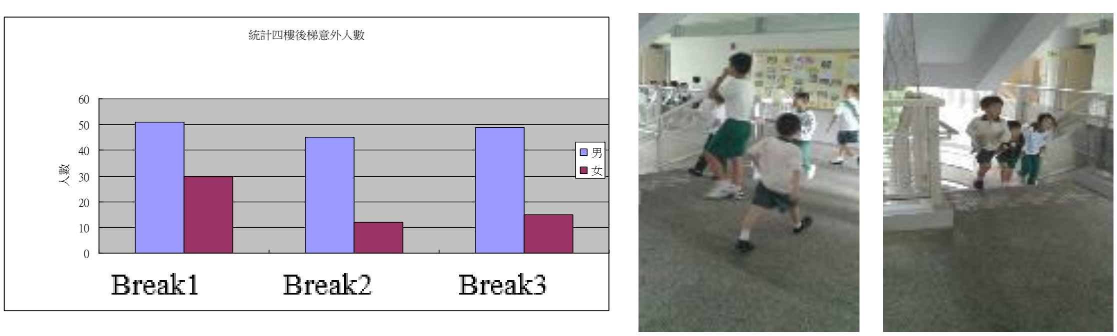
Places		G1			G2			G3			G4			G5			
Observation		1st	2nd	3rd	1st	2nd	3rd	1st	2nd	3rd	1st	2nd	3rd	1st	2nd	3rd	**4th**
The game zone	Boy	51	45	49							2	4	5				
	Girl	30	12	15							3	0	2				
Corner of 2nd floor	Boy				2	4	5										
	Girl				3	0	2										
Garden of 2nd floor	Boy							12	19	26							
	Girl							5	4	18							
Back staircase on 4th floor	Boy	4	6	5													
	Girl	0	2	3													
Around corner of staircases	Boy													12	9	11	8
	Girl													7	8	7	9

Staircases with big steps	Boy	7	6	5	6
	Girl	5	6	6	5

G5 made four observations in each venue instead of three done by other groups. G5 members reported their findings after their observation followed by teacher interviews, “Our hypotheses were correct in general. Accidents often took place near the open space on the corner and big steps of staircases due to rushing and their knees were often hurt. They are in accordance with what the teachers said”.

Explain: Further findings

Students in groups made sense of how the explore phase aligned with findings from the observation phase which were presented in the PPT. They also used pictures (see Figure 3 a, b, and c as examples) or “four-panel comics” (see Figure 4 a, b, c, d and e as examples) as evidence to support their findings or providing alternative explanations for their findings. In this phase, they gained deepened understanding of “black spots” and developed awareness of safety issues in their daily study life. They were able to provide suggestions on how to avoid accidents to happen in these areas. Table 5 shows the findings and suggestions.



(a) (b) (c)

Figure 3 (a, b and c). G1’s statistical results of accidents on the 2nd floor supported by pictures

(a) (b) (c) (d) (e)

Figure 4 (a, b, c, d, and e). Groups 1-5's "four-panel comics" for supporting their hypotheses

Table 5. Explain further findings of "black spots" and make suggestions

Places	Identified "black spots"				
	G1	G2	G3	G4	G5
Game zone	Yes			Yes	
Corner of 2^{nd} floor		Yes			
Garden of 2^{nd} floor			Yes		
Back staircase on 4^{th} floor	May not be				
Around corner of staircases					Yes
Staircases with big steps					Yes
Suggestions	The order is not good in the game zone which is near the sports zone. It is suggested that this area only opens to students in Grades 2 and 3. The back staircase on the 4^{th} floor leads to the classrooms and gatherings, thus a lot of students pass by. It is suggested that students keep good order here.	Don't run near the corner; and don't play games near the garden.	Students should not chase each other on the 2^{nd} floor and should avoid the garden and corner of the 2^{nd} floor.	Put up "danger signs"; remind students of safety issues; have more prefects in this area.	The celling near the corner should be higher; the stair step should be smaller so that they will not stumble.

Reflections and sharing the findings

Students communicated their findings via oral presentation in class and uploaded their findings in the form of PPT to Edmodo. In addition, students made and shared their reflections after the inquiry on Edmodo. Their reflections fell into five categories:

(1) Improved inquiry skills: Student reflected that they learned how to use the mobile device to search information on the internet, collect data and share their work. They also learned how to do observations, analyse data and present and explain their findings. One student reported, "I learned how to observe events, then explore further and make analysis". (Group4 student)

(2) Enhanced understanding of content knowledge: Students reported that in their inquiry, they learned how accidents happen and what consequences are, hence, understood the concept of "black spots" better. They grew awareness of safety issues and learned how to avoid accidents. A student reflected, "Through this activity, I understand very well about where the 'black spots' are on campus and how accidents happen. I am also aware of safety issues".

(3) Ubiquitous authentic learning opportunities: The mobile devices provided opportunities for students to access information, communicate and share files with peers on the social network platform Edmodo anytime, anywhere; they could also be used for data collection such as picture-taking, and video-taping the interviews with teachers. A student reflected, "This activity provided us opportunities to explore our problems and collect data in authentic environment anywhere, anytime with the mobile device. I realized that the mobile devices are really helpful tools when we need to search information and collect data. I will never forget the experience".

(4) Increased collaboration and communication: Many students admitted that collaborative work was critical for their successful completion of the inquiry tasks. They learned how to collaborate with others better by complementing each other's

strength and weakness and how to construct knowledge as a team. For example, a student reflected, "We developed collaborative spirit in the inquiry learning process, and we've got to know our team members better. I hope that I can collaborate with our team members to do more projects soon". (Group3 student)

(5) Increased motivation: Students deemed that such learning experience was more meaningful, interesting and thought-provoking than that conducted in classroom with textbooks. They liked it a lot and hope there would be more such learning experiences. They would never forget the experience.

On the whole, student reflections were very positive. Only one student reported the technical issues he encountered, "The mobile device is very helpful in my learning, but I also learned that the devices are sometimes hard to control so I am still working hard on it!"

The results of the study show that all groups of students improved their inquiry skills in the process of inquiring into "black spots" on school campus supported by BYOD although the inquiry path of G5 was different from the other four groups. In their "black spots" inquiry learning process, with the help of BYOD, students developed the skills from preliminary hypotheses, explore and observe to verify their hypotheses with statistics and pictures, to explain their findings with evidence (various artefacts) and reflect and share their findings. The advancement of student inquiry skills is pictorially shown in Figure 5. Students had a sense of success in the science inquiry experience with BYOD. A group proudly reported in the presentation, "We found the 'black spots' on campus on our own".

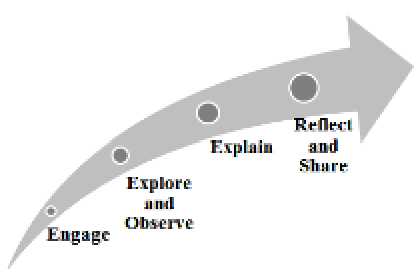


Figure 5. Advancement of students' science inquiry skills supported by BYOD

Results of student perceptions of the BYOD-supported science inquiry learning experience

The questionnaire results of student perceptions of the BYOD-supported inquiry experience are presented in Table 6.

Table 6. Student self-reported questionnaire results

	Question Items	ean	D
1	Use of BYOD allows me to do science inquiry anytime, anywhere.	.20	.58
2	Use of BYOD allows me to do science inquiry beyond the classroom.	.16	.90
3	I could explain / present my / our group research results better supported by BYOD.	.28	.79
4	Use of BYOD makes me formed a habit of raising questions in science inquiry.	.24	.83
5	Use of BYOD helps me make more reflections in science inquiry.	.12	.93
6	I could try different ways to do science inquiry supported by BYOD.	.24	.78
7	I am more motivated to do science inquiry supported by BYOD.	.36	.95
8	Use of BYOD in the science inquiry can help improve collaborative learning.	.28	.74
9	My teacher supports me in using BYOD to enhance my learning.	.40	.71
10	Use of BYOD helps me relate better the science content knowledge learned in the classroom to the things in my daily life.	.16	.62
11	I can understand better the content knowledge learned in the classroom supported by BYOD.	.28	.61
12	Use of BYOD helps deepen my understanding of science knowledge.	.32	.75

Table 6 shows that the mean values of students' responses to their perceptions of the learning experience (calculated against the 5-point likert scale) were above 4.1 in all question items. The results suggest that students perceived their inquiry-based science learning experience positively. It is noted that Item 9 obtained the highest value among all items followed by Items 7 and 12, indicating that the teacher was supportive in the students' learning process, and students were motivated in the learning experience and improved their understanding of domain knowledge in "black spots".

Discussions

In this study, students were able to lead their own science inquiry and successfully find out the "black spots" on campus on their own and developed the awareness of safety issues. It is believed that authentic inquiry problems, guided inquiry using scaffolds, BYOD-supported science inquiry learning environment and the key role of student reflections are all contributing factors to their success.

Authentic inquiry problems

Inquiry into authentic problems generated from student experiences is the key strategy for science learning (Hakkarainen, 2003; Lakkala et al., 2005). In the pedagogical design, the teacher made every effort to provide opportunities for the students to explore the problems in real-life situation. The inquiry problem reported in this study was only one example of his pedagogical design. By raising questions about "black spots" and working in authentic context of exploring "black spots", students was able to conceptualize the knowledge of the concept and retain better mental representation of the knowledge (Marshall et al., 2009).

Guided inquiry using scaffolds

Students may not be able to develop inquiry skills without adequate scaffolding (de Jone, 2006; Van Joolingen, 2007). The study adopted a guided inquiry-based learning model and provided a prompt (PPT template) for students to conduct inquiry and present conceptualized ideas. The scaffolds helped students to focus on what needed to be learned (Tobias & Everson, 2002). In the meantime, students were allowed flexibility in generating their own hypotheses, planning and making their own investigations. Scardamalia and Bereiter (1994) posit that questions that arise from students' own need to understand have a special value in the process of inquiry. Although a teacher needs to set up a general frame of investigation, it appears to be essential to engage students themselves in a process of question generation.

Through proposing hypotheses, exploring and observing the phenomena to be investigated, students were empowered to identify and then elaborate whether their hypotheses were correct, and how to continue doing the research to explain their findings. Although G1 to G4 accomplished their investigations guided by the inquiry-based learning model and the prompt, it is noted that G5 adopted a different inquiry process from that of G1 to G4's. Instead of following the inquiry-based learning model step by step, G5 formed their own path of inquiry (Engage-observe-explore-explain-reflect-share) and their findings were with better quality in providing more scientific exploration, more evidence and clearer conceptualization of what it meant for "black spots" and feasible suggestions. Lin and Lehman (1999) maintain that metacognitive skill development is typically fostered by providing students opportunities to reflect on and monitor their learning performance and revise their investigative strategies. In this regulative process, students are reflective inquirers looking to accomplish projects and gain a deeper understanding of domain knowledge and inquiry skills (Loh et al., 2001). In addition, in the course of preparing the PPT for presenting their inquiry results, the students worked in groups throughout the inquiry process which increased their awareness of taking collective responsibility for advancing the group's knowledge (Zhang, 2010).

BYOD-supported science inquiry learning environment

BYOD provided students the opportunities to learn anywhere, anytime with a social network platform – Edmodo, and apps such as camera, recording and Comic Maker and Photo Comics apps. Thus, BYOD functions as a personal "learning hub" (Wong, 2012) to support students' inquiry process in terms of capturing pictures, taking video clips, and making "four panel comics", as well as accessing learning resources posted by the teacher or peers, uploading information and work and making reflections on Edmodo. In addition, in the learning environment, the teacher acted as a facilitator, allowing students to monitor their group's own learning process and develop increased agency in the collaborative knowledge construction process (Zhang, 2010).

The key role of student reflections

Student reflections played a key role in the investigation into "black spots". Although "reflect" is one component in the inquiry-based learning model, it is noticeable that "reflect" spread throughout the inquiry process (see Figure 6). For example, during "explore" and "observe" phases, students could explain the strategies used to test their hypotheses, and provide detailed information about the inquiry process in selecting and implementing these strategies. Deep understanding was gained when students were confident in what they learned, learned how they learned and critically examined their own knowledge (Marshall et al., 2009). In the inquiry process, students were engaged in guided reflections either via the inquiry-based learning model or the PPT prompt, and involved in meaningful learning.

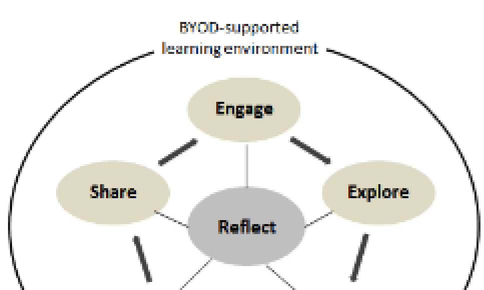


Figure 6. The key role of reflection in BYOD-supported science inquiry learning environment

Conclusions and future research

This article reports on a study aiming at investigating into how students improved their inquiry skills and what student perceptions of the inquiry learning experience were in BYOD-supported learning environment, taking the topic of "black spots" as an example. A mixed method was adopted to investigate the research problems. Especially a process-oriented analysis was used to understand the development of student inquiry skills. The research findings show that students advanced their inquiry skills and identified the "black spots" on their own; in the meantime, they deepened their understanding of domain knowledge in the BYOD-supported learning environment and perceived the learning process positively. The key factors contributing to the achievement of the inquiry involves authentic inquiry problems, guided inquiry using scaffolds, BYOD-supported science inquiry learning environment and the key role of student reflections. It is expected that the findings of the study can shed lights on guided inquiry-based learning in BYOD-supported learning environment in schools. Nevertheless, the findings of this case study cannot be generalized. Future research needs to focus on a longitudinal study through multiple-case study on development of inquiry skills and advancement of domain knowledge, analyze and report the results holistically. In addition, tracing students' inquiry-based learning process through learning analytics to inform inquiry-based pedagogical design in a BYOD-supported learning environment will be another line of research that can help improve inquiry-based pedagogical practices in the digital age.

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A cultural shift at the district level in a one-to-one laptop initiative in a large urban school district in the United States.

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This article addresses the positive cultural shift to transform teaching and learning at the district level in the implementation year of a one-to-one laptop initiative at the secondary level in a large urban school district in the United States. Data was collected from 27 individual interviews from district administrators and school-based staff at six sites associated with the laptop initiative in its first year. Results indicate the technology initiative shifted the district's culture by bringing together multiple departments or workstreams to collaborate and work together for the initiative. Implications for district's engaging in similar technology initiatives are provided.

Keywords: district leadership, context, case study, one-to-one initiative, qualitative

Introduction

Technology initiatives are swiftly changing how educators think about education and the needs of today's students. Initiatives from laptops to iPads to chromebooks, for example, are being implemented in districts around the United States to boost student achievement and students' 21st century learning skills. However, the ways in which districts organize themselves to implement these innovative technology initiatives are even more critical to the actual devices being purchased and distributed to students and teachers. Technology initiatives require careful thought and planning at a variety of levels—district, school, community—in order to be effective. This paper presents a key finding from a qualitative case study of a large urban school district implementing a high school laptop initiative based on the following question: *What initial effects, if any, does the laptop initiative have on district culture?* The paper focuses specifically on how one large urban school district in the United States organized the district's departments or workstreams for the roll-out of a technology initiative for secondary students. To address this question, we present the responses from interviews with district and school-based administrators implementing the large-scale laptop initiative. Implications for how school districts can organize themselves at the district level to pursue and implement technology initiatives are shared. **Literature Review**

Effective leadership in general is key to any successful school district. Districts that show effective leadership characteristics and are successful in closing the achievement gap also have a strong culture of collaboration (Leithwood, 2010). The contexts in which districts are situated are important for fostering a culture where partnerships and teamwork are the norm and not the exception. Bredeson, Klar, and Johansson (2011) also support the idea that context matters when examining educational leadership at the district levels. In their interviews with superintendents in both the United States and Sweden, one specific finding highlighted the importance of superintendents' awareness and responses to their districts' cultures and organization set up. The superintendents shared that they understood the significance of building relationships with their staff in order to ensure staff were productive and not divisive in the organization. This was particularly noted from interviews with superintendents from the large school districts in the study.

Given the increase in the presence of technology initiatives in education, literature related to effective technology integration in schools and districts is mostly focused on principal and teacher leadership, and professional development needed to experience successful technology initiatives at the school-based level (Dawson & Rakes, 2003). Anderson and Dexter (2005) also argue that technology leadership is more important than technology infrastructure. The authors state principals, in particular, must be knowledgeable about a variety of topics at the school level such as instruction, operations, and professional development (Anderson & Dexter, 2005). By focusing on individual leadership, such as that from the principal, contextual factors, such as district level culture are absent from the discussion of the factors that support effective technology implementation.

There are few studies, however, that discuss how district culture is influenced by the collaboration of multiple departments or workstreams in large urban districts implementing technology initiatives from the perspective of district and school-based administrators. In their study of successful secondary school districts implementing technology initiatives in the United States, Levin and Schrum (2013), for example, build on the importance of the topic of systemic improvement and provide an extensive examination of lessons learned from successful secondary districts integrating technology for student achievement. The authors discuss one area of technology planning, infrastructure, and support and how successful districts provided opportunities for technical staff to participate in discussions regarding “education uses of technology” and not just “technical support” (Levin & Schrum, 2013, p. 40). Technical staff appreciated being a part of discussions and decision-making at the district level (Levin & Schrum, 2013). However, beyond also having a chief officer who understood the technical and curriculum side of technology integration, there were no examples of district culture or context prior to this collaboration or an understanding of how that collaboration was perceived by district personnel.

Similarly, in her case study and cross-analysis of five middle schools implementing laptop initiatives, Dexter (2011) found that a team leadership approach with distributed leadership among school personnel was integral for effective technology integration. Interestingly, one finding illustrated that the two schools whose laptop initiatives were framed around instructional improvement showed more evidence of district and school leaders working across departments. District personnel in charge of technology and those in other departments such as professional development or curriculum regularly worked together and collaborated around the academic goals of the initiative, which helped focus efforts beyond just technical issues related to the laptops. However, Dexter (2011) also did not describe the setting around these school district's cultures and whether or not those collaborations were already in place because of other initiatives or the mentality district personnel had working together from multiple departments.

Holt and Burkman (2013) interviewed leaders of large suburban school districts who were responsible for guiding digital initiatives and technology efforts in their districts, focusing on questions related to their behaviors and beliefs about technology in education. Although the study highlighted important themes (and made recommendations) related to, for example, how to set expectations, manage funding and materials, staying abreast of technology changes, the authors did not identify specific behaviors related to how individuals work together at the district levels and the setting or context of these districts.

As districts across the country continue to implement technology initiatives, it is important to understand the culture and context of the district and how departments work together. If the district context is characterized by silos and lack of collaboration—opposite the qualities that are required for success—then ultimately, students, teachers, and schools face the consequences of the dysfunction. This lack of cohesion also negatively impacts the success of the initiative. This case study of Livingston School District fills the gap in providing qualitative responses that highlight how one large urban district shifted their district culture and how departments worked together for the benefit of the implementation of the secondary laptop initiative.

Methodology

District Background

This paper is based on a case study of Livingston[9] School District's laptop initiative in Year 1 conducted from January to May 2014. Livingston School District is one of the largest school districts in the Southwest United States. The district serves just over 200,000 students in 283 schools. Approximately 80% of students are economically disadvantaged. The majority of students are Hispanic (62%) and African American (25%).

In Fall 2013, the Livingtson School District announced the launch of a one-to-one technology program that would provide laptops for all the district's high school students. Over the course of three years, every high school student in the district will receive a laptop to use at school and home during the school year. The purpose of the initiative was to digitize all high

[9] Note: Any names referenced in this paper from the case study are pseudonyms.

schools in the district and ultimately transform instruction. In addition to promoting ideas such as students as producers and not consumers and preparing students for 21st century skills, the initiative also incorporates digital citizenship, professional development, and the development of digital content. A specific technology staff person in addition to a district-assigned support person supports each high school on campus. The initiative, combined with the entire goals and focus of the district, will ultimately support increases in student attendance, student engagement, academic achievement, as well as decrease disciplinary incidences and suspensions.

Participants

To gather the perspectives of multiple stakeholders, researchers conducted individual interviews with both district-level and school-based administrators. Researchers interviewed a total of 27 district and school based personnel at six sites responsible for overseeing the laptop initiative and supporting teacher development over the course of the three-year initiative. In order to develop a baseline understanding of the first year of implementation of the laptop initiative, individual interviews were conducted with district level administrators and school-based staff responsible for the development, training, and implementation of the laptop initiative. The interviews lasted between 30 and 45 minutes each, and focused on the purpose and vision of the laptop initiative, preparation and training, challenges, concerns, and recommendations about the initiative. An interview protocol was used in each individual interview. Interviewees were asked questions that focused on the following key areas: 1) initiative purpose and vision; 2) training and preparation; 3) challenges, concerns, questions, and recommendations.

Data Analysis

All collected data was analyzed together to identify patterns and themes in participant responses. Three researchers using content analysis to identify patterns and themes analyzed the transcriptions from the individual administrator and school based staff interviews and teacher and student focus groups. To ensure interrater reliability, the research team conducted multiple rounds of readings of transcripts. Through these repeated readings, themes emerged, were organized into specific findings and agreed upon by the research team. Researchers carefully presented findings that are supported by multiple forms of evidence and consistent data.

Findings

Findings from 27 interviews with district and school based staff indicate that participants experienced changes in district culture due to the laptop initiative. The findings below detail what participants described as district culture *prior* to the laptop initiative and their perceptions of district culture as a result of the implementation of the laptop initiative.

Pre-Laptop Initiative

Prior to the laptop initiative, participant interviews indicated that projects were done in silos and departments did not work together.

> It was rare in the district that cross-functional groups would come together for a common goal. We would have successful projects but maybe they only involved one or two central office departments. Or maybe it was one central office department and multiple schools. Participant A

Another participant described the culture of the district and the individualistic nature of how departments worked:

> We've been so decentralized and side-based here that we've let every individual teacher and every individual school do whatever they want to do. And now the idea of coming together, even in teams, of working together is alien to a lot of people. And then coming together in teams, working together to become co-architects of a curriculum that everyone's going to use, not just some, again, alien's the word that comes to mind. Participant B

Similarly, another participant described a "territorial" atmosphere at the district level in which project success was individualized versus a collective effort. As these participants stated:

> So you ultimately had, what I have seen, is territorial battles kind of ensue, right, when you look at the traditional model of how the district operated. And everybody wanted to be that person in the room that was going to do this big thing. They were going to run this piece and get the acknowledgement for it. Participant C

> When we got here we were specifically told you don't mess with curriculum. Participant D

One participant described learning from other districts about the roll-out of technology initiatives and trying to avoid similar mistakes for Livingston's laptop implementation:

> That [district department collaboration] was something that we didn't do in Irving School District, and it was painful because when we did get in the middle of the project and realized, "Oh man, we're not aligned with curriculum" or we're not aligned with X department, we had to get them at the table, we had to explain what we've done, the decisions that we've made, why we made them, and it really just kind of put the project on hold. Whereas now the project team has been together from the beginning so when the bumps occur we don't have to bring anybody up to speed. We get in a room, we identify what the problem is, and we identify what the solution is and we keep moving forward. Participant E

In summary, before the laptop initiative at Livingston School District, participants characterized the district as having an individualistic culture. Departments worked in silos and were also "territorial" in that projects and initiatives were not done in collaborative spirit. Participants with experience in previous technology initiatives learned that without multiple workstreams present for the creation and implementation of initiatives, the effectiveness of projects were comprised.

Post Laptop Initiative

Livingston district officials were explicit about the intentional efforts they made to bring together workstreams such as professional development, curriculum, instructional technology, communications, and family and community engagement at the start of the planning process to provide input into strategies and ensure the success of the roll-out. One participant commented:

> So from the very beginning we had Technology, we had the curriculum department, we had the professional development department, we had the school support department, and we had communication. All of those departments were at the table from the very beginning of the project. Participant E

When participants were asked to discuss their thoughts about infrastructure, nearly half of them indicated that the initiative had created opportunities for multiple district departments to work together, which was different than their prior experiences working across departments or workstreams. As one participant stated:

> …the main thing that came out of this initiative…[was departments] working together to research, develop, and implement a plan for a far-reaching initiative. We had never ever done that before…and kind of bashed heads about what's the best way we need to do this, and what things do we need to think about. Participant B

Several participants described the new collaborations as challenging as indicated in the following comments:

> Another thing, when I came in, I couldn't even get people in the curriculum department or in the school support office or in the professional development department to answer my phone calls or my emails. And then this year, those silos have been broken down significantly. And now I wouldn't dream of talking with a vendor without sending a text to my colleague in curriculum, secondary curriculum, or the director of academics, or the woman that runs the professional development. We've

> broken down silos pretty effectively. And I'm not going to say it's all peachy and cream because it's not. Sometimes there is conflict. But we are definitely working together. Participant F
>
> And we had some bumpy stuff at the beginning. This is mine. No, this is mine. Okay, well I guess we'll have to work together. So we've really become, there's a lack of territoriality that has been just beautiful. So if you're not territorial and you're not scared of people seeing that you might not know everything, then you can say hey, do you have a resource for this because we don't know how to do this? Yeah, we've just found this. And so that's what's made this work like it has, and it gives me real hope. Everyone is in it together, and we're all learning together. Maybe it's because it's something none of us have ever actually pulled off before. So we get to be a little vulnerable and it's okay. Participant G

Another participant described how district and school-based personnel were also working together around the initiative:

> Now as far as other departments working together, this is one the few times, and this may just be because this is the first time I've been on this end of it, where I can us working with curriculum. The curriculum is a big thing But then it came to a point where they [district curriculum team] wanted to change their documents just for these laptop schools, and there's a lot of tools that their people [district curriculum team] really weren't that familiar with. So then we [district technology team] teamed up with them [district curriculum team] and said well these are really good for English, or whatever the course subject, foreign language. So there's a big team effort. Just because you're assigned to one place we've really got our open concept of whoever needs us is where we're going to go. We try to maximize our time and efficiency. Participant D
>
> With this project what we've seen is truly a cross-functional group coming together, representing both central office and the schools, to achieve a common goal. We would not be successful without the schools doing their part – whether it's identifying the teachers to go to Professional Developments, deploying the laptops and deployment days – we really need the school to provide the facilities and the staff. Participant H

Another participant referred to the "flower diagram" as the key visual representation of how the department workstreams have come together with the school support offices central to the diagram. The participant stated:

> Okay. So that's kind of, when you look at the flower diagram, what we deemed, why we were successful with this, you could see various petals, right. You've got the device deployment petal; you've got the infrastructure petal; you had the instructional

> technology petal; you had the curriculum petal; you had the professional development. And then right in the center of it was ultimately school support, because those within school support touched all those petals. And then you had communications. Those were two big components within this whole program. Participant C

Another participant described the team effort mentality and being able to get support and questions answered as needed from the various departments:

> I think the most beneficial has been that it's a whole team effort, we meet on a weekly basis as a project team, so there is somebody from curriculum at the table, somebody from professional development, a couple people from instructional technology, another project manager, central office or high school office are there- so we've had the ability when we've had questions to ask those questions to the right people, get responses back as far as how to keep moving. Participant I

In fact, collaborative efforts were so well received and effective that several central office personnel reported they now insist on forming cross-functional work-streams for other district-wide projects. As one participant commented:

> We have another big project coming up and I hope that these other departments can see okay, now that I'm involved with this other project, my recommendation is this. We really do need cross-cultural teams, and we need to meet every week; we do need to involved everybody. So hopefully that will happen as we move forward on projects. It's really just changing the culture of how we work together. Participant B

The interviewees' statements about the culture post laptop initiative highlight challenges in departments working together, but also detail positive outcomes that were generated with the district's organization in this initiative.

Discussion

Findings indicate the workstream collaboration and participation of multiple departments at the Livingston School District for the laptop initiative at the secondary level was instrumental in shifting the *culture* at the district level. The presence of a large-scale technology initiative across the district's secondary schools made it imperative that multiple departments at

Livingston School District work together and ultimately, shifted the way the district operates.

Pre-laptop initiative, the district operated in silos and was individualistic in its undertaking of projects and initiatives. Several participants referred to this culture as even territorial and competitive. Individuals were not accustomed to working together and communicating with one another to implement projects or initiatives. Individual departments or a small number of staff operated projects and initiatives that were disconnected from a larger group of district personnel and workstreams. Personnel felt they could not interact with other departments or combine efforts for a common goal. There was an overall lack of relationships and cohesion across departments, which participants clearly noted was problematic.

Despite the territorial and challenging district culture pre-laptop initiative, this case study, however, illustrates that technology initiatives can bring departments together as seen in this case study of Livingston School District. It highlights previous findings that also document the importance of workstreams coming together in technology initiatives and the overall importance of collaboration within a district context (Dexter, 2005; Leithwood, 2010; Levin & Schrum, 2013). Working together in the laptop initiative created a shift in the way individuals at Livingston School District collaborate and also connected departments together for the first time. There was evidence that district personnel now feel more comfortable reaching out to their peers before making decisions. Communication lines are open and conversations are more likely to occur. In our interviews, many district personnel cited increased collaboration as one of the best outcomes of the initiative.

The findings also illustrate that it was a challenge to get departments working together in new and collaborative ways. At times, it appears personnel had conflict and at times still struggle in their partnerships; yet, everyone works through the challenges and/or problems together. It is also apparent that individuals recognize and accept being vulnerable with one another, which builds capacity of personnel and alleviates dysfunction. Additionally, these findings show promise for how district and school based personnel work together at school sites and not just in district settings. The shift in a culture of teamwork has for some participants, trickled down into the school level and influenced how these individuals work together. District and school based administrative staff are teaming up to support one another and train teachers, share ideas, and ensure that a variety of help is available at the school sites and for each other.

Conclusion/Implications

The implementation and effectiveness of technology initiatives require a significant leadership capacity and efforts from district personnel. Due to the complex and challenging nature of any technology initiative, it is imperative to bring different workstreams together to ensure that implementation is organized and effective for all stakeholders. For example, a district with departments such as curriculum, professional development, technology, family and community engagement, should make efforts to bring these representatives together from the beginning to plan and ensure that communication is open and encourage collaboration across departments. This case study encourages us to consider the potential for a *positive shift* in district culture when teamwork and communication across workstreams may not be present. This case study also builds on the literature needed to support districts implementing technology initiatives and provides real examples of the experiences of personnel in one large urban district in the United States. Although this paper did not expand on the role of teachers and their participation or collaboration in technology initiatives, these individuals are also critical to the success of technology initiatives and should be included as well. Future studies can continue to inform educators about the importance of understanding district culture and how multiple departments or workstreams can effectively be organized in their implementation of technology initiatives that aim to increase student achievement and create a positive organizational culture.

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Flipping the MOOC Global/Local Shakespeare: Understanding the Visual and Verbal Metaphors

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The researcher integrated her on-campus Shakespeare class at the Providence University with her newly created MOOC Global/Local Shakespeare class. Funded by the Taiwan Ministry of Education, the MOOC Global/Local Shakespeare was designed to study Shakespeare's texts with intercultural awareness. Students in a for-credit course at the Providence University were assigned to watch the MOOC video lectures and when they came to the flipped classroom, they were instructed to use visualizing techniques to interpret and create their mind picture. By the end of this 5-week project, student participants answered a questionnaire of their learning style and their self-assessment of visualization and comprehension. Most students agreed that visualization activities greatly increased their understanding of Shakespeare's text.

Keywords: flipping the MOOC; visual literacy; reading comprehension

Introduction:

Funded by the Taiwan Ministry of Education, the MOOC Global/Local Shakespeare curriculum intended to provide a platform for online learners to share their opinions of learning Shakespeare and to develop a capacity to find the relationship between Shakespeare and their own cultures. The course, launched in September 2014, was designed based on Benjamin Bloom's prominent Taxonomy theory (1956) to guide students to the higher levels of intellectual skills, like critical thinking and problem solving, in the Revised Taxonomy (Krathwohl, 2002; Mayer, 2002) through the scaffolding instructions. Online learners were required to watch 10-15 minute videos on the ShareCourse, one of the Taiwanese MOOC platforms. These video lectures offered knowledge which can be remembered and understood by self-learning. Their learning outcomes would be evaluated in different types of assessment.

The course assessments were to fulfil the different levels of cognitive domains, such as knowledge, comprehension, application, analysis, synthesis and evaluation (See Table 1). The assessment tasks included reading Shakespeare's texts in a scenario, analyzing Shakespearean texts and adaptations, and staging a Shakespeare scene. The assessment types contained unit tests (20%), practice by doing assignment (10%), two case studies (10%), a midterm (30%) and a final presentation (30%). Both the curriculum contents and the assessments were designed to examine Shakespeare's texts with a global perspective, and to translate them into the relevant cultural contexts.

Table 1. Assessment and Bloom's Taxonomy

Assessment Type and Percentage	Assessment Task	Bloom's Taxonomy
Unit Tests 20%	20 multiple choice questions, automatically graded by computer to give the immediate feedback to students.	After watching a lecture film, students will take a multiple choice question to assess their learning. The assessment is to evaluate a learner's knowledge and comprehension of the lectures. It responds to the cognitive domain of remembering and understanding.
Practice by Doing Assignment 10%	A film of reading a sonnet in a scenario. The film will be randomly assigned to and graded by their peers and then by their instructor.	After studying the Sonnets, students have to read Shakespeare's texts in a scenario. Students learn to apply their knowledge of Shakespeare's text to create a

		film. Afterward, they will evaluate their classmates' works. The assessment hopes to achieve the cognitive domains of remembering, understanding, applying, creating and evaluating.
Case Studies 10%	Two short papers, graded by the instructor. Students have to analyze non-Anglophone Shakespearean adaptations by using online materials.	The two assignments aim to assess a learner's cognitive domains of applying, analyzing, and evaluating.
Midterm Exam 30%	A written exam, graded by the instructor, is to analyze and explain Shakespeare's texts in the cultural and social contexts.	The written exam aims to evaluate a learner's cognitive domains of remembering, understanding, applying, analyzing, and evaluating.
Final Presentation 30% (summative assessment)	After the midterm, students have to stage a scene. They use five questions to analyze a character, and begin to recite and memorize the lines. Once they are confident of their speech, they can rehearse the scene with movement. They should upload a film of their works to the ShareCourse.	Staging a play requires synthetic skills, including all the cognitive domains of remembering, understanding, applying, analyzing, evaluating and creating.

However, despite the diverse curriculum contents and multiple assessments, the MOOC Global/Local Shakespeare had its limits, which obstructed the online learners' development of creativity and originality. For instance, it was difficult to carry out collaborative learning on the internet. Although the ShareCourse offered a chat room to support a synchronous meeting with online learners, it was still impossible to meet a large number of learners online. The cooperative learning between online learners was limited to written feedback and responses on the discussion bulletin board or through peer grading assessments. Due to the geographical distance, it was almost impossible for online learners to meet up for staging a scene.

To complement the MOOC limitations, the researcher used her created MOOC curriculum to conduct flip teaching in the actual classroom at the Providence University. The flipped classroom aimed to achieve higher cognitive levels of Bloom's Taxonomy. Students in a for-credit course were assigned to watch 10-15 minute videos. Seeing that the compulsory education in Taiwan has never offered a fair chance for students to cultivate their aesthetics competence, the researcher decided to create a curriculum to foster both visual and verbal competences.

Literature Review:

Because of new digital technologies, anyone has to deal with visual images everyday more or less; however, despite the prevalence of images and visual media nowadays, it does not necessarily mean that "individuals are able to critically view, use, and produce visual content" (Introduction, ACRL Visual Literacy Competency Standards for Higher Education). Seeing the ignorance of visual literacy, individuals must develop these essential skills in order to engage capably in a visually-oriented society. Visual literacy empowers individuals to participate fully in a visual culture. However, due to the emphasis of verbal literacy, there is no tradition to evaluate one's visual literacy in education.

The research on visual literacy is a relatively new subject. Schools tend to focus on a student's reading, writing and verbal form of communication in schools, and ignore the capacity of visual skills. Recent research on the integration of visual and verbal literacy has focused on the childhood education (Edwards and Willis, 2000; Gerrade, 2008) because young children have to use any possible communicative tool to convey their thoughts. Children tend to draw without judging their aesthetic competence.

Aware of the significance of technology, the Taiwan MoE has encouraged the higher education to offer MOOCs; however, it does not notice a paradigm shift in the definitions of literacy in the 21st century. Because of the prevalence of multimedia and digital technology, it becomes tremendously important to read and interpret information from images (Bleed, 2005). ELI (EDUCAUSE Learning Initiative) and ACRL (Association of College and Research Library) in the U.S. (Bleed, 2005; ACRL 2011), DECD (Department for Education and Child Development) in Australia (Draper, 2012), and ISTE (International Society for Technology for Education) in Britain (Baker, 2012) all suggest standards and assessment strategies for evaluating visual competence and comprehension. However, the standards have not been properly recognized in the higher education yet, and most of the teaching experiments, conducted by librarians (Hattwig, 2012, Hoover, 2012; Upson, 2014), were to explore a student's ability to manage and interpret the textual and visual information.

Recognizing the importance of visual literacy, this research developed a program to insert visualization activities into the MOOC Global/Local Shakespeare curriculum. Shakespeare was adapted into different forms of popular culture, including manga (Japanese comics), comics and graphic novels. This course used them to demonstrate various cultural interpretations of Shakespeare's text. Students were able to observe a visual text, the integration of a visual features and verbal feature to convey a message across the audience, while reading Shakespeare. Furthermore, the course's assessment tasks were evaluated based on the aforementioned resources for assessing visual literacy.

Methodology:

Based on the ACRL standards for visual literacy (2011), assessments include to examine the degree to which students comprehend, interpret and analyze the meaning of images and visual media, to evaluate whether students are able to choose and use images and visual media effectively, and to create meaningful images and visual media in a cultural context. In terms of the teaching methods, this research followed Vygotsky's concept to provide resources and support to students when they learned new concepts, and the cooperative learning theory to organize classroom activities into academic and social learning experiences. During the five-week he class usually consisted of a group project, followed by an individual project. In the beginning, students were put into groups of three to five, and given approximately 15 minutes for discussion to complete a theme-based project. Afterwards, each student was responsible to accomplish an individual creative work.

For instance, in Week 3, learning objectives were to use images and visual media effectively and to edit images as appropriate for quality, layout and display. Students worked as a group to discuss and find appropriate visual metaphors to express Juliet's soliloquy. They were able to identify and recognize metaphors in a cooperative learning environment. As the students became familiar with applying their visualizing skills, the supports were gradually removed. Later, they could move on to accomplish an Individual Project, which allowed students to create and explain choices made in the production of the images to construct meaning relevant to the metaphors. The combination of Scaffolding strategies and cooperative learning in visualization activities would help students to build up their confidence in drawing and develop both verbal and visual communicative experiences. These instructional strategies encouraged students to become active learners, and share insights with their peers in classroom. By so doing, they not only had to analyze specific details of Juliet's soliloquy, but also learned to interpret it with meaningful metaphoric images.

Because assessing visual comprehension is a relatively new idea, the researcher developed the criteria for visualization activities based on the ACRL standards for visual literacy to locate and analyze the representations of visual and verbal metaphors in their creative works. The criteria, including the response to the Shakespeare's text, the use of image, and design and composition, took Kathy Schrock's rubric (2014) and Quinnipiac University visual literacy essential learning outcome rubric (2014) as reference (See Table 2).

Table 2. Rubric for visualization activities

ACRL Visual Literacy Competence Standards & Outcomes with Activity Example				
Score	Redo	60 (effective)	80 (advanced)	100 (outstanding)
Level Descriptions	Student work provides evidence of a **limited** understanding	Student work provides evidence of a **basic** understanding	Student work provides evidence of a **strong** understanding	Student work provides evidence of an **exemplary** understanding
Respond to the Text	Unable to find an image to represent abstract or symbolic words.	Can identify some abstract or symbolic keywords and find some images to interpret the text.	Can understand abstract or symbolic keywords satisfactorily and find appropriate images to interpret the text.	Can understand the abstract or symbolic keywords thoroughly and find effective images to interpret the text.

Use of Images	Images do not support the content. In a creative work, images are randomly placed and add no meaning.	Images vaguely support the content. In a creative work, images add little meaning.	Images are properly related to the content. In a creative work, images add meaning to the text.	Images are used to illustrate a concept clearly. In a creative work, images add meaning to the text and beyond the text.
Design and Composition of the Comics	Poor alignment of information (text and/or graphics). Space not used effectively. Graphics only somewhat relate to text.	Aligns some information, other areas have too little/much space between content and graphics. Most graphics relate to the content and/or text and are of good quality.	Work is attractive, well organized, visually appealing. Good balance of text and graphics. Aligns information appropriately, uses space well to organize ideas and information. Graphics relate to content and/or text & are good quality.	Very impressive or engagingly surprising to audience. Creative use of text matches the message. Aligns the information, giving order to the page. Graphics are strategically placed for effect. Uses space and graphics creatively that enhance the content of the message.

Upon completion of this course, the researcher conducted a survey to find out student learning styles and the perceptions of their leaning outcomes. In the survey, the researcher used the Felder & Solomon's index of student learning styles (Felder & Solomon, n.d.) to define whether student belongs to visual or verbal learning style. The second section of the survey is to understand whether the visualization activities in the flipped classroom enhanced their learning (See Table 3).

Table 3. Questionnaire: Visualization

Visualization Directions: Please circle the number at the right of each question to indicate your opinion following the below guide: Not at All 1; Very Little 2; Moderately 3; Strongly 4; very strongly 5

How good are you to visualize a scene…

1. Looking at illustrations helped me get a better understanding of the text.	1 2 3 4 5
2. Visualizing the pictures after reading the text greatly helps me understand what I'm reading.	1 2 3 4 5
3. Drawing a picture of my thoughts after visualizing them helped me better understand what I read.	1 2 3 4 5
4. Making mind pictures in my head are easier to do after this lesson, than it was before.	1 2 3 4 5
5. Orally discussing my visualization helped me increase my own comprehension and understanding about the text.	1 2 3 4 5

Data Analysis:

13 Students in the Global/Local Shakespeare flipped classroom were instructed to use visualizing techniques to interpret and create their mind picture. Take the activity to find appropriate images in Juliet's soliloquy for example, 2 students achieved an outstanding level, 2 an advanced level, 5 an effective level and 4 were suggested to redo the assignment. The 2 outstanding level students successfully drew effective images to match the metaphoric words or keywords in Juliet's soliloquy while 4 were unable to draw any images to represent Shakespeare's lines.

By the end of this 5-week project, students answered a questionnaire of their learning style and their self-assessment of visualization and comprehension. The research indicated that the students' perceptions of their understanding of the Shakespeare's text have increased after reading it with assistance of illustrations. They claimed visualizing the pictures after reading the text greatly helps them understand what they read. According to the survey designed based on the Felder & Solomon's index of student learning styles questionnaire (Felder & Solomon, n.d.), students who tended to be verbal learners were frustrated with drawing a picture and making mind pictures. The results also confirmed the importance of cultivating creativity and imagination in the higher education. The survey showed 11 of 13 participants perceived the improvement of their understanding of the Shakespeare's text after reading it with assistance of illustrations. According to the statistics, 12 of 13 participants claimed that visualizing the pictures after reading the text greatly helps them understand what they read. Furthermore, 10 of 13 participants agreed orally discussing their visualization increase their comprehension of the text.

Conclusion:

Most curricula in the English departments in Taiwan have devoted to the practices of reading, writing, and verbal communication. However, in the new digital age, everyone has to deal with visual images everyday more or less. Despite the prevalence of visual media nowadays, it does not necessarily mean that "individuals are able to critically view, use, and produce visual content" (Introduction, ACRL Visual Literacy Competency Standards for Higher Education). This MOOC Global/Local Shakespeare curriculum gives a holistic and integrated approach to teaching and assessing student visual and verbal comprehension. The visualization activities help students to understand, interpret and express their thoughts and opinions in visual languages. Through these activities, students can enhance both their visual competence and reading comprehension of Shakespeare.

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Adoption of mobile learning in schools: Impact of changes in teacher values

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School teacher beliefs, attitude and anxiety are factors influencing acceptance of mobile devices as a new technology. The acceptance understands how the factors influence teacher behavioral intention and concerns the stage of introducing mobile devices. Practical experience can change the factors. To understand how to sustain the uses of mobile devices in classrooms, we need to understand how the adoption changed the factors. Literature suggests that teaching subjects have impacts on the changes. In this study, we adopted a quasi-experimental design and used pre- and post- questionnaire to investigate how different subject teachers change their beliefs, attitude and anxiety. The participants were 62 secondary school teachers, resulting in two groups – language and humanity, and mathematics and science. Mixed repeated measures ANOVAs were used to analyze the data collected from the questionnaires. The results showed that the mathematics and science group improved their beliefs, but the language and humanity group did not. The results also showed that the two groups improved level of anxiety but not attitude. We suggest four implications on teacher professional programs and school policies for mobile device integration, discussed limitations and future research.

Keywords: adoption, mobile learning, teacher beliefs, attitude, anxiety

Introduction

Mobile technologies are widely used in many different contexts, for example, entertainment, commercial and education. More individuals tend to have more than one mobile device and use them in a daily basis. In educational context, mobile devices offer a new way of teaching and learning. Using the devices in classrooms can offer diverse opportunities for teachers and students. They shift learning processes more to students to create learner-centered environments. These environments encourage individual and independent learning, learning by doing, sharing and peer-reviewing, which make teaching more effective (Godwin-Jones, 2005; Wong, 2012). Numerous studies suggest how to design materials and activities when using mobile device for the environments (e.g. Chiu & Churchill, 2015; Gedik, Hanci-Karademirci, Kursun, & Cagiltay, 2012; Martin & Ertzberger, 2013). However, the environments are only established after mobile devices are successfully introduced in classrooms and integrated in teaching sustainably. Most adoption of mobile devices in teaching is first determined by school management teams and teachers. The school management teams including principals, vice-principals and ICT coordinators would consider their Information Communication Technology (ICT) policies and resources for their decision marking (Blackwell, Lauricella, & Wartella, 2014). The teams would also consider the impacts of using mobile devices on student behavior, for example, cyberbullying and mobile device missing. Another decision maker considered here is teachers. Teacher belief, attitude and anxiety are three important factors influencing new technology integration into classrooms (Bitner & Bitner, 2002; Blackwell et al., 2014; Kim, Kim, Lee, Spector, & DeMeester, 2013; Venkatesh, 2000). The teachers would take their beliefs about and attitude towards mobile learning into account when making their decisions (Chen, 2010; Kim et al., 2013; Yuen & Ma, 2008). When they find mobile devices useful and easy to teach with, they are more likely to integrate them in their classrooms (Kim et al., 2013, Chen, 2010; Kim, et al., 2013; Yuen & Ma, 2008). Another factor – anxiety – has a negative influence on the integration process (Bitner & Bitner, 2002). Helping teacher overcome their anxiety is crucial to the success of the mobile devices as new technology integration (Bitner & Bitner, 2002). Teacher training programs should be provided to teachers for helping them understand how to use the technology, which could reduce the anxiety (Bitner & Bitner, 2002).

The teacher beliefs, attitude and anxiety will be changed while/after experiencing, understanding or using new teaching methods (Ertmer & Ottenbreit-Leftwich, 2010; Lee, 2004). The changes in teacher beliefs and attitude appear some patterns (Lee, 2004). Understanding the changes could aid schools to plan their teaching professional programs and policies to increase sustainability of the methods. When implementing mobile devices in teaching, one of the major focus needs to be on the change in the teacher thinking, value and emotion (Bitner & Bitner, 2002). The present study aims to investigate change in teacher beliefs, attitude and anxiety after adopting mobile devices in schools.

Literature review

Teacher beliefs, attitude and technology acceptance

Teachers' beliefs are fundamental and include their views on knowledge acquisition and effective ways of teaching (Kim, et al., 2013), which can be categorized into six dimensions: 1) the structure of knowledge, 2) the source of knowledge, 3) the stability of knowledge, 4) the speed of learning, 5) the ability to learn (Schommer, 1998; Schommer-Aikins, Duell, & Hutter, 2005), and 6) effective activities to support learning and instruction (Chan & Elliott, 2004). These beliefs that are directly or indirectly related to performance mediated by attitudes, efforts and behaviors (Schommer, 1990), are the most valuable factors for teacher acceptance (Ajzen & Madden, 1986; Kim, et al., 2013). For example, if a teacher finds a tool easy to learn, she/he is more likely to try the tool in her/his lessons; if a teacher believes that teaching is about students' reflection on what they learned in the lessons, that the teacher is more likely to use lesson reflection approach in teaching.

The view of research on teacher beliefs about technology is narrower than that of research on teacher beliefs in general. The beliefs should be associated with teacher beliefs in relation to technology (Kim et al., 2013). Abbitt (2011) refers the beliefs as self-efficacy regarding computer use; Polly and colleagues (2010) regard the beliefs as the value of technology in learning and teaching; Davis and colleagues (1989) suggest the beliefs include perceived ease to use and perceived usefulness of, a new technology. Teacher beliefs about technology are an important predictor in technology acceptance (Celik & Yesilyurt, 2013; Davis, et al. 1989; Kim et al., 2013; Teo, 2009). Teachers who perceive higher computer self-efficacy are more likely to find new technologies easy to use and useful in teaching, and adopt the technologies in teaching (Celik & Yesilyurt, 2013; Teo, 2009). Moreover, teachers who hold positive attitude towards using a new technology in teaching are more likely to use the technology in classrooms (Blackwell et al., 2014; David et al., 1989). In conclusion, teacher beliefs and attitude can affect mobile devices adoptions.

Anxiety and technology acceptance

Anxiety is defined as an emotional state of unpleasantness, fear, frustration, rumination and apprehension (Nayak, 2014; Venkatesh, 2000), which threatens decision making (Wray & Stone, 2005). Anxiety is an important predictor in technology acceptance. (Venkatesh, 2000; Celik & Yesilyurt, 2013; Hsu, Wang, & Chiu, 2009), which has negative influences on technology integration (Venkatesh, 2000; Celik & Yesilyurt, 2013; Hsu et al., 2009). Introducing new technologies as a teaching tool in classrooms would lead to changes in instructional methods and the use of unfamiliar technologies (Bitner & Bitner, 2002). These changes of any kind bring about anxiety, fear and concern of teachers (Bitner & Bitner, 2002).

Teachers may be worried about heavier workload from learning or using the technology or lost control of the classroom procedure due to the unfamiliarity. Teachers who feel anxious about teaching with mobile devices as a new technology are less likely to recognize them as effective teaching and learning tools (Celik & Yesilyurt, 2013; Hsu et al., 2009).

Individuals' anxiety is associated with their beliefs and attitude (Celik &Yesilyurt, 2013; Hsu et al. 2009; Igbaria & Parausraman, 1989; Roberts & Henderson, 2000; Venkatesh, 2000). Anxiety can negatively affect user beliefs on how easy a technology is to use (Igbaria & Parausraman, 1989; Roberts & Henderson, 2000; Venkatesh, 2000) and attitude towards a new technology (Agbatogun, 2010). Attitude towards using a technology also negatively affects anxiety (Celik & Yesilyurt, 2013). Teachers with positive attitude towards using a technology would hold less anxiety; teachers with higher anxious would hold a more negative attitude towards using a technology. For example, teachers who hold higher anxious about taking mobile devices as learning and technology tools are less likely to find the devices easy to use and hold positive attitude.

Change in teacher belief and anxiety

Experiencing new instructional methods offer teachers opportunities to get familiar with the methods by understanding more how and when to use, which can change teachers' beliefs and anxiety towards the methods (Ertmer & Ottenbreit-Leftwich, 2010; Lee, 2004; Wilkins & Brand, 2004). For example, taking a mathematics methods course, teachers found teaching with the methods more effective, and changed their beliefs about teaching and learning (Wilkins & Brand, 2004). The changes in teacher beliefs appear some patterns (Lee, 2004). Teachers gradually changed their beliefs about a new instruction when they noticed their students successfully learned under the instruction or saw the instruction benefits student learning (Lee, 2004). For example, teachers started to change beliefs about incorporating natural phenomena in science learning when they observed there were student improvements in tests and classroom assessments (Lee, 2004). Once teachers observed students got higher motivated in classrooms when learning with mobile devices, they gradually changed their views on the use of mobile devices. Moreover, less visible evidence of technology integration usefulness as a tool for teaching and learning causes more anxiety and feelings of reluctance to use technology (Hennessy, Ruthven, & Brindley, 2005). More visible evidence is necessary to change teacher anxiety.

Some other factors affect the degree of change in teacher beliefs, for example, curriculum context, subject culture/knowledge and pedagogical change (Goodwyn, Adams, & Clarke, 1997; Hennessy et al., 2005). Subjects develop their own perspectives on learning outcomes, objectives, and they shape their plans and actions accordingly (Firestone & Louis, 1999; Hennessy et al., 2005; Lave & Wenger, 1991). Studies of Goodwyn and colleagues (1997), and Hennessy and colleagues (2005) revealed that there is a relationship between subject and level of technology integration into practices. Their studies suggest that mathematics and science teachers feel more positive about the educational benefits and less reluctant to use technologies; language teachers have larger varieties on their views on technology use, and feel more anxiety and larger reluctant to use technologies. They further suggest that there might a tension between anxiety and beliefs about attitude towards educational technology use. Their results showed that some teachers who found a technology useful in teaching and learning felt more anxiety of using the technology in classrooms.

In conclusion, adoption of mobile devices in teaching, that can offer opportunities to understand what mobile devices bring to student learning and how to use mobile devices in classrooms, is more likely to change teacher beliefs, which may change their anxiety. Moreover, different subject teachers would change their beliefs about, attitude and anxiety towards, differently.

The present study

Using mobile devices as teaching and learning tools is still new to most schools. Teachers in the schools would see the devices as a new/unfamiliar educational technology. They might feel confident or panic when they are told to teach with the devices. Their beliefs, attitude and anxiety can influence the effectiveness of mobile device adoptions in classrooms, and are likely to be changed after the adoptions. Understanding the changes help schools to plan to sustain the uses of mobile devices for successful technology integration. The present study aims to investigate how different subject teachers – language and humanity, and mathematics and science – change their beliefs, attitude and anxiety after mobile devices adoption in schools.

Based on our discussion in the previous section our predictions were as follows:

Hypothesis 1. The main prediction is that language and humanity group will not significantly affect the change in their beliefs about computer self-efficacy, ease to use, usefulness of, and attitude towards mobile devices in teaching and learning after the adoption.

Hypothesis 2. The main prediction is that the mathematics and science group will significantly affect the changes in their beliefs about computer self-efficacy, ease to use, usefulness of, and attitude towards mobile device in teaching and learning after the adoption.

Hypothesis 3. The third prediction is that the two teacher groups will affect the change in anxiety towards using mobile devices in teaching after the adoption.

Hypothesis 4. The final prediction is that the change in computer self-efficacy, perceived ease to use, perceived usefulness, attitude and anxiety of the mathematics and science group is significantly larger than that of the language and humanity group after the adoption.

Method

Participants and design

The participants were 62 teachers from a secondary school in Hong Kong. Seventeen participants were male (27.42%) and 45 were female (72.58%). The average teaching experience was 12.8. The teaching subjects of the participants were English, Chinese, Chinese History, Western History, Mathematics, Junior Science, Chemistry, Biology and Physics.

In this study, we adopted a quasi-experimental design with pre- and post- questionnaire to compare different subject teacher groups. The participants were divided into two groups according to their primary teaching subject, resulting in a language and humanity group (n=29) and a mathematics and science group (n=33). The school environments supported technology in teaching – they had learning management support systems, projectors in the classrooms and wireless services.

Materials

In this study, the material comprised a self-report questionnaire and a consent form. We designed and constructed the questionnaire, and conducted a read-through with 2 experienced teachers to confirm the questionnaire format and wording were understandable and readable. The questionnaire items to collect data on teacher background, and views on teaching and learning with mobile devices. In this paper, we report results from the teacher answers to the questionnaire items that addressed their computer self-efficacy, perceived ease to use and usefulness of mobile devices, attitude to mobile devices in teaching, and anxiety towards using mobile devices in teaching. These were: (a) 3 questions about teacher background; and (b) 10 Likert-types questions (5=strongly agree, 1=strongly disagree). Questions in the questionnaire were modified from relevant research studies. The questions in computer self-efficacy were adapted from Compeau and Higgins (1995); the questions in perceived ease of use, perceived usefulness and attitude towards using were adapted from Davis (1989); the questions in anxiety were adapted from Hsu and colleagues (2009). The followings show the items in the questionnaire.

Computer self-efficacy

- *I know how to use a computer to do my work.*
- *I am confident about using computer to do my work.*

Perceived ease of use

- *I find mobile devices easy to teach.*
- *Learning to teach mobile devices would be easy for me.*

Perceived usefulness

- *Using mobile devices will improve my work.*
- *I would find mobile devices useful in my teaching.*

Attitude towards

- *Mobile devices make my teaching more interesting.*
- *I think it would be very wisely to use mobile devices in teaching.*

Anxiety

- *I feel mobile devices is a waste.*
- *I feel apprehensive about using mobile devices in teaching.*

Procedure

The researcher first spoke to the principal about this study and got the consent. The teachers completed the questionnaires in their school at the end of an academic year before the mobile device adoption. The school purchased 40 mobile devices and introduced them in classrooms in the next academic year. The teachers received training workshops and taught in their classrooms. After 10 months, the teachers completed the same questionnaires in their school. We collected the completed questionnaires and captured the data in the SPSS 21 for analysis.

Results

The data collected from the pre- and post- questionnaires reflects the changes in teacher beliefs, attitude and anxiety after the mobile device adoption in the school. We used mixed repeated measures ANOVAs to analyze the data collected in this study. One-way repeated measure ANOVAs were used to measure the score differences between before and after the adoption; two-ways repeated measure ANOVAs were used to compare the changes in scores between the language and humanity, and mathematics and science teacher groups.

The analyses showed that the adoption processing significantly improved the two groups' anxiety level, but not attitude towards teaching with mobile devices. The analyses also showed only the mathematics and science teacher group significantly improved computer self-efficacy, perceived usefulness and perceived ease to use mobile devices in teaching. Moreover, the changes in computer self-efficacy, perceived usefulness and perceived ease to use of the mathematics and science group are significant higher than that of the language and humanity group.

Table 1 shows descriptive statistics of the two groups. The mean scores of all the five measures in the pre-questionnaire were greater than 3. The participants tended to agree that they had abilities to teach with mobile devices and found mobile devices useful in teaching. Since anxiety has negative influence, the participants tended to have feelings of reluctance to use mobile devices.

To further examine hypotheses 1, 2 and 3, repeated measures ANOVAs were used. In the language and humanity teacher group, the analyses, see Table 2, showed that: there was a significant difference in anxiety scores between before (M = 3.03, SD = 0.74) and after (M = 2.74, SD = 0.59) the adoption, $F(1,28) = 7.15$, $p = 0.01$, partial $\eta^2 = 0.20$; there was no significant difference in computer self-efficacy scores between before (M = 3.76, SD = 0.53) and after (M = 3.79, SD = 0.45) the adoption, $F(1,28) = 0.10$, $p = 0.75$, partial $\eta^2 = 0.004$; there was no significant difference in perceived usefulness scores between before (M = 3.28, SD = 0.65) and after (M = 3.62, SD = 0.65) the adoption, $F(1,28) = 3.50$, $p = 0.07$, partial $\eta^2 = 0.111$; there was no significant difference in perceived ease to use scores between before (M = 3.62, SD = 0.76) and after (M = 3.78, SD = 0.80) the adoption, $F(1,28) = 0.57$, $p = 0.46$, partial $\eta^2 =$

0.02; there was no significant difference in attitude scores between before (M = 3.59, SD = 0.55) and after (M = 3.60, SD = 0.57) the adoption, $F(1,28) > 0.05$, $p = 0.83$, partial $\eta^2 = 0.002$.

In the mathematics and science teacher group, repeated measures ANOVAs, see Table 2, showed that: there was a significant difference in anxiety scores between before (M = 3.02, SD = 0.73) and after (M = 2.70, SD = 0.67) the adoption, $F(1,32) = 16.68$, $p < 0.001$, partial $\eta^2 = 0.343$; there was a significant difference in computer self-efficacy scores between before (M = 3.65, SD = 0.63) and after (M = 4.21, SD = 0.65) the adoption, $F(1,32) = 13.61$, $p =0.001$, partial $\eta^2 = 0.30$; there was a significant difference in perceived usefulness scores between before (M = 3.47, SD = 0.67) and after (M = 4.30, SD = 0.53) the adoption, $F(1,32) = 40.00$, $p <0.001$, partial $\eta^2 = 0.56$; there was a significant difference in perceived ease to use scores between before (M = 3.39, SD = 0.98) and after (M = 4.14, SD = 0.70) the adoption, $F(1,32) = 17.09$, $p < 0.001$, partial $\eta^2 = 0.35$; there was no significant difference in attitude scores between before (M = 3.73, SD = 0.60) and after (M = 3.71, SD = 0.50) the adoption, $F(1,32) > 0.05$, $p = 0.83$, partial $\eta^2 = 0.001$.

To compare the two groups for examining hypothesis 4, two-ways repeated measures ANOVAs, see Table 3, showed that: there was no significant differences in anxiety scores, $F(1,60) = 0.04$, $p = 0.85$, $\eta^2 = 0.001$, and attitude scores, $F(1,60) = 0.09$, $p = 0.76$, $\eta^2 = 0.002$, between the two groups; there were significant differences in computer self-efficacy, $F(1,60) = 7.58$, $p = 0.01$, $\eta^2 = 0.11$, perceived usefulness, $F(1,60) = 4.82$, $p = 0.03$, $\eta^2 = 0.07$, and perceived ease to use, $F(1,60) = 4.69$, $p = 0.03$, $\eta^2 = 0.07$, scores between the two groups.

Discussion and conclusion

The main goal of this study was to investigate how different subject secondary school teachers change in their beliefs – computer self-efficacy, perceived ease to use, perceived usefulness –, attitude and anxiety after the adoption of mobile devices in classrooms.

The pre-questionnaire results revealed that the teachers perceived good computer skills, suggesting that they were capable of using mobile devices in teaching. The results further showed that the teachers found mobile devices easy to use and useful in teaching and held positive attitude, but held stronger anxiety. This contradiction is in line with the studies of Goodwyn and colleagues (1997), and Hennessey and colleagues (2005). We suggest that the teachers acquired knowledge and skills to use mobile devices in classrooms; however, they would try mobile devices in the classrooms when they feel comfortable.

Practical experience will change teacher beliefs, attitude and anxiety (Ertmer & Ottenbreit-Leftwich, 2010; Lee, 2004). The adoption allowed teachers to experience the uses of mobile devices in classrooms, and changed their beliefs and anxiety accordingly. Teaching subjects have impacts on the degrees of the changes (Goodwyn et al., 1997; Hennessy, 2005). Our results agreed with the studies of Goodwyn and colleagues (1997), and Hennessy and colleagues (2005), and revealed that there can be a gap between different subject teachers. The adoption of mobile devices as a new teaching method changed the computer self-efficacy, perceived ease to use and perceived usefulness of the teachers in different ways. In this study, the mathematics and science teacher group significantly improved their views on their computer skills, ease to use and usefulness, but the language and humanity group did not. The analyses further showed that differences of the improvements were significant, which suggest that the practical experience are most likely to change views on using mobile devices and computer skills of mathematics and science teachers, but not language and humanity teachers. These changes were influenced by subject culture and objectives (Firestone & Louis, 1999;

Hennessy et al., 2005; Lave & Wenger, 1991). The mathematics and science group would find that the adoption can help them achieve their subject teaching goals; the language and humanity group would find that mobile devices were not appropriate teaching and learning tools in their subjects.

The results also revealed the two groups significantly had less anxiety after the adoption, suggesting that the practical experience can switch teacher emotional state from reluctance to willing of teaching with mobile devices. One of the plausible explanations is that unfamiliarity usually causes anxiety (Roger, 2010). The teachers would get more familiar with the uses of mobile devices after the adoption and become more comfortable. In contrast, the results showed that changes in attitude towards teaching with mobile devices were not significant in both groups, suggesting the adoption did not improve teacher attitude. School supports and policies influence teacher attitude (Blackwell, et al., 2014; Teo, 2009). The teachers may be worried about lacks of school supports, resulting in the possible increase in workload caused by using mobile device in classrooms. They are more likely to neglect other factors, such as, ease to use and usefulness, even though they think mobile devices were effective teaching and learning tools.

The adoption can provide different subject teachers with equitable practical experience and training opportunities to acquire knowledge and stimulate thinking. However, the knowledge and thinking cannot effectively motivate all the teachers to integrate mobile devices into their teaching practice. Moreover, students were less likely to receive teaching strategies using mobile devices from the language and humanity teachers. This leads to disparities in learning opportunities: language and humanity students might miss out on effective teaching strategies, which could enhance learning.

This study offers four implications for implementing teacher professional programs and school policies for mobile teaching and learning. First, the programs should be tailored to the different subject teachers in a school, and focus on how to use mobile devices to deliver teaching goals. Second, since the adoption that offers practical teaching experience change some teacher beliefs and anxiety, the programs should offer teachers practical teaching opportunities. Third, school management teams should take teacher anxiety seriously when planning mobile device integration into classrooms (Bitner & Bitner, 2002). The teacher processional programs should focus not only on developing teacher knowledge and thinking, but also on how to reduce teacher anxiety, and drive or motivate teachers to apply new knowledge and thinking. Four, schools should suggest how to reduce possible extra workload when integrating mobile devices in classrooms. For example, they can hire teacher assistants to help in-service teachers in the beginning stages when implementing plans of mobile device integration, which the teachers would feel more comfortable or confident.

There are limitations in this study and some are noted here. First, this study considered learning area instead of individual teaching subjects. Chinese and English language teachers may think differently. Future studies should invite more schools to examine the impact of individual subjects. Second, to study how to sustain mobile teaching in schools, a longer period should be conducted; data should be collected in more than two times. Future research should be conducted using longitude design to investigate the changes in teacher thinking and knowledge.

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Tables

Table 1

Descriptive statistics of the two teacher groups

		Language and humanity group (n=29)		Mathematics and science group (n=33)	
		Mean	S.D.	Mean	S.D.
Anxiety	Pretest	3.03	0.74	3.02	0.73
	Posttest	2.74	0.59	2.70	0.67
Computer self-efficacy	Pretest	3.76	0.53	3.65	0.63
	Posttest	3.79	0.45	4.21	0.65
Perceived usefulness	Pretest	3.28	0.65	3.47	0.67
	Posttest	3.62	0.65	4.30	0.53
Perceived ease to use	Pretest	3.62	0.76	3.39	0.98
	Posttest	3.78	0.80	4.14	0.70
Attitude	Pretest	3.59	0.55	3.73	0.60
	Posttest	3.60	0.57	3.71	0.50

Table 2

One-way repeated measure ANOVA results of the two groups

Group	*Variable*	*N*	*F*	η^2
Language and humanity group	Anxiety	*29*	*7.15***	*0.20*
	Computer self-efficacy	*29*	*0.10*	*0.004*
	Perceived usefulness	*29*	*3.50*	*0.111*
	Perceived ease to use	*29*	*0.57**	*0.02*
	Attitude	*29*	*0.05*	*0.002*
Mathematics and science group	Anxiety	*33*	*16.68****	*0.343*
	Computer self-efficacy	*33*	*13.61****	*0.30*
	Perceived usefulness	*33*	*40.00****	*0.56*
	Perceived ease to use	*33*	*17.09****	*0.35*
	Attitude	*33*	*0.83*	*0.001*

*p<0.05, ** p<0.01, ***p<0.001

Table 3

Two-ways repeated measure ANOVA results of the two groups

Variable	*F*	η^2
Anxiety	*0.04*	*0.001*
Computer self-efficacy	*7.58***	*0.11*
Perceived usefulness	*4.82**	*0.07*
Perceived ease to use	*4.69**	*0.07*
Attitude	*0.09*	*0.002*

*p<0.05, ** p<0.01, ***p<0.001

Transforming outdoor learning with the use of location-based technology and rapid authoring tool: Singapore experience

Png Bee Hin and David Jeremiah Mok

LDR Pte Ltd

LDR's **POCKET TRIPS** platform is a web-based HTML5 rapid authoring tool with multiple location-based technologies (such as A*Star's on-board Image Recognition technology, GPS and Bluetooth 4.0 triggers), that enables anyone without programing knowledge to create highly interactive and engaging mobile trails running on iOS and Android OS smartphones and tablets for outdoor learning, leadership training, team-building and curriculum-based learning journeys with live-tracking of results on users' own mobile devices.

Keywords: LDR, Pocket Trips, HTML5, authoring tool, location-based, Image Recognition, Blue-tooth, GPS, mobile, trail, iOS, Android OS, smartphone, tablet, curriculum-based, learning, journey, training, leadership, team-building, live-tracking, results, innovative, ICT, heritage, history, culture, Singapore, transform, outdoor

Introduction

LDR is a leader in providing pedagogically sound and highly innovative technology-enabled-learning solution to educational institutions - having designed more than 100 location-based mobile trails in Singapore for students and adults alike, and has also been deeply involved in the co-design, development, and operation of some 39 strands of interactive Heritage Trails (iHTs) using its proprietary location-based mobile authoring platform with MOE Curriculum

Planning Division since Dec 2010.

The iHTs were launched by the Minister of Education, Mr Heng Swee Keat in May 2012, and has since seen more than 45,000 students from more than 100 different schools in Singapore coming on board and exploring the various historical and cultural precincts of Singapore using tablet devices.


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Heritage trails go high-tech

App sends site-specific info, queries to enhance students' experience

ST PHOTO: ASHLEIGH SIM

BY STACEY CHIA

SCHOOL trips to learn about Singapore's past are about to get more high-tech.

The Ministry of Education (MOE) yesterday launched a new mobile programme to teach students about Singapore history, geography and social studies.

Called the Interactive Heritage Trails programme, it will be available from next month to students from primary school to junior college.

The new initiative was introduced by Education Minister Heng Swee Keat yesterday at the inaugural Humanities Educators' Conference at Raffles Institution.

Mr Heng said the programme would help students develop a greater appreciation for the humanities, as their study becomes increasingly important in a globalised world.

'Our students need civic literacy, global awareness and cross-cultural skills so that they can interact with people of diverse backgrounds with confidence and empathy,' he told about 1,000 humanities teachers and speakers at the two-day conference organised by MOE and the National Institute of Education.

With the help of 12 schools and other partners, the humanities branch at MOE identified seven

Figure 1: Launch of Mobile iHTs by Minister of Education on 30 May 12

The success of the iHTs has seen LDR receiving a **master contract from MOE HQ in Jan 2015 to operate the iHTs for all schools in Singapore,** with many more schools coming on-board to design their own location-based trails using the mobile authoring platform (see below.)

Figure 2: School-generated Mobile Learning Trails created in partnership with LDR Pte Ltd

Many schools have also partnered LDR to create **'DIY school-generated trails'** i.e. by digitising their existing pen and paper worksheet trails to the mobile using LDR's rapid authoring platform. Thereafter, schools like Admiralty Primary School use their own school-owned iPads to run the trail (e.g. Little India Trail shown below) for their students, and have since also created more trails in URA City Gallery and also Telok Ayer with LDR.

Figure 3: Example of Little India Trail on iPad for Admiralty Primary School

Most recently, the company was also awarded a 3 year contract to design and operate a series of mobile interactive Total Defence trail in the Civic District in `Amazing Race' fashion for all units of the SAF as part of their National Education cum Unit Cohesion activities. These are now conducted regularly using LDR's mobile devices and facilitators (see below).

Figure 4: Launch of Mobile Total Defence Trail by NEXUS, MINDEF

The company has also been awarded a contract to design and develop a mobile trail app on iPad for Changi Airport which will allow travellers on transit to explore and learn about the various attractions in the Airport using location-based Image Recognition (IR) Technology to summon the site-related information, multimedia, activities and quizzes.

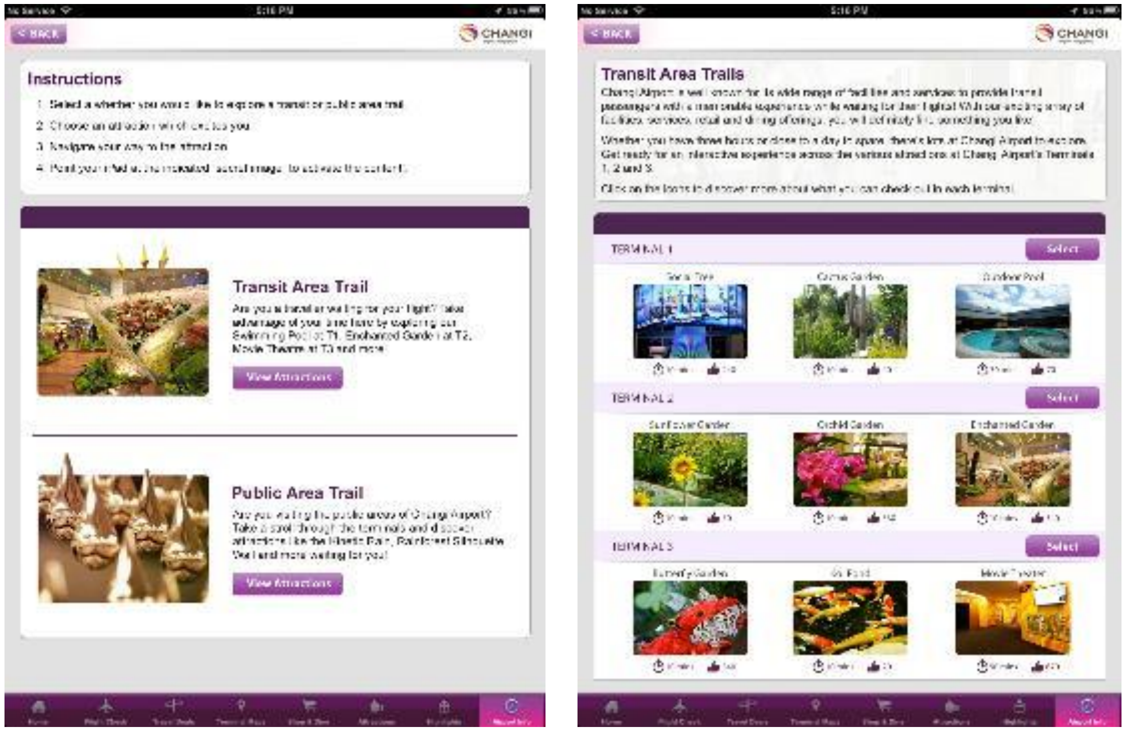


Figure 5: Mobile learning trail with Image Recognition triggers developed by LDR for Changi Airport

Figure 6: Example of Mobile Learning Space Information Content developed for Members of Public

Figure 7: Example of Mobile Learning Space Quiz and Facebook Activities Content developed for Members of Public

LDR Technology is now also integrating a Beacon management System (BMS) as part of our proprietary **Pocket Trips** solution, to facilitate even more educational learning journeys being created with a variety of GPS, Image Recognition and Blue-tooth 4.0 triggers to choose from. Pocket Trips comprises a powerful **web-based authoring platform** for users to create, edit and customise a Smart Learning Space anywhere in the world, with new mobile learning contents activated **using GPS, Image Recognition or BLE beacons**. The Pocket Trips platform is able to publish trails on iOS and Android mobile apps that can be used to create and host the learning contents. The learning trail app can be used by students and members of public to access multiple trails created using Pocket Trips.

Figure 8. Pocket Trips by LDR Technologies Pte Ltd

The unique features of Pocket Trips include:

- Content access: Content-push, GPS, On-board Image Recognition for comparison
- Easy-to-use web-based authoring platform: What-you-see-is-what-you-get (WWSIWYG) that allows agency to make direct changes to the content, subject to the complexity of the content design
- Mobile trail solution (interactive Information, Quizzes, Multimedia, Activities)
- For Android & IOS devices (iOS 5.0 onwards and Android 2.3 onwards)
- Trail Creation in 3-Simple Steps (taught in a 3-hour workshop)
- Fully Customisable Content Pages (with Ready Templates, Buttons, Graphics)

Pocket Trips also has added new features in 2015 including:

- Quiz analytics, with ability to generate reports for agency
- Allowing users/students to send photos and quiz results via the mobile app automatically to the portal to be retrieved by Agency/School, with option for photos to be sent direct to own school/public Facebook accounts (versus emailing their learning results to email addresses that they specify)

The Pocket Trips web-based authoring platform can deliver different learning content, and cover unique user profiles and content formats for students, as well as members of public. The learning content will be delivered contextualised to the location and the user's profile. The application will also allow Users/students to take photos and upload to the system when data access (WIFI, 3G or 4G) is available.

LDR instructors conduct workshops to train users how to make direct changes to the content, subject to the complexity of the content design; and generate reports for agency to provide useful information on:

- Traffic to each BLE beacon;
- Duration of stay within each BLE beacon; and
- Movements of users from BLE beacon to BLE beacon and more.

The **fully web-based authoring tool** is based on **HTML5.** Users can have easy and complete control over their content design down to the fine-grain details of position coordinates and order of depth. The diagrams below illustrate how simple it is to create and publish a new trail.

Figure 9. Step 1 - Users login to the Pocket Trips web portal and begin to ‘Create New Trip”.

Figure 10. Step 2 - Select the Trip Type e.g. to create a Cultural, Heritage or Nature trail.

Figure 11. Step 3. Select between Satellite/Street view to drop the pin for the desire hotspot location and Geo-fence i.e. decide where the GPS will trigger the hotspot contents using a Circle or a Polygon.

The authoring tool can then be activated to create the content pages, inclusive of uploading images, creating text, creating questions etc. Within the rapid authoring tool, the script editor offers an additional dimension of versatility for expert users to create their custom interactions via a Javascript editor. This creates a whole new level of possibilities for users to design new trails with **no need for pre-installation of any other software**. By publishing the content in HTML5 format, it becomes **scalable across different platforms such as iOS and Android OS.**

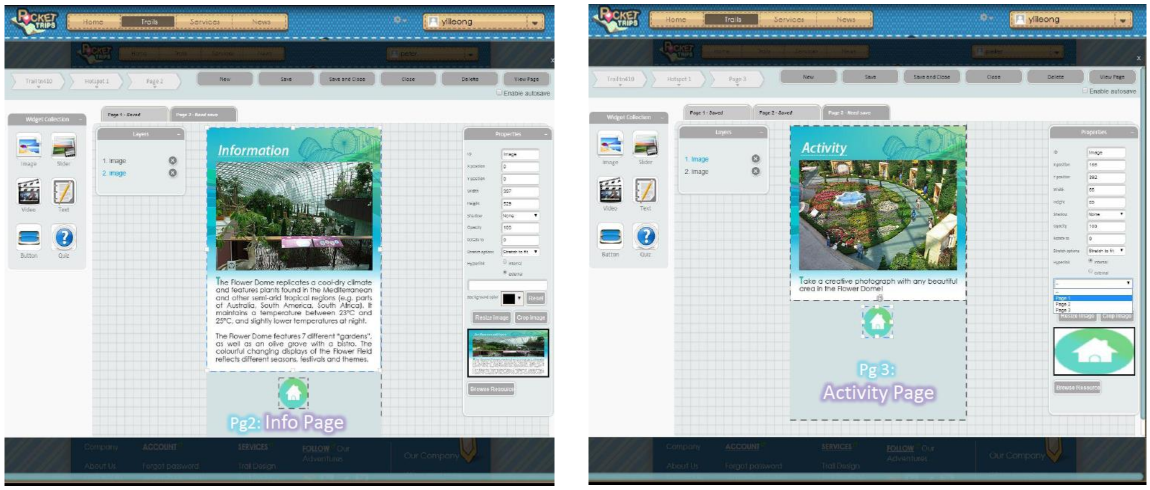


Figure 12. Illustration how Pocket Trips' authoring tool can easily be used to create hotspots in Gardens by the Bay

To experience the trail, the agency simply needs to install the 'Pocket Trips' User mobile app on their own iOS or Android OS mobile device, then download the desired trail. In addition, Pocket Trips comes with a trail simulator - which is an emulator system that runs within the web portal, thus reducing time spent on ground testing and validation. This allows the agency to **check any content changes prior to publishing their trails on the live portal.** The **trail simulator runs within an emulated environment with a map viewer.**

Figure 13. Step 4 - Simulator Mode Emulator will display the live content on the virtual phone the way things would appear on that user's phone in real life

Once ready, the agency can publish the finalized version and make it available for download on own public, school or student devices. Upon login in the mobile app, users will see a trip overview, and click Start to access the hotspots as illustrated in below diagrams using examples of the Marina Bay Trail and Southern Ridges Leadership Challenge.

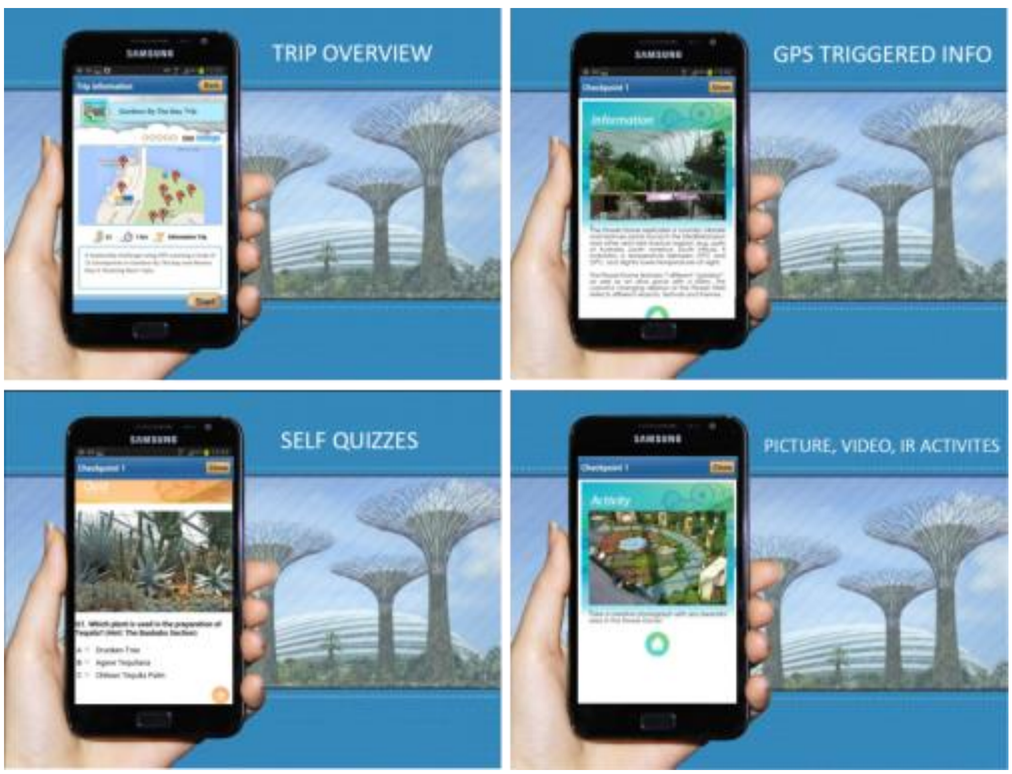


Figure 14. Mobile Hotspot Contents Triggered via GPS to reveal information, self-quizzes, picture, video activities in Gardens by the Bay

Figure 15. Example of Map view and Checkpoint Overview Instructions to trigger Mobile Hotspot Contents via Image Recognition currently for Southern Ridges Leadership Challenge Trail (substitutable with BLE)

Pocket Trips has been used to create trails by schools for members of public to enjoy and learn as part of Singapore's national day celebrations in 2015. It will also be used for upcoming projects in places of attraction such as the Singapore Discovery Centre, and can be employed anywhere across the world to create unique world-class location-based trails for education, tourism and even team-building corporate programs.

More information and photos illustrating how our trails have benefited more than 100,000 participants (from students to working adults) can also be viewed at our corporate Facebook site (www.facebook.com/ldr.pteltd).

ANNEX A USER REFERENCES

A. Ministry of Education (MOE) Singapore

ITEM	**DESCRIPTION**
Customer Name	**Ministry of Education**
Contact Person (s)	**Ms Elaine Lim**, Deputy Director, Humanities Branch, Curriculum Planning and Development Division
Email	LIM_Pik_Ying@moe.gov.sg
Contact No:	+65 6879 6763
Nature of Customer's Business	Curriculum Planning and Development, Humanities Br, MOE
Project Description	To design, develop, deploy and host a total of **37 Curriculum-Based and National Education interactive mobile learning trails for MOE.**
Nature of LDR's Involvement and Deliverables	LDR won the Proposal by MOE to design, develop, deploy and host a total of 37 Curriculum-Based and National Education learning trails for the Ministry of Education covering areas such as Singapore River, China Town, Little India, Fort Canning, Civic District, Central Business District (CBD), Bukit Timah Nature Reserve, Bukit Timah History Trail, Bukit Timah Heartware Trail, etc to help students from JC to Primary Levels experience humanities and national education subjects in an immersive, inquiry-based and experiential manner using location-based rapid authoring tool and hosting the trails on mobile devices supplied by us. MOE HQ has officially launched this new concept of outdoor learning by Minister of Education on 29 May 2012 at the inaugural Humanities Educators' Conference jointly organised by NIE and MOE.
Contract Period	2011-2012
Current Status	100% completed and delivered.

B. Changi Airport Group (CAG)

ITEM	DESCRIPTION
Customer Name	**Changi Airport International**
Contact Person (s)	**Mr Mohamed Shadiq Bin Shawall Hamid**, Senior Manager, Changi Airports International Pte Ltd
Email	mohd.shadiq@changiairport.com
Contact No:	6595 6886
Nature of Customer's Business	Management of airport e-services and corporate communications
Project Description	Design, Development And Deployment Of The **Mobile Explorer@Changi Airport Location-Based Interactive Learning Trail.**
Nature of LDR's Involvement and Deliverables	LDR was contracted by CAG to design, develop, and deliver a mobile interactive learning trail app in Changi Airport spanning across all three terminals. The content was interdisciplinary and covered topics from aviation and airport history to mathematics and art/architecture. The trail was very well received by the secondary school participants and LDR is currently in discussions with CAG to create more trails.
Contract Period	2013
Current Status	100% completed and delivered.

C. United Overseas Bank (UOB) Ltd

ITEM	DESCRIPTION
Customer Name	**United Overseas Bank Ltd**
Contact Person (s)	**Ms Susan Leong**, Vice President, Talent and Organization Development Human Resources, UOB Ltd
Email	susan.leong@uobgroup.com
Contact No:	68508709
Nature of Customer's Business	Banking and Wealth Management
Project Description	Corporate Trail Delivery for Team-building event using LDR's **'Amazing Race'@Singapore River Mobile Interactive Trail**
Nature of LDR's Involvement and Deliverables	LDR was contracted by UOB Ltd to customize and organize a team-building event for more than one hundred UOB IT management staff using LDR's location-based mobile trail. LDR combined the trail activities with situational leadership games and challenges and delivered the event with high satisfaction rates by UOB.
Contract Period	2013
Current Status	100% Completed and Delivered

D. National Heritage Board (Singapore)

ITEM	DESCRIPTION
Customer Name	**National Heritage Board**
Contact Person (s)	Mr Alvin Tan, Director, Heritage Institutions, National Heritage Board
Email	Alvin_tan@nhb.gov.sg
Contact No:	6332 5480
Nature of Customer's Business	Heritage and Conservation
Project Description	To design, develop and deploy a **"Battle for Singapore" Heritage Mobile App on iOS**
Nature of LDR's Involvement and Deliverables	LDR was contracted by NHB to develop a mobile interactive learning app on iOS as a downloadable self-directed app to commemorate the 70th anniversary of the Battle for Singapore during World War II. To date, more than 4,000 downloads have been recorded.
Contract Period	2012-2013
Current Status	100% completed and delivered

E. Nanyang Technological University (NTU)

ITEM	**DESCRIPTION**
Customer Name	**Nanyang Technological University**
Contact Person (s)	Kaleivani d/o Arumugam (Ms)
Email	kalei@ntu.edu.sg
Contact No:	(65) 6790-5811
Nature of Customer's Business	One of the top universities in Singapore, providing higher education and research
Project Description	**LOTM Trail Creation Workshop and Trail Operation for 'An Induction Program with a Difference'**
Nature of LDR's Involvement and Deliverables	LDR conducted a LOTM Trail Creation workshop for NTU HR Office, and now supports the quarterly runs of the NTU Staff Induction trail with a variety of hotspots all across Nanyang Technological University. Each hotspot has interactive quizzes, and activities that get the new staff engaged upon GPS and IR activation.
Contract Period	2012-13
Current Status	100% completed and delivered

F. GKS Command and Staff College (SAF)

ITEM	DESCRIPTION
Customer Name	**Goh Keng Swee Command and Staff College**
Contact Person (s)	LTC (NS) Terence Goh
Email	Tgkm7@yahoo.com.sg
Contact No:	98184911
Nature of Customer's Business	GKS CSC is the premier training institute of the Singapore Armed Forces. The main thrust of its educational system is directed towards developing the student's professional judgment and intellectual growth, through the creation of an environment that generates innovative and creative thinking.
Project Description	**Outdoor 'Amazing Race' Team-building-team-learning activity for GKS CSC**
Nature of LDR's Involvement and Deliverables	LDR created and has run multiple runs of the "Re-Making of Singapore" outdoor 'Amazing Race' mobile interactive trail in Marina Bay to support the team-building-team-learning activity as part of CSC's end-of-course summary exercise for both local and international officers, fusing LOTM's location-based triggers with video- and photo-taking activities.
Contract Period	2013
Current Status	100% completed and delivered

G. NATIONAL CADET CORPS (NCC)

ITEM	**DESCRIPTION**
Customer Name	**HQ National Cadet Corps (NCC)**
Contact Person (s)	MAJ (NS) Singam Suppiah
Email	suppiah_veerasingam@moe.gov.sg
Contact No:	98578367
Nature of Customer's Business	HQ National Cadet Corps is the Head Quarters for the NCC military cadet corps youth organisation supported by the Singapore Ministry of Defence and the Ministry of Education. The primary mission of the organisation is to develop resourceful, responsible, resilient, loyal leaders and team players through fun and challenging military-related activities.
Project Description	**NAVIGATION TRAIL USING POCKET TRIPS**

Nature of LDR's Involvement and Deliverables	LDR conducted a location-based navigation trail using Pocket Trips for cadets to: • Uncover information and quizzes at the various hotspots • Solve a trail puzzle challenge within the stipulated time using clues given at each hotspot, triggered using on-board Image Recognition
Contract Period	2014
Current Status	100% completed and delivered

H. Ministry of Education (MOE) S1 CLUSTER

ITEM	DESCRIPTION
Customer Name	**MOE S1 CLUSTER (comprising total of 13 primary and secondary schools)**
Contact Person (s)	Mr Steven Wong
Email	wong_chiow_kwei_steven@moe.edu.sg
Contact No:	94791248
Nature of Customer's Business	MOE S1 Cluster's intent is to create a series of heritage trails in various areas including Serangoon, Ang Mo Kio, Hougang and Kovan as part of MOE's SG50 Trails and Exhibition project to celebrate and commemorate Singapore's 50th Anniversary.
Project Description	**COMMUNITY LEARNING TRAILS USING POCKET TRIPS**

Nature of LDR's Involvement and Deliverables	LDR conducted a trail creation workshop attended by 20 teachers on the use of Pocket Trips to create fun and engaging trail experiences for public and students to enjoy: • Uncovering information and quizzes at the various hotspots • Solving trail activities, triggered using GPS and on-board Image Recognition to learn more about each heritage site
Contract Period	2014 - 2015
Current Status	Awarded

ANNEX B Additional Information

Here is a summary of the milestones by LDR in the area of **mobile learning and education** leading to development of the LOTM Tool:

(a) In Mar 2009, LDR won a 4-year contract to design, develop and operate a series of C2S (Commitment to Singapore) program for **HQ National Cadet Corps (NCC)** to build leadership and learning competencies.

(b) By Apr 2010, LDR Pte Ltd had developed more than **15 highly interactive mobile learning trails** to help students and adults alike to appreciate the rich historical, cultural and natural heritage of Singapore using location-based technology.

(c) In May 2010, LDR was invited to speak on `Singapore's Location-based Mobile Learning Experience' in the **2nd Advanced Distributed Learning Seminar held in UK** through the recommendation of IDA.

(d) In Oct 2010, LDR won the **Call-for-Collaboration LOTM Tool Project initiated by IDA** to develop a software-based tool to enable teachers to create mobile learning trails in order to enhance learning beyond the classroom.

(e) In Feb 2011, CEO COL(Ret) Png Bee Hin was invited to the **2nd International Teachers' Conference in Indonesia** to share on the topic 'The Mobile Learning Wave - Trends & Applications' hosted by the Minister of Education Indonesia and attended by more than 600 over principals and teachers from across Indonesia.

(f) In April 2011, LDR won a contract from MOE to develop more than **32 curriculum-based mobile learning trails for the Ministry of Education, Singapore**.

(g) In Dec 2011, LDR won a contract from **National Heritage Board (NHB)** to develop a **`Battle for Singapore' app** for the iPhone to commemorate the 70th Anniversary of the Fall of Singapore which has been downloaded more than 4,000 times since its launch.

(h) In March 2012, LDR conducted workshops in the **International Conference for Teaching and Learning with Technology (ICTLT) 2012** and organised learning journeys for delegates using the Heritage Trails developed by LDR.

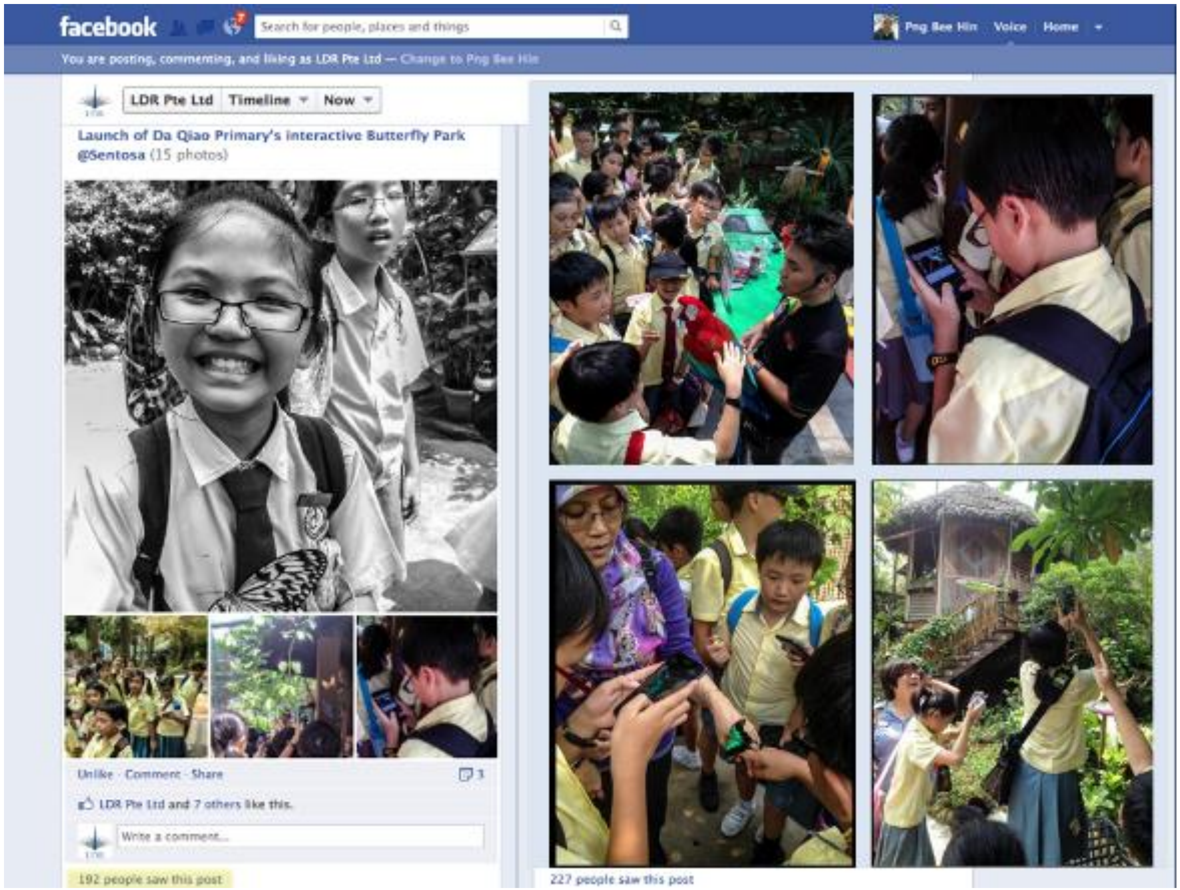
(i) In April 2012, the **interactive Cultural Mapping Trails** developed using the LOTM Tool were launched by the Minister for Transport.

(j) On 30th May 2012, the **interactive Heritage Trails (iHTs)** and **LOTM Tool** were launched by the Minister for Education (Singapore) in the presence of more than 1,000 Humanities teachers. More than a hundred schools have since signed up for the license to book and run the iHTs.

(k) In April - May 2012, LDR was invited by IDA to showcase our LOTM Tool in **COMEX ASIA 12** in **Oman** and also with education counterparts in **Qatar.**

(l) On 24th Oct 12 to 25th Oct 12, LDR participated in the inaugural Mobile Learning Asia Conference.

(m) Between 1st Nov 12 to 31st Jan 13, LDR organised and trained more than 10 MOE schools on the use of the LOTM trail creation module, including Da Qiao Primary School which created the Butterfly Trail in Sentosa Island on Android devices (see diagrams below).



(n) On 5th December 2012, LDR emerged as the Top Winner of Asia Pacific ICT Award (APICTA) 2012 in the eLearning Category, whereby we showcased the Mobile Learning solutions using both our LOTM mPlayer App and location-based capabilities for GPS and Image Recognition. This was against a total of some 156 nominations from 16 other countries competing in 17 different categories.

(o) Between August to December 2012, LDR has also received two Awards for our Learning-On-The-Move (LOTM) Tool for the **SiTF Awards Competition**, viz for **Mobile App category** (**Silver** –highest in the category) and **eGovernment category** (**Bronze** – only private company to win in this award category). Both IDA and SiTF have also nominated us for the **ASEAN ICT Award 2013**. In addition, SiTF nominated us for the World Summit Award 2014 as the best m-Content example in m-Learning & Education from Singapore.

(p) Today in 2015, we are also beginning to see a new trend of adult learners coming onboard from the corporate world (such as SINGTEL, STENGR, CISCO CERTIS, SAF etc) as well as from the Community Development Groups (such as PA, SINDA, NPPD, NACLI), using our award-winning LOTM Tool and location-based collaborative trails for **social cohesion, team building and leadership development purposes.**

Students' conceptions of m-leaning

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This article presents emerging results from a phenomenographic study that examines Bangladeshi university students' experience of using mobile devices in their learning. Three students from one renowned university participated in the semi-structured interviews to explore their experiences of m-learning. The findings revealed that university students viewed mobile learning (m-learning) in four qualitatively different ways that were: (i) storing learning materials; (ii) accessing information and knowledge; (iii) effective learning tool; and (iv) effective tool for collaboration. This study constructs on previous studies of university students' conceptions of learning. However, the focus taken in this research on the experience of m-learning, as an emerging research area, which revealed new facets of university learning. The findings of this study play a significant role in faculty development program and have an impact on teaching and learning practice in university education.

Keywords: m-learning, conceptions, phenomenography.

Introduction

Over the last few decades, most of the developing countries have been trying to introduce Information Communication Technology (ICT) in their education sector (Kafyulilo, 2014). As such, ICT, in recent years, has gone on to become one of the most crucial components that determine the basic competence of student learning (Noor-Ul-Amin, 2013; Potyrala, 2001). This has been possible because of a number of reasons. For example, Hammond (2014) claimed that some of the major reasons behind the introduction of ICT in education being promoted in England was because of “the belief that ICT can have an impact on the standards, and provide more vocational relevance in the curriculum and can be a catalyst for curriculum reform” (p. 192). On the other hand, Hammond, Reynolds and Ingram (2011) reported that it offers a number of benefits such as “supporting personalized pathways; monitoring progress; providing for ‘anytime, anywhere’ learning; enabling independent and collaborative learning and developing new modes of learning” (p. 191). All these reasons have led to the successful introduction of ICT at different levels of education in almost all the countries in the world. The trend goes well beyond this with the rapid advancement of mobile devices. This new trend has led to the formulation of mobile learning or simply, m-learning (Serin, 2012). Considering its importance, the current Government of Bangladesh has already introduced several initiatives to integrate different forms of ICT *(mobile devices for teaching and learning is one of the emerging areas of ICT)* in both higher education and secondary education (Karim, 2010).

Moreover, the present Government realized that ICT is the key element to eradicate poverty from the society, so is taking steps by integrating ICT in education. Due to this, the Government has introduced a charter for change in the form of a long-term development strategy called "Digital Bangladesh". In order to make this vision a success, universities have been deemed to be one of the pivotal areas in which different forms of ICT, for instance mobile learning, could be put to full effect. This emerging area is predicted to contribute enormously, particularly for producing technologically rich manpower that could meet industrial requirement. This mass of future graduates can also work in a technology integrated environment for the development of their country. It is important to point out that these benefits will show themselves only when the university students will start using mobile devices effectively in their everyday learning process. To support this claim, research has discovered that technology alone cannot lead students to learn (Koehler & Mishra, 2005). Therefore, research need to be conducted on how the students could use mobile devices effectively in their learning. Considering this emerging demand, the present study is proposed to investigate the experiences of university students on applying mobile devices in their learning.

M-learning and related literature to research problem

As m-learning is a recent concept in student learning, at first we attempt to clarify the term along with its possible benefits from previous literature. According to Park, Nam, and Cha (2012) m-learning can be claimed to be "any educational provision where the sole or dominant technologies are handheld or palmtop devices" (p. 592). These devices can facilitate learning to take place anytime and anywhere (Ozdamli & Uzunboylu, 2014; Serin, 2012). In this study, m-learning is considered as a learning platform by using portable (mobile) devices such as cell phones, smartphones, palmtops, tablets and portable multimedia players. The use of these devices in learning has eased the geographical barriers that existed among students as well as provided a learning environment that is collaborative among different groups of students (Ozdamli & Cavus, 2011).

The advantages in using mobile devices in student learning are quite enormous. The biggest advantages of using mobile devices are to provide student oriented teaching and learning contexts where the learning of the students generally depends on their active involvement, and where teachers are generally seen as a facilitator. For instance, Sha, Looi, Chen, Seow and Wong (2012) claimed that the collaborative environment afforded to them by m-learning enables them to learn at their own pace. It is considered as playing a vital role in simulating critical and logical thinking from the students. Thus, the use of mobile devices provide myriad ways of offering student learning opportunities in university-level education.

Considering the huge emerging benefits, the popularity of using mobile devices among students in developed and developing countries has been growing quite exponentially. This has emerged because of the fact that most of the students have owned these mobile devices in recent times. At this point, Bangladesh, despite being a developing country, is following the same notion. It is found that majority of university students in Bangladesh are in possession of their own mobile phones or other forms of mobile devices simply due to technology being easily available. The other reason for taking in mobile devices is to reduce the cost of Internet and to compare it to that of the last few years. All these facets bring a huge opportunity to use mobile devices in Bangladeshi universities.

In addition to that, it is realized that there has been very little research in the world (including Bangladesh) that explores the students’ experiences of using mobile devices in their learning. The majority of the previous research on m-learning mainly focused on identifying different factors of using mobile devices in education (Al-Fahad, 2009; Park et al., 2012); how mobile devices can facilitate student learning (Rogers, Connelly, Hazlewood, & Tedesco, 2010) or the students' perceptions on mobile learning (Hashim, Tan, & Rashid, 2014; Kafyulilo, 2014) that were based on either a mixture of quantitative and qualitative paradigm or other methodologies including surveys. However, none was found to have been conducted with the use of phenomenography as their theoretical and methodological perspectives. Whereas, a significant number of prior research investigated students' conceptions of learning by using phenomenography and subsequent studies showed evidence for contributing improvement of student learning (Duarte, 2007; Eklund-Myrskog, 1998; Ellis, Goodyear, Calvo, & Prosser, 2008; J. Vermunt & Vermetten, 2004; Virtanen & Lindblom-Yla¨nne, 2010). Considering this gap (theoretical and methodological), it is urgent for conducting research on the students' experiences of learning through these devices. These experiences will be crucial for formulating instructional strategies (pedagogy) that will assist the teachers in properly facilitating the teaching and learning practices. In addition to that, policy makers and curriculum developers need to know about these experiences so that they can develop a curriculum that will encourage and promote the use of mobile devices in the university education. In order to fill up this emerging gap, the main purpose of this study is set to identify the qualitatively different ways of experiencing the role of mobile devices in the Bangladeshi students' learning practices. In order to achieve this purpose, the following research question is used to guide the study:

What are the qualitatively different ways in which university students understand the role of mobile devices in their learning practices?

Methodology

This study was a qualitative-based and was carried out using qualitative research methodology. This study was conducted using phenomenography as its theoretical and methodological framework. It is a research methodology that is used to qualitatively differentiate ways in which different people experience, understand, and conceive a phenomena (Marton, 1981). The main purpose of phenomenography is the description of the various experiences and conceptions that people have for a specific phenomenon (Marton & Booth, 1997). Phenomenographically, a conception is considered to be the way in which one is seeing or understanding something, or in other words, comprehending the exact meaning of something to a specific individual (Sin, 2010). In this context, it can therefore be said that conceptions are always expected to be different when various people are involved. Therefore, phenomenography was used in this study to identify the different ways of students' conceptions of m-learning in Bangladeshi university education. The final outcomes of this research were revealed as the "categories of description".

Sample

Each student that was selected for attending this study, should have experience of using any mobile or handheld devices like smartphones, tablets, iPads, and iPod in their learning for at least six months. It was required to have the minimum level of experience towards the phenomenon and creating variations (getting participants' in-depth awareness) while taking the interviews. However, the degree of experiences among different respondents and the type of handheld devices they use were not necessarily the same and were tolerated to vary from one respondent to another. In total, a sample of three students from one university of Bangladesh was recruited by using purposive sampling technique. The main characteristics of the participated students were:

- *Disciplines:* students were selected from two disciplines, one from electrical and two from computer science.
- *Institutions:* students were invited from one engineering university.
- *Study level:* two from post-graduate and one from undergraduate.
- *Experience of m*-learning: two to four years.
- *Language:* fluent in English.
- *Gender:* three male students.

Data Collection

In this study, the major tool that was used for collecting data was the phenomenographic interviews (Åkerlind, 2005; Barnard, McCosker, & Gerber, 1999; Bruce et al., 2004; Harris, 2011; Limbu & Markauskaite, 2015). In the method of investigating the Bangladeshi students' conceptions on m-learning in university education, interviewees were asked to share their reflection on the role of mobile devices in their learning as well as how these devices could be useful in their learning. A semi-structured in-depth interview protocol was used to conduct data collection and each interview was lasting about 40-50 minutes. Initially the participants were asked about 'what aspect', for instance, *what is m-learning meant to you?* In order to get much dipper understanding, the follow up questions were asked. For example, *could you explain this* *further?*

Analysis of the data

The interviews taken from the various respondents of the study were recorded by an audio recorder and listened each interview several times (Åkerlind, 2005; González, 2009; Limbu & Markauskaite, 2015). The audio-recorded data was transcribed verbatim. The process was then followed by reading the transcripts many times in order to get a deep insight of the various experiences received from the participants (Åkerlind, 2005; Limbu & Markauskaite, 2015). At this stage, similarities and differences from each transcript were recognised and later followed the preliminary categories, which was then checked with transcripts. The final outcome spaces were confirmed based on back and forth discussion with the research members. No category was identified without supporting the quotations from the transcripts.

Results

The results revealed four different categories of description:

- Category A: storing learning materials
- Category B: accessing information and knowledge
- Category C: effective learning tool
- Category D: effective tool for collaboration

The detailed elaboration of each of those categories is followed by the most appropriate quotations obtained from the interview transcripts. Some identification numbers were used at the end of every quotation to help the researchers keep track of the ones that have been used and to keep the interviewees anonymous in the study.

Categories of description

Category A: storing learning materials

In category A, mobile learning is viewed as a way of getting various learning materials from different sources and storing them in these handheld devices for further use as required. In this way, students will be able to get their learning materials from different sources and store them in their mobile and later they can access them. For instance, if a teacher gives a lecture using PowerPoint presentations, and students can easily download those presentations from the sharing device (teacher usually uploads that presentation for the students) by using their mobile devices and save them. In that way, they have wider scope for keeping learning materials save. With reference to this argument, one participant stated that:

> *May be I came in a little bit late, but my friends took notes and I don't have that much time to copy and write everything, so I just get my phone, take a snap of the notes and then when I go back to my room … Then I just read them direct [B3].*
> *… You will get everything like PDF that you can put in your phone, you can even download many books in your phone and pictures also [B2].*

Besides this category, mobile device is also seen as a recoding tool for future learning. For example, the participating students mentioned that with their mobile devices, they can record the lecture live during lectures so that the teachers' explanations will be used later during their free time:

> *You can even make records. You can record the lectures … [B2].*

Category B: accessing information and knowledge

Category B represents the view that mobile devices facilitate the access to information and knowledge that are important in their learning. Firstly, this perceived ease of access to information was expressed in various ways. For example, use of free online and offline dictionaries that may have been in the phone, as expressed:

> *I installed a dictionary application. In case I get a word that I don't understand, I use the dictionary on my mobile phone then I can know the meaning of that word [B1].*

Alternatively, participants also discussed that they can get the meaning directly from the internet in case they get a terminology that is new or ambiguous for them:

> *I can access the internet like google search in case I get a terminology that I don't understand. I can search the internet and use it… [B1].*

Secondly, in this category, the mobile device is perceived as a way to access knowledge. It is seen that students use different search tools such as Google, Google scholar and the like by using their mobile devices to gain related knowledge that provide them more explanations and clarifications about a specific topic on the Internet.

> *Then maybe another thing mobile devices, there are a variety and a vast number of apps, educational apps. So I can just go to google play, search and then I can get a very long list… [B3].*

Category C: effective learning tool

In this category, learning with the help of mobile devices is perceived as an effective learning tool. This effectiveness is perceived mainly through criteria such as time-saving, cost as well as mobility. More elaborately, m-learning allows students to access a vast variety of information and knowledge within the shortest time possible. It is viewed that learning is much quicker in m-learning than it could be in the traditional or other learning methods:

> *There, I will be wasting time writing everything down. But I just go direct, read, understand then memorize. So it saves some time while revising [B3].*
> *If I just take a snap, it will take like a second but if my colleague decides to draw it in his book, it will take him like 20 minutes. So in such a way, it saves time to me [B3].*

In this category, m-learning is also perceived to be cost effective. Although it involves an initial cost to buy a mobile device but in the long run it saves students' money:

> *Then another thing [is that], it saves money. In which way? For example if a teachers gives us a slide which has like 56 pages, it means if I print it will be costly. But if I just copy the slide to my phone, I think in that way, it saves me some TAKA (Bangladeshi Currency) [B3].*

Additionally, this category viewed mobile device as a means of mobility in student learning. University students in this category perceived m-learning as the learning that occurs anytime and anywhere that students want. For example, the participants stated that in most cases, they can move with these devices anywhere they go. It enabled them to access to whatever they want to learn at their convenient time.

> *It always depends but the major point is that it's mobile. The mobility aspect. It's like wherever I go I have my mobile phone… [B3].*
> *Mobile learning, I understand it by using some devices which you hold in your hands and can have access to it anywhere and anytime for your use in learning [B1].*

In brief, in this category the use of mobile devices is seen as a time-saving cost effective and portable devices for enhancing student learning in university.

Category D: effective too of collaboration

In this category, m-learning is viewed as an essential means for collaboration. For example, phone calls from mobile phone or Skype could be used for direct communication, text message from mobile or email could be used for sending information to enhance their learning. Some of the participants mentioned that their mobile devices enable them to communicate with their teachers, supervisors, colleagues as well as senior students in case they are in need of some assistance.

> *During that time, our teacher was not in the campus. Even he was not in Bangladesh. He gave us his Skype and I used one time to ask him one question…. I practice most of the problems, I got some difficulties. So I sent a message to the teacher through Skype, he answered me and I got the answered, I practiced and it worked [B2].*
> *Also having communication with the teacher because I can easily consult the teacher through the email for more clarification [B1].*

In addition to that, Category D presents another understanding of using mobile devices in student learning which is direct (synchronous) and indirect (asynchronous) collaboration among student and teacher and/ or student and student. In this point, students are seen to use different social Medias such as Facebook, LinkedIn, and WhatsApp for stated collaboration. For instance, university students many cases used Facebook for collaborating with their supervisors when they face any difficulties with regards to their projects, thesis and so on.

> *For example in this semester, I have a supervisor for my thesis. So in case I have a query and he is not around, I just log into Facebook then I ask him via Facebook then he replies [B3].*

Collaboration is also seen while students work in a group. Students generally use their mobile devices to get in touch with their colleagues (peer groups) to complete their groups works such as assignments, solving problems, group discussion. One of the participant sated this in his response:

> *… But remember you have to work on the assignment in time. So I may do something, maybe my part, first of all maybe we can divide the assignment. So I do my part, maybe go to Facebook, send him what I have done, when he is at home. When he reads through he also maybe sends me his. So by the time he comes back to school… [B3].*

Discussion and conclusions

Before discussing the result of the study, we like to state the limitations of this study. First, the participants were recruited from one Bangladesh universities and were small in number. However, a sample of three is not an unusual practice in phenomenographic research approach. For example, Forster (2013) interviewed three professionals from nursing practice about their conceptions of information literacy. Moreover, the results depend on the setting or the context of each study, therefore this results may not be generalizable for other contexts. However, the aim of phenomenographic research approach is not to provide generalizable result rather its focus is on a particular phenomenon that needs to be investigated deeply.

Turning to discussion, the findings are limited in scope in relation to previous phenomenographic studies, because students’ experiences of m-learning are a new area of investigation. However, the results of this study could be interpreted in a wider context. The results revealed four qualitatively different ways of seeing mobile devices in student learning: storing learning materials; accessing information and knowledge; effective learning tool; and effective tool for collaboration. The four categories are placed from lower level to higher level understanding, therefore, four categories are broadly divided into two orientations: *fragmented orientation* (Category A and B) in which the mobile devices are considered as a way to store and access information in student learning. Students do not consider mobile devices for constructing their knowledge or solving their problem or engaging collaborative learning. It mainly focuses on students' surface level of learning. In contrast, *cohesive orientation* (Category C and D), in which the mobile devices are viewed as a means to develop students' understanding, to construct their own knowledge, to engage them in collaborative learning, construct their own knowledge. It is mainly involved with deep level of learning. These findings are broadly consistent in previous phenomenographic studies (Biggs & Tang, 2011; Eklund-Myrskog, 1998; Ellis et al., 2008; Ellis, Goodyear, Prosser, & O'Hara, 2006; Lucas, 2001). Generally, these studies reported students' conceptions of learning in different contexts and were broadly placed into deep and surface level of learning. Nevertheless, the results provide emerging conceptions of m-learning.

As m-learning becomes a growing concern in the teaching and learning practice of a developing country, the role of using mobile in student learning is becoming a major focus of research initiatives (Kafyulilo, 2014; Rogers et al., 2010). It is suggested then that the findings of this study could be used to inform these initiatives, as this study provides a second order experience (the findings derived from participants who had experiences of m-learning) of the investigated phenomenon. In recognition of the significance of these findings, this research provides different ways of using mobile devices in student learning, which is a potential input for improving teaching practice. For example, it may help teachers to create different teaching approaches that will match students' learning approaches, which will guide university students to make maximum use of mobile devices in their learning. Additionally, the emerging results will contribute improving professional development program and to provide valuable insight for improving curriculum related to m-learning in higher education. It is important to acknowledge that our study reports a preliminary exploration of using mobile devices in student learning, thereby suggesting a future investigation with a broader sample (more than 15) from more than one university. It is also suggested to explore its analysis in different dimensions to understand the investigated phenomenon in a more conclusively.

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The Status of Mobile-Assisted Language Learning in China's Higher Education

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Due to the increased college enrolments in China in recent years, today's college English teachers are facing more challenges than ever. Influenced by the traditional Chinese culture, particularly Confucian, current college English classes in China are often critiqued for their teacher-centred approach, lack of student autonomy, and detachment from realistic social purposes. The use of mobile technologies in language acquisition has been explored by many researchers around the world, and has the potential to incur positive changes in China's college English education, including enhanced teacher competencies, increased learner autonomy, and improved teacher-student interaction. This paper provides an overview of existing research and practices pertaining to mobile-assisted language learning in China's higher education, and proposes that certain elements should be in place to ensure its successful integration.

Keywords: Mainland China; College English Education; Mobile-Assisted Language Learning; Literature Review

Introduction

With the globalization of China in recent decades, there is a growing demand for college graduates that are proficient in the use of English (Ruan, & Jacob, 2009), which has become "the lingua franca of the world due to its widespread use in academia, business, commerce, and technology" (Spolsky, & Shohamy, 1999, as is cited in Lan, Sung, & Chang, 2007, p. 130). In order to meet this demand, English has been made a mandatory subject for all freshmen and sophomores across the country (Xie, 2013), and integrated College English Tests (CET) 4 and 6 as prerequisites for graduation (Xie, 2013), with the purpose of producing employable college graduates that are competent in various facets of English, including reading, writing, listening and speaking.

Numerous research studies have revealed, however, that current college English education is far from satisfactory in producing such ideal graduates (Li, 2014). On one hand, both teachers and students are deeply influenced by the Confucius culture (Biggis, & Watkins, 2001), making English classes teacher-centred and lecture-based. The passive role of students in class has led them to have little autonomy over their English learning. On the other hand, the college expansion policy has increased college enrolments dramatically and resulted in severe shortage of competent English teachers in higher education in China (Cai, 2006). Many in-service college English teachers, therefore, are often found to be lacking adequate knowledge about how English should be taught and how students learn second/foreign languages best (Chen, &Goh, 2011). Consequently, Chinese college English learners not only perceive China’s college English education negatively (Cai, 2012), but also fail to support and sustain their own learning when teachers are not present (Hurd, & Xiao, 2012).

With increased accessibility to and awareness of using information and communications technology (ICT), Chinese policy-makers have recognized the important role ICT plays in supplementing college English education. In 2002, the Chinese Ministry of Education proposed an ICT-incorporated teaching approach that aimed to not only promote students’ learning autonomy but also improve teachers’ efficiency and productivity (Hu, & Mcgrath, 2011). This proposal, despite of its theoretical validity, was not implemented well in China’s higher education institutions. One of the major reasons was that integrating ICT into

English education required not only teachers' proficiency of utilizing technologies but also some fundamental changes regarding the roles they themselves and students should play, both of which would only happen with the provision of effective and continual support and training from schools (Hu, & Mcgrath, 2011).

Mobile technologies, while originally derived from information and communication technologies, has taken on unique characteristics with its recent developments. Aside from the benefits it brings in as a regular computing technology, it also provides distinctive advantages, such as mobility, portability, connectivity and ubiquity to its users (Kukulska-Hulme, & Shield, 2008). Simply put, mobile technologies allows its users to access resources and connect with the rest of world from anywhere at any time with access to the Internet. The effectiveness of using mobile technologies to support language acquisition has been spotted in numerous research studies across different subjects around the world. For instance, Motallebzadeh and Ganjali (2011) investigated the effectiveness of using SMS to deliver English words to 40 Iranian university students, and it was found that those learned with this service outperformed significantly than those who received traditional board and paper instruction, because learning content were more convenient and accessible that way. In Wong and colleagues' (2010) study, 40 primary students were asked to use camera on given smartphones to take photos of objects and/or scenes that would demonstrate their understanding of assigned English idioms. They found that mobile technology not only allowed students to create artifacts easily, but also promoted in-situ learning that connected learning with their real life context.

Mobile technologies in China, while widely accessible, have not been investigated much as a language learning tool through an academic lens. Relevant studies are not only scarce, but also problematic in certain domains, such as lack of originality, inadequate research methodologies as well as inconsistent control of quality. This paper provides an overview of current mobile-assisted language learning (MALL) research in China's higher education, with the purpose of identifying trends, gaps and issues that may inspire future researchers and other interested parties to improve the status of MALL-related research and practical uses in related context. Specifically, I argue that in order to promote and integrate mobile technology as an appropriate and effective way to support college students' English learning, the capacity and culture of using mobile technology as a learning tool must be built first among all stakeholders, including college teachers, students, administrators, and policy-makers through recommended ways.

Definitions of Key Terms

In order to maintain consistency throughout this paper, relevant terms are defined as below:

MALL (Mobile-Assisted Language Learning): "Language learning enabled by the mobility of the learner and …portability of handheld devices…" (Hoven, & Palalas, 2011, p. 76-77)

Mobile Technology: Communication technologies that utilize cellular data, such as mobile phones, GPS, 4G data, etc.

Mobile Learning or m-learning: "learning mediated via handheld devices and potentially available anytime, anywhere" (Kukulska-Hulme, & Shield, 2008, p. 273).

SLA (Second Language Acquisition): SLA theories address "cognitive issues (how the brain processes information in general and language in particular), affective issues (how emotions factor into second language processing and learning), and linguistic issues (how learners interact with and internalize new language systems)" (Florez, & Burt, 2001, p. 1).

College English Education in China

Historical Context

College English language education in Mainland China has always been interweaved with China's political situations and decisions (Lam, 2002; Hu, 2007). For example, in 1991, after detaching from the former Soviet Union, China was facing a political situation in which a more international stance was possible (Lam, 2002). This pursuit of a more international role since then has been furthered by China's constant engagement in the international arena, such as its entry into the World Trade Organization and the hosting of 2008 Olympics in Beijing. Such globalization of China demands versatile professionals that are not only experts in their own fields of study, but also proficient in their use of English (Li, 2014). In order to meet this demand, English has been made a mandatory subject for all freshmen and sophomores across the country since , and integrated College English Tests (CET) 4 and 6 as prerequisites for graduation, with the purpose of producing employable college graduates that are competent in various facets of English, including reading, writing, listening and speaking.

As a result, College English curriculum in Mainland China has been reformed several times to meet this demand, namely 1980, 1986, 1999, and 2007 College English Curricula (Table 1). From 1980 to 2007, there have been some transformative changes pertaining to teaching aims and approaches, such as a qualitative shift from emphasis on linguistic competence to communicative competence, and from teacher-centered to learned-centered approach (Li, 2014).

Problems

While great development has been achieved in College English curricula reform, “present College English language education in Mainland China is continuously criticized for failing to meet the public’s demand for good English proficiency” (Li, 2014, p. 292). One of the main problems is that, regardless of their theoretical soundness, the College English curriculum requirements were never executed well in practice (Li, 2014). As a result, College English Education in China has been rather perceived as time-consuming and ineffective (Cai, 2010; Wang, 2002) by different entities.

The ineffectiveness of China’s college English education can be first observed in a number of national studies that investigated the perceived effectiveness of current college English education. For instance, Yu and Zhong (2008) surveyed 1615 students through random sampling in 12 universities and found out that, among all the courses they are studying, students were most unsatisfied with their improvement in English. Specifically, 11.3% of the surveyed students considered themselves having made great progress, while 23.6% made no progress and 24.6% believed that they even digressed compared with their English proficiency in high school. Cai (2010) surveyed a total of 1246 students from eight provinces in 16 universities about their English learning experience and the results showed that 3.9% of the students believed that college education improved their English capability to a great extent; 35.2% believed that some progress was made; 25.4% stated that not much was learned while as high as 35.1% of the students believed that their English proficiency deteriorated from high school to college.

The reasons that have led to student dissatisfaction with college English education are multitude. To begin with, the current in-service college English teachers do not meet students' needs adequately. Starting 1999, Chinese government has implemented the expansion policy of higher education to increase the number of college graduates (Bai, Millwater, & Hudson, 2012). During the 1996-2000 period, there was a total enrollment of over 11 million, while from 2001 to 2005 the number of university students was expected be up to 16 million (Meng, & Tajaroensuk, 2013). However, this policy has caused a severe shortage of qualified College English teachers (Cai, 2006). According to a national study conducted by Dai and Zhang (2004), 32.4% of the surveyed college English teachers had no more than 5 years' teaching experience. Also, Wang and Wang (2012) investigated 457 colleges in China and found out that among the surveyed 21, 065 English teachers, only 1.5% hold a doctor's degree and 60.1% hold a master's, which is below average when compared with other majors and programs.

The increased college enrollments have also resulted in heavier workloads for in service teachers. According to Zhang (2006), the college English teacher to student ratio is nearly 1:200. Limited time and the overwhelming workload are critical factors that hinder these teachers from participating in continuous professional development (Carney, 2003; Quaglia et al., 1991; Day & Gu, 2010; Wan, 2011).

In terms of pedagogy, most College English teachers enter into the profession without a solid understanding of second language acquisition (SLA) theories, psychology, and pedagogy (Chen, &Goh, 2011) that collectively may influence to great extent students' language learning experiences. The absence of such professional language education knowledge has resulted in the prevalence of "a teacher-centered, textbook-reliant, grammar-translation teaching method" in English classrooms at Chinese universities (Li, 2014, p. 296).

This traditional approach prevents students from engaging in active English learning and having ownership of their learning process. Culture, on the other hand, also has a profound influence on Chinese classroom dynamic. Chinese education is heavily impacted by Confucius beliefs and principles (Biggs, & Watkins, 2001; Li, 2003), which hold that students should highly respect their teachers as authority figures and do as the teachers dictate (Ho, 2001).

When students learn passively, however, they are less likely to be motivated to learn (Cai, 2010) and may thus produce unfavorable results that harm their self-efficacy and strengthen their reluctance of using English in or outside of classrooms. Research indicates that many employers have complained about how college graduates often perform poorly when it comes to communication in English (Ruan, & Jacob, 2009), regardless of their performance in the written form of College English Tests (CET).

In order to tackle some of the above challenges, the Chinese Ministry of Education initated a reform of College English that proposed for a "more economical and effective methodology in language teaching based on the use of information and communications technology (ICT)" was recommended in the reform (Hu, & Mcgrath, 2011, p. 42). The incorporation of ICT was believed to not only support and enhance language teaching and learning, but also provide students more access to resources that they can learn independently. Ideally, it would lessen teachers' workload and alleviate the tension caused by the shortage of college English teachers (Hu, & Mcgrath, 2011). However, the proposal was not implemented well and created even more challenges for these teachers. Hu and Mcgrath (2011) stated that

> …The reasons are manifold: insufficient and inefficient CPD (college professional development), insufficient access to ICT facilities, unfavourable ICT policies, lack of technical support, unfavourable appraisal systems related to ICT use, difficulty in changing deep-rooted roles of teachers as well as roles of schools and students, inappropriate beliefs and attitudes towards ICT use, and as noted above, lack of ICT knowledge and skills among teachers and students, and poor ICT pedagogy (O'Mahony, 2003). All these issues hinder the use of ICT in schools (p. 43).

In short, College English education in China is now facing multi-faceted challenges. On a social level, deeply rooted Chinese culture (e.g., Confucian) is still influencing the roles that teachers and students respectively play (Tang, 2009). On the institutional level, national policies and propagandas that aim to improve CE education fail to be implemented wholeheartedly due to the complexity of incorporating ICT, the lack of effective trainings and just-in-time support from school administration. On an individual level, college teachers and students are both confronted with issues that prevent them from achieving desirable goals. Particularly, college English teachers are expected to obtain more advanced qualifications in their profession, and enhance pertinent knowledge and skills on not only subject matters but also popular instructional technologies, while striving to maintain a balance between such expectations and the overwhelming workload. Students, on the other hand, need to transform their existing beliefs about how they are expected to learn, take a more active role in learning English, and learn to locate and utilize available resources on their own. Having a clear and comprehensive understanding of these challenges and relevant policies can help us demarcate what needs there are to be met, and if they can be met appropriately and effectively by potential solutions or strategies.

Mobile technologies, which are introduced in the following section, are believed to have a huge potential to alleviate, if not fully resolve, the problems and needs identified above.

Mobile Technologies

In recent years, mobile visitors have become the fastest growing web community that access web pages or locate web information (Chen, 2008). Cellphones, most of which are well equipped with functionalities including internet access, media player, digital camera, and video recorder, have become the most widely used and accessible devices for almost every university student (Chirimbu, & Tafazoli, 2013). In China, so far 85 percent of the younger urban residents (age from 18 to 30) own smart phones (Netease News, 2013). With regard to college students, around 80.8 percent have at least one smart phone with internet connected service, which means virtually all higher education students carry some form of mobile devices (People's Daily Online, 2013). The widespread ownership of mobile devices among Chinese college is a strong index of its accessibility and makes its integration as a learning tool possible.

Mobile devices, such as smart phones, PDAs, and tablets, provide its users with many advantages that surpass the affordances of other ICT tools. According to Klopfer and Squire (2008), such advantages include but do not limit to: 1) portability—they are light-weight handheld devices that can be easily carried everywhere; 2) mobility—which indicates the accessibility of resources even while both the users and the devices are on the move; 3) connectivity—the availability of cellular data on those devices empowers its users to connect with the rest of the world from almost anywhere at any time; 4) individuality—not only can users customize the device in a way that best suits their preferences, but also seek information that is tailored to their particular needs or requests.

Levy and Kennedy (2005) contended that the prevalent use of mobile devices in non-learning situations does not necessarily imply their success and value in educational environments. In addition, the provision of access to technology does not ineluctably guarantee its successful integration into an educational setting, especially when the learners are not motivated to use the technology (Selwyn, 1997). These statements caution researchers as well as language instructors to examine and evaluate existing technological studies, in this case mobile-assisted language learning studies, with a critical mind.

While positive findings of using MALL have been reported in numerous studies in countries like U.S. and Japan (e.g., Hegelheimer, & O'Bryan, 2009; Miyakoda, Kaneko, & Ishikawa, 2011), China is a developing country that possesses its unique characteristics, including historical context, economic status, political structure and education system. It is thus paramount to examine MALL studies that resonate with the local culture and situation of CE education in China, which may shed most light on its future development. While China consists of provinces and districts that often vary dramatically in economic and political status, it is the author's intention to review only Mainland China where both statuses are more consistent and analogous.

MALL Research in China's Higher Education

In China's higher education, mobile-assisted language learning, while being used consciously or unconsciously, is still a new concept. For instance, the search for MALL studies in the target context yielded very few results compared with the large volume of MALL studies conducted in countries like U.S. or Japan. In addition to the lack of research, the awareness of this concept among public is low as well: Most of the participants in related studies admitted to have heard of mobile learning for the first time at the time of study (e.g., Wang, Zhong, & Lv, 2009), regardless of their ownership of, and experience with, mobile devices. As a technology, which is defined by Roger (2003) as "a design for instrumental action that reduces the uncertainty in the cause-effect relationships involved in achieving a desired outcome" (p. 139-140), MALL in China's higher education obviously still resides in the initial stage of technology transfer—research and development (Roger, 2003). During this stage, scientific and applied research are conducted about a problem and initial prototyping solutions are proposed by lead users (Roger, 2003). Specifically in China, problems related to current college English education have been recognized in numerous studies (e.g., Cai, 2012; Wang, & Wang, 2012), and MALL has been advocated as a potentially viable solution to address many of the identified problems.

Current research, in terms of the purpose of studies, has primarily focused on three major categories: theoretical rationality, user perceptions, and empirical effectiveness. Studies related to theoretical rationality are concerned with where MALL derived from and what theoretical frameworks it is built upon. Such studies provide Chinese readers with the research foundations of MALL, helping them to understand the rationale behind MALL design and a promising integration with pedagogical practices. For example, Liu and colleagues (2013) provided an overview of three relevant theories, including situated cognition theory and Construction of Cognitive Learning Theory and collaborative learning. However, their report was merely an reinstatement of important concepts often found on relevant international journals, and thus lack originality and connection with China's context.

Most of the reviewed studies have focused on the affective domain of learning, namely how students perceive MALL with regards to its usefulness and viability, and whether there is need or market for MALL. For example, Li (2014) conducted a survey on 89 undergraduates at Guangxi University, aiming to investigate their current perceptions and uses of mobile devices to support language learning. Zou (2014) used a mixed-method approach to research Chinese undergraduates' perceptions of MALL, and found that 78% of the researched students hold a positive attitude of trying MALL, but many are not aware of how to use mobile technologies to learn.

The third type of studies was the least researched among all. One of the possible causes could be that awareness of MALL is not yet high among college teachers or students, let alone using it intentionally. The search only yielded three empirical studies, which interestingly focused on different aspects of MALL. Xue (2014) explored how effective mobile technology (including MMS, mobile apps) could help increase students' test scores; Ruan and Ma (2014) reported the use of an intentionally designed mobile app to improve students' grammar learning; Yin (2013) investigated the effectiveness of using a social media tool—WeChat—to push learning information (vocabulary, grammar, etc.) as a way to prepare students for CET 4 test.

While the three categories of studies collectively provide a preliminary framework for MALL research in China's CE education, there yet has much to be done if MALL is to be integrated as a legitimate component of China's higher education system. In this section, problems associated with, or derived from, these studies are identified and some preliminary considerations are given to potential strategies for future directions.

Overall, studies about MALL in China's higher education are increasing in recent years, but is still in its infancy. First of all, the quality of reviewed studies are concerning. Most of the current studies were published in local Chinese journals that were not internationally peer reviewed and often had low threshold for publication. These same studies are also questionable regarding their validity and reliability, because they often don't adhere to consistent academic writing standards. For instance, it is common among these studies to cite less than ten references, or less than three pages, or fail to articulate certain critical research writing components, such as limitations, instrument description, or theoretical frameworks. In addition, the abstracts of those studies are unsatisfactory. According to Pyrczak (2003), an abstract should be a summary of a research that consists of purpose of study, methodology, results and implications or future directions. The reviewed abstracts, however, fail to include those essential components that synthesize the gist of the study; rather, they often come from the first few sentences of a study's introductory paragraphs that provide little for readers to understand the research at hand. Moreover, important appendices are usually missing in the reviewed studies, especially survey instruments. What questions are asked in a survey and how valid those questions preludes to certain degree if a study is reliable, and thus should be described and explained.

Research studies in journal articles are perceived as authoritative and reliable sources of knowledge for Chinese educators, researchers, and even the entire public. The quality of these studies, such as accuracy and validity, has an undeniable influence on readers' understanding of MALL, such as its legitimacy, prevalence, usability, etc. Therefore, editors of relevant journals should establish consistent criteria for acceptance and publication, especially pertaining to data collection, analysis, and content originality, since these are often most convincing information among all. Incentives can also be considered as a strategy to encourage related research, such as allocating grants for innovative use of MALL in higher education.

Secondly, a number of studies are found to be simple reiterations of MALL findings or trends reported in foreign language journals, with little or no originality or applicability in China's context. Such knowledge, while providing readers an overview of what is happening worldwide, does not contribute much to the growth of MALL in China, which has its unique set of characteristics. For instance, educational hierarchy is much different in China from that of the U.S, due to their difference in political structure. It is thus recommended that researchers synthesize research from countries that share as many similarities with China as possible, so that Chinese reformers can draw upon successful experiences from those areas when planning or initiating changes for MALL.

Thirdly, current research studies are often limited in their scope of study. While mobile technology has the potential to benefit both students and teachers (Aubusson, Schuck, & Burden, 2009), most published studies pertaining to mobile learning have focused almost exclusively on students as the learners or consumers of mobile technology. However, for any educational change to happen, it is indispensible to involve the collective effort among all stakeholders (Fullan, 2010), which in this case are not only students, but also teachers, administrators, and policy-makers. For instance, to incorporate and promote MALL in regular instruction, teachers must be equipped with knowledge of MALL themselves, while administrators will have to design corresponding training and provide continual professional development for such knowledge, and policy-makers have to at least not prohibit, if not promoting officially, the use of MALL in higher education. At the same time, incorporating any new educational technology may unavoidably demand additional effort and time from teachers, who already have a heavy workload to maintain. To get teachers' buy-in, the right conditions for change must be present, including clear and practice guidance for the change, support from administrative leaders, and readily accessible resources (Fullan, 2010). Research on solely any of the stakeholders without making connections with others would result in a partial and even inaccurate understanding of the big picture that hinders a successful integration of MALL. Future research may turn to stakeholders other than students to collect data about their perceptions of, attitudes toward, and current uses (if any) of MALL in the context of higher education, so as to build organizational capacity, which is defined as “policy, strategy and actions taken that increases the collective efficacy of a group to improve student learning through new knowledge, enhanced resources, and greater motivation on the part of people working individually and together” (Fullan, 2010, p. 58).

Methodology-wise, in addition to quantitative approaches, such as survey or questionnaire, researchers are suggested to also utilize qualitative methods more, so that they can gain more in-depth and rich understanding of target research topics or populations.

Last but not least, technology itself is either advantageous or disadvantageous (Selwyn, 2007). Learning with a mobile device does not guarantee successful outcomes. When designing mobile-based language learning activities, teachers or researchers must take pedagogical principles into consideration. The affordances of mobile technologies nowadays, such as multimedia, enable teachers and researchers to design activities that capitalize on these functionalities. For example, instead of using WeChat as a information distribution tool, teachers may foster social learning through group chatting. Also, teachers may take advantage of the digital camera on mobile phones to realize situated learning by asking students to take photos of objects around them and write a story about them. Moreover, students can use any note applications to reflect their daily learning progress and use them as data for teachers’ formative assessment.

Conclusion

The current college English education in China is far from satisfactory. The various affordances of mobile technologies and their wide accessibility among Chinese college students have made MALL a favorable and potential solution for some of the prominent issues identified in our earlier review. However, whether mobile technologies can become an integrated component of, or a positive catalyst for improving, China's college English education needs further and more comprehensive exploration and investigation. Current related research is not only insufficient, but also deficient in terms of quality of writing, design of methodologies, as well as scope of study. Future researchers may strive to improve upon the problematic areas recognized in this review, so that interested users or adopters of MALL can gain a more thorough and clear understanding of its viability in their specific contexts and compatibility with their existing practices.

Table 1 College English Curricula from 1980 to 2007

Table 2 ***Four College English Curricula from 1980 to 2007***

	1980 Curriculum	1986 Curriculum	1999 Curriculum	2007 Curriculum
Aim	To provide students with capability to gain some information through English	To provide students with capability to gain some information through English for their professional needs	For students to be capable of exchanging information in the target language	For students comprehensive ability to use English to communicate effectively and to study independently, and to improve their cultural awareness in international exchanges
Objective	No specific description	Proficiency reading ability, certain listening ability and elementary speaking and writing ability	Strong reading ability and fairly good ability for listening, speaking, writing and translating	Competent in using English in a well-rounded way, especially in listening and speaking
Methodology	Teacher centred, grammar translation	Learner centred (grammar translation and audio-visual approach in practice)	Learner centred (grammar translation and audio-visual approach in practice)	Learner-centred in combination with modern technology (grammar translation and audio-visual approach in practice)
Vocabulary	From 1,500 to 1,800	From 1,600 to 4,000	From 4,200 to 6,500	From 4,500 to 6,500

Note: Retrieved from Li (2014), p. 294

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Innovation implementation: Lessons learned implementing inexpensive and easy to use tools to drive interaction and ubiquitous learning with mobile devices

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The concept of Simultaneous Media or the "second screen" has become a focus for mobile marketing professionals around the world. The present study focused on enabling students to proactively make use of their mobile devices as their own 'second screens' to collaborate with one another, search topics and ideas on the internet and submit findings in real-time in the classroom. As the only tools required were smartphones, students were able to easily access course materials and collaborate in class, at home, or anywhere they had internet access. By using these tools, students were able to work together in the classroom as apprentice researchers, enabling them to find and analyze ideas, use higher level cognitive skills to discover, evaluate, generate content and moreover, assess their own findings. The students' submitted data and experiences were analyzed using Csikszentmihalyi's flow framework and a modified version of the Experience Sampling Method. Findings showed evidence of improved engagement and on-task behavior, higher level thinking and more frequent and higher level questions directed to the lecturer. Both the instructor and students used this platform to direct teaching and learning while making real-time decisions and adjustments to enhance teaching and learning. This paper discusses a pilot study using an inexpensive, easy to learn and quick and simple method to adapt tools to subsequently enhance student engagement and formative assessment. Both qualitative and quantitative feedback will be discussed.

Keywords: interactive learning; u-learning; ubiquitous; interactive classroom; in-class research; engagement; learner engagement; classroom engagement

Introduction

When I am attending trainings, symposiums, workshops, or conferences, I am constantly checking ideas and sources on the Internet with my device. Why can't we enable students to proactively make use of their mobile devices as their own 'second screens' to collaborate with one another, search topics and ideas on the internet and submit these real-time findings in the classroom. As most all students carry a smartphone, a mini computer, they are able to easily access course materials and collaborate in class, at home, or anywhere they have internet access.

The concept of Simultaneous Media or the "second screen" has become a focus for mobile marketing professionals around the world. In October 2013 eMarketing (10/10/2013) reported second screen users were mainly talking about the program they were watching on TV. By October 2014 eMarketing (10/6/2014) found these second screen conversations evolved into discussions including other topics including social media, share ideas, and other discuss other topics. Watching TV, similar to classrooms lectures, is an activity that doesn't seem to fully engage students, so there may be more opportunities for increasing student engagement with mobile devices in classrooms.

Students are continually using their mobile devices to communicate, share, and learn. Facebook reported there are 1.9 billion mobile active users (1/28/15) and eMarketing (3/16/2015) reported nearly half of 19- to 22-year-olds spent at least 4 hours with the mobile internet every weekday. This is not only for social media, but also for music, searching, and consuming information.

Dewey (1938) asserted that we need to provide learning experiences that are interesting and meaningful enough to interest students so they will want to continue learning. Hidayanto and Setyady (2014) found that ease of use and usefulness of collaborative tools drive students' use of those tools. It makes sense students will continue to use learning tools outside of the classroom if they learn how to use the tools easily and collaboratively in class. Also, students are more likely to continue to collaborate with lecturers when they have positive experiences using technology in the class.

The concept of Flow proposed by Csikszentmihalyi (1990) consists of optimal experiences as those in which someone is totally engaged in an activity. To achieve this state of flow, three predominate conditions are needed, clear goals, immediate feedback, and a balance between skills and challenges. In his book, Finding Flow (1997), Csikszentmihalyi describes Optimal experiences as involving the following six factors as encompassing an experience of flow.

(1) concentration is intensely focused on the activity

(2) awareness has merged with the activity

(3) reflective self-consciousness is lost in the activity

(4) feels a sense of personal control in activity

(5) subjective experience of time is distorted

(6) experience of the activity as intrinsically rewarding

As Flow experiences are positive, those who experience those Flow moments seek them again in the future. This pilot aimed to study student in-class experiences using mobile devices. To assess ongoing Flow experiences Hektner, Schmidt, and Csikszentmihalyi, (2007) developed the "Experience Sampling Method" (ESM). This method was adapted by Roseth, Akcaoglu, and Zellner (2013) to gather data on the students' collaborative, on-line learning experiences in real-time and ongoing bases as the students were using Google Forms and Docs. Also, Chu and Kenedy (2011) mentioned that students commented that Google docs were easy to use. The present study asked students use Google Form and Docs and monitored a simplified version of the ESM.

Methodology

This pilot was launched to help discover free to use tools that were easy to create, implement, use, and assess. In this study we asked students use Google Form and Docs and monitored their experiences using a simplified version of the ESM. As the only tools required were smartphones, students were able to easily access course materials and collaborate in class, at home, or anywhere they had internet access.

During lecture one method of interaction used in this study was Google Forms. Google Forms are free, simple to use survey tools used, in this case, to create interactive worksheets for students to complete using their mobile devices. The students asked to submit short answer, T/F, MC, etc., answers and they were instructed to click through to the internet or to other artifacts and information to bring back and submit into their own individual forms. These ‘click through’ tasks asked students to search for information, complete online survey forms (communication styles, learning styles, etc.), view photos and videos, etc.

At the beginning of the semester, groups were given a business communication problem and were asked to create a website (group e-portfolio) that solved the problem. Each week a different angle (communications topics included; different styles, projects, writing, team, visual, and self) was introduced in lecture. The different groups of Students simultaneously worked together on the same shared with only their group worksheets using a smartphone app called Google Docs. Students in groups cooperated as apprentice researchers, and were enabled them to find and analyze ideas, use higher level cognitive skills to discover, evaluate, generate content and moreover, assess their own findings.

Findings

The findings from using Forms and Docs were informative. When using Forms, although students responses were individual, students had high interaction (questions and discussion) with one another and the lecturer. A sample Form, Appendix A, shows questions and links for students to click to access outside information.

As students completed these group worksheets, there was high interaction (questions and discussions) with each other and the lecturer. Sample worksheets, Appendix B, were created with six separate sections, each having a different task for each student and all tasks were focused on solving the group problem.

The students' submitted data and experiences were analyzed using Csikszentmihalyi's flow framework and a modified version of the Experience Sampling Method questions. Findings showed evidence of improved engagement and on-task behavior, higher level thinking and more frequent and higher level questions directed to the lecturer.

One focus of this pilot was to find inexpensive, easy to use tools that cold be used in the classroom with little or no training. This follows Hidayanto and Setyady (2014) findings that collaborative tool are more likely to be used if they are easy to use. To gain understanding of students' perceptions of these tools' usefulness, students were asked a few questions about using mobile devices in individual and group work.

The Table 1, contains summary of opinion responses for students.

Table 1.
Descriptive statistics: ratings related to students' usage.

			Frequency						
Question	Mean	SD	(1)	(2)	(3)	(4)	(5)	(6)	(7)
More Instructor interaction	4.78	1.26	0	1	3	11	7	7	3
I asked more questions	4.78	1.43	0	0	7	10	3	7	5
Classmates asked more questions	4.68	1.53	0	1	7	10	3	5	6
Learned more than what was required	4.50	1.32	0	2	3	15	4	5	3
Immediate email feedback after submit was helpful	4.45	1.37	1	0	6	13	3	7	2
Like to use device in other courses	4.69	1.42	1	0	6	7	8	7	3

Using a 7 point Likert like scale 1 = disagree and 7 = agree

The Table 2, contains summary of FLOW responses for students.

Table 2.
Descriptive statistics: ratings related to students' FLOW experiences. When students responded to " When you were using your device did you experience feeling...

			Frequency						
Question	Mean	SD	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Motivated	4.81	1.12	0	0	3	12	7	8	2
Involved	4.46	1.52	1	2	5	9	6	6	3
Engaged	4.59	1.34	0	2	4	11	5	8	2
Inspired	4.71	1.37	0	1	7	6	6	10	2

Challenged	4.34	1.56	1	3	6	7	6	7	2
Curious	4.65	1.31	1	0	5	8	8	9	1
Using a 7 point Likert like scale 1 = disagree and 7 = agree									

Discussion

I have been studying and developing ways to increase classroom learning engagement for 20 years. In this study, I was looking for systems that are easy to adopt and use both for lecturers and students.

In the future I want to build learner input/feedback more into the course by helping students see/analyze their own submissions (what you found shows, what we discussed, how it relates, where we can use it, how to evaluate it, if we change/take part of the learning where else can we apply this new awareness to different situations?) The purpose of this would be to help them focus more on how to think not what to know.

From this pilot I have formed many ideas for future research in developing student skills, assessing classroom learning, and assessing student engagement. First, I would like to test using progressively higher level learning questions based on popular learning taxonomies. Also, using Forms and Docs I can create more opportunities to guide students' development of critical reasoning skills. Finally, Forms and Docs can give many opportunities to help students learn research and information literacy skills useful for life-long learning.

Another focus for future study is assessing classroom learning. By adopting some ideas from Thomas Angelo's Classroom Assessment Techniques book with Google Forms, I could better assess and understand how well the students are learning during class. For example, one-minute papers can be somewhat cumbersome when one collects, reads, and returns the forms. Using Google Forms however, students can complete and submit the worksheet on line using Forms, the lecturers get a spreadsheet with responses, and students get their own answers returned to their email immediately.

Although the initial findings of this pilot seem promising, there are some opportunities to improve. First, there was no control or comparison group, so it would be nice to compare engagement and learning with other students. Also, it would be interesting to understand longitudinal implications of using mobile devices to assess classroom and learning engagement. Finally, using forms and Docs, I found students can generate very large quantities of data. I need to have processes in place to quickly and easily organize information, and filter out key performance indicators.

Also, I have interest to know how to better include Flow EMS survey questions in worksheets. This semester I have tested ways improve effectiveness of the questions of in-class worksheets used to measure learner engagement experiences. These extra questions were included the in-class Forms of exercise/worksheet review and debrief, and students are answering them as part of the in-class worksheets.

To end, two ideas that have become more clear from this pilot. First, the challenges students meet should be with learning the subject and not with learning how to use the technology. Second, lecturers need to create a space where students can experience flow or engagement in their own way.

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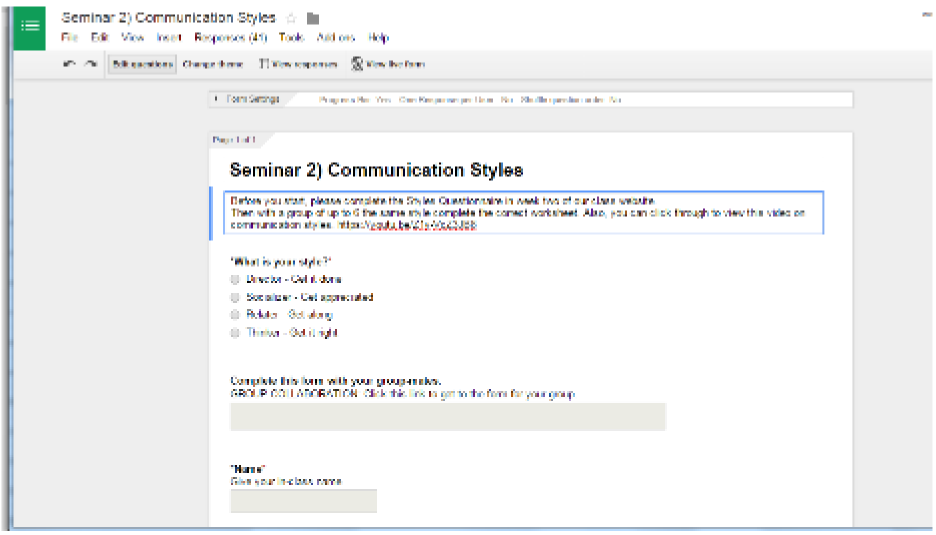
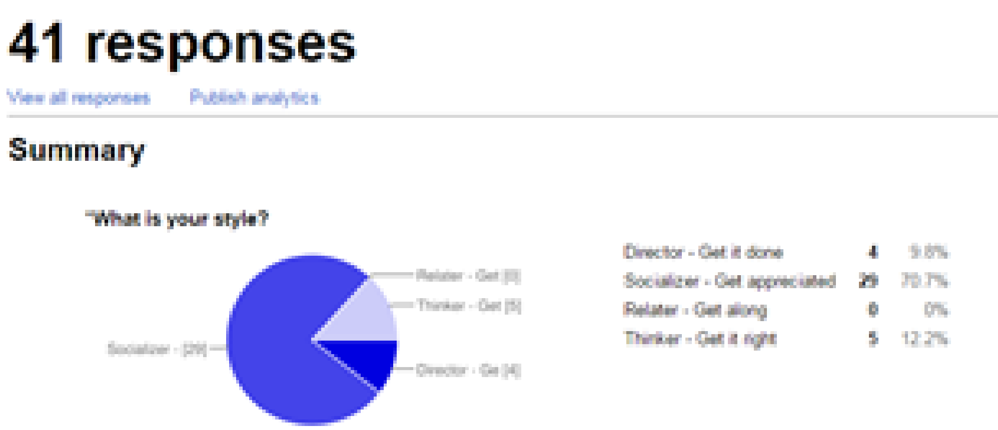
Appendices

Appendix A

This is a sample form used in the second class where we discussed communication styles.



This is an image from the summary of the students' submission.



Appendix B

This is a sample form used in the second class where we discussed communication styles.

Team Communication (or Team Building) Smart-phone Skills In-class Research
Focus: Team communication (or team building or improving team morale)
Your Group Member Names will do some In-Class RESEARCH. CREATE ONE WORKSHEET PER GROUP* (Click File>Make a copy… then add your group number to the name and check the ☑ "Share it with the same people box.") For each of these resources, write (one sentence each of these three, 15-20 words per sentence)
1) give stars (poor) ☆ ☆ ☆ ☆ ☆ or ★ ☆ ☆ ☆ ☆ or ★ ★ ☆ ☆ ☆ or ★ ★ ★ ☆ ☆ or ★ ★ ★ ★ ☆ or ★ ★ ★ ★ ★ (good)
2) how it is useful/easy to use and help solve the problem,
3) how it is not useful/problems in use and help solve the problem, and
4) how it addresses team communication (or team building or improving team morale).
NOTE: Everything you submit must be from ENGLISH sources (and not translated into English).

Group Name:

Critique a team communication (or team building) app (also it should have some images with team building posters you can copy into your site) Group Member Name: Search Engine: Search Terms: Search hit number: App name: Paste link:	Critique a YouTube team communication (or team building or improving team morale) video Group Member Name: Search Engine: Search Terms: Search hit number: Video name: Paste link:
Answers: 1) 2) 3) 4)	Answers: 1) 2) 3) 4)

Critique a team communication (or team building or improving team morale) exercise Group Member Name: Search Engine: Search Terms: Search hit number: Website name: Paste link:	Searching from the TED database (NOT Youtube) Critique a TED talk ON team communication (or team building or improving team morale) Group Member Name: Search Engine: Search Terms: Search hit number: TED talk name: Paste link:

Appendix C

Student responses to open ended questions.

The following are responses from the question, “What did you like best about using your mobile device for learning?”

- like viewing ppts on phone simultaneously
- Sometime I find this week is talking about something related to something taugh last week, at the moment I can open the ppt and have a look at it.
- Using mobile device to finish classwork looks smart rather than doing paper work. just personal feeling *^O^*
- I use more function in mobile, I enjoy the class more
- immediate email feedback
- In class research assignments
- can communicate with each others immediately
- I can involves more in the class and feel interesting on usinf mobile device within the class.
- convenient
- interesting

The following are responses from the question, “What are some improvements you would suggest?”

- Learning Google Docs was difficult at first
- wanted to be told to bookmark helpful pages
- need power bank/charging station/power supply
- wanted paper notes for important information
- use bigger device/phone/tab/i-pad is easier
- give more time to use
- understand i-phone and android are different

Appendix D

As the lecturer in this pilot, here are some of my thoughts of the experience.

- I thought I would be looking over shoulders and watching students work, but surprisingly I spent most of my time answering students’ questions and guiding their work.
- As the systems were implemented during the summer, what had the makings of an incredibly busy semester much more smooth that would have
- It seemed like students asked many more questions than the past. During a normal lecture students would ask 3-5 questions per hour, and using these Forms and Docs I was consumed with almost non-stop questions.

- In most every class many of the students and often more than half of them stayed in the classroom after the class finished.
- Some of the finished work products they developed were more creative than I have experienced in Hong Kong.

Appendix E

During the course and after the semester ended, students were telling their other lecturers about using mobile devices in class. Here are two comments from other lecturers.

- Did you teach them the E-CV? They are so creative, and they persuaded me to use Google Docs now too.
- What are you doing with mobile devices in your classes? My students are talking about it and they really like it.

Appendix F

The following are suggestions for questions that could be tested to help assess and understand engagement.

To assess student engagement many different types of questions could be adopted and tested. These include, but are not limited to the following samples.

- Rate your engagement, motivation, etc.
- Tell a friend/classmate/another teacher what you liked best/ like to change next time.
- Give a success report: describe what helped you succeed.
- Finish this sentence; What helped me the most was…
- Role play: If you were to design your own mobile device exercise, what would you create and how would you measure engagement?
- If you were the teacher, what would you use to help make it more interesting/engaging
- If you could only change one thing what would you change and why?
- Exam preparation: What most/least helped you prepare for the exam?
- What is something you learned and what did you do that helped you learn that something.
- Review learning, comment on what helped and what didn't.
- What are your learning goals for the next class?
- What are your engagement goals for the next class?

Exploring the suitability of the Book Creator App for early childhood education

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Handheld mobile devices are part of young children's everyday life as they observe others use them or engage in activities with such devices. Early childhood education cannot ignore the popularity of mobile touch devices and starts to investigate how tablets, especially iPads, can improve learning and teaching. This study joins this field of study and investigates if the 'Book Creator App for iPads' is a suitable app to enhance three to six years old children's ability to express their ideas, creativity and illustrate their understandings of the world around them. Over a period of twelve weeks, the children familiarized with the app, completed assignments and created sophisticated digital artefacts that included drawings, photos, voice and video recordings. These artefacts reflected their interests, cognitive abilities and level of fine motor skills.

Keywords: mobile learning, iPads, early childhood education, knowledge building

Introduction

The implementation of computers in early childhood education (ECE) showed that technology can enhance young children's learning (Clements & Sarama, 2002). Governments promote the use of information and communication technologies (ICT) in ECE (Curriculum Development Council, 2006) and a plethora of research described how children as young as four years old use ICT independently, purposefully and for learning purposes (Hertzog & Klein, 2005; Zevenbergen, 2007), but ECE educators remain sceptical (Lindahl & Folkesson, 2012a;

Lindahl & Folkesson, 2011). Thus, the implementation of ICT in ECE is progressing slowly and the activities remain basic (Edwards-Groves & Langley, 2009). The prejudices and misconceptions about the effects that ICT has on children and a lack of positive ICT teaching experiences lead to the teachers' opposed attitude (Ertmer, 2005; Lindahl & Folkesson, 2011).

Mobile devices such as phones and tablets, especially iPads, are highly accepted and popular among and adults and children (Chiong & Shuler, 2010; Yelland & Gilbert, 2011). Recent tablet and iPad studies investigated the viability of iPads (Yelland & Gilbert, 2011; Michael Cohen Group Llc, 2011), the children's use behaviour (Falloon, 2013; Hutchison, Beschorner, & Schmidt-Crawford, 2012) and the impact that applications (apps) and app interface have on learning (Falloon, 2013). The findings of these studies, the wide acceptance and use of iPads, their intuitive operation, and the easy access to a wide range of low cost apps may change the current ICT use in ECE (Chiong & Shuler, 2010). This study introduced 27 three to five years old children to the 'Book Creator for iPads' app (hereafter: Book Creator) to examine the viability of the app for ECE.

Literature Review

Today's children and parents use mobile phones and tablets on a daily basis (Mara & Laidlaw, 2011). Chiong and Shuler (2010) found that children are given mobile phones to entertain them while the family is traveling, and older children use handheld mobile devices to play, look a photos and videos or to take photos and videos or engage in so-called educational apps. Chiong and Shuler called this phenomenon 'pass-back effect' and Prenksy (2001) called this generation of children 'digital natives'. According to him these children think and learn differently and require new ways of teaching methods that accommodate their ICT knowledge and abilities (Zevenbergen, 2007). Prensky's preposition to adjust the current educational approaches to accommodate the children's ICT knowledge and skills stands in great contrast to the views of many early childhood teachers (Lindahl & Folkesson, 2011 and 2012). Teachers' unquestioned assumption that ICT-related activities are naturally more interesting for young children than traditional play or outdoor activities (Lindahl & Folkesson, 2012a; Lindahl & Folkesson, 2011) suggests that ICT may threaten children's healthy development if introduced too young. As a result, many early childhood teachers try to protect their young students from ICT use and avoid using ICT (Lindahl & Folkesson, 2012b and 2011).

Some teachers took on the challenge to implement ICT in their early childhood classrooms, but the use of technology remained basic (Edwards-Groves & Langley, 2009). Hence, Yelland and Gilbert (2012) suggest that teachers should rethink their current technology use. They envisage that teachers go "beyond using new tablet technologies as playthings like blocks, puzzles or construction toys … [and] be aware of the wider range of uses of tablets to enable learners to become creators, innovators and to support them in their reflections about the things around them" (p. 1). The use of apps like the Book Creator within the context of ECE may support realization of this mission.

Creating to Learn

Young children learn through experiences (Andresen, Boud & Cohen, 2000), and interactions with the environment and the people around them (Vygotsky, 1987). For many years researchers and teachers wondered how technology fits in an ECE environment (Lindahl & Folkesson, 2012). Today we know that ICTs do not hinder the children's natural approaches to learn, but are additional resources for learning (Sarama, 2004; Herztog & Klein, 2005). ICT can help children to practice and reinforce specific content (e.g., Plowman & Stephen, 2007; Clements & Nastasi, 1993), and enhance their ability to create original content, express ideas and present knowledge in sophisticated ways (Scardamalia & Bereiter, 2006; Couse & Chen, 2010). Paintings and drawings are traditionally ways for children to express their knowledge and thoughts (Lancaster, 2007). The interpretation of these artifacts lay in the hands of the teachers, who may use the child-created artifacts as well as teacher-created photos (Broadmann, 2007), videos and written documentation to assess the children’s development and learning (Couse & Chen, 2010). But their analysis of the children’s work may be wrong as a study of Einardottir shows.

Einarsdottir's (2005) photo research is among the few studies that attempted to understand the motivation behind child-made photos. She gave preschool children cameras to take photos of things that are important to them in the school. She found that the neutral viewer could not identify which element of the photo was important to the young photographer without his or her verbal support. So, a visual artefact is not enough by itself to understand what children try to communicate, because there is a lack of information like a caption. The Book Creator may improve this situation, because it allows the user to draw, type, take photos, videos and voice recordings and add them to their digital artifacts. So, children may enhance their works with voice or video recordings in lieu of captions to explain their work.

Given that tablets provide a unique opportunity for young children to be in control of the device without lengthy pre-use training (Couse & Chen, 2010) it is interesting to investigate how children use open-ended and complex creating apps that allow them to present and explain their ideas. Thus this study poses one main research questions: To what extent is the Book Creator app a viable tool for early childhood education?

Methods

This exploratory study used a mixed methods approach. A qualitative approach was used to understand the children's use behaviour in depth. The data collection occurred within a twelve weeks period. The research instruments included narrative observation records, daily log book entries, weekly video recordings and the analysis of children's work samples. The quantitative component used the video data of multiple single-subject case studies (Creswell, 2002) to examine how individual children used the app. The video data from 27 children was analysed and critical incidents were tagged and transformed into quantitative data. These 27 sets of data were compared to determine if there are any differences in the ways the children used the app. The analysis of gender specific differences and the impact of children's character are in process and not included in this paper. This information will be included in future articles.

Early childhood setting

27 children of the German section of an international Kindergarten in Hong Kong participated. The school values social play, outdoor activities, and art and crafts. Teachers use computers and digital cameras on a daily basis to communicate with the parents and to document the children's learning. The participating teachers were not familiar with the iPad and did not implement it as a part of the children's daily learning prior the study. They designed their daily schedule freely and their flexibility was only restricted by activities that are conducted by special subject teachers (e.g. music). Table 1 illustrates the distribution of age and gender across the participants.

Table 1: Participating children

Age	oys	irls

3 - 4 year olds		
4 - 5 year olds		

The school charges 130,100HKD per year. Therefore, it can be assumed that the social economic background of all children is high. The school was selected, because it was assumed that these children are familiar with the touch operated devices. This pre-conditioned allowed the researcher to focus on the implementation of the Book Creator and spend less time on explaining how to use the iPad.

Ethical Considerations

Prior to study begin, the school, teachers and parents were asked to complete a consent form that confirmed their participation in the study and their understanding of 1) the study's purpose, aims and activities, 2) the basis of a voluntary participation, and 3) associated risks and their right to stop their participation at any time. To avoid that some children feel excluded all children could observe the iPad-related activities, but only children that had the parent's consent could use the Book Creator app. The children's participation was voluntary and no child was forced to join. The researcher invited them and respected their choice to decline.

Selection and evaluation of app

The app suitability was assessed using Diaz's (2013) matrix for educational eBooks. Since the Book Creator allows the user to create ebooks, this tool was deemed suitable. Diaz suggested evaluating the:

- **Richness**
- **Completeness**: the number of content and interaction mechanisms to cope with the goals of different kinds of users.

- **Motivation**: how students are motivated, to use the system and to learn more about the subject being addressed.
- **Autonomy**: the degree of navigation freedom offered to the user and the degree of interaction freedom.
- **Competence**: the ability to navigate through the system and to reach a particular goal.
- **Flexibility**: The ease with which the system can be used.
- **Aesthetic**: How the inclusion of multimedia information is harmonized and used to enhance the comprehension of concepts.
- **Consistency**: the extent to which elements that are conceptually similar are treated equally by the application, while those that are different are treated differently.
- **Ease of Use**: how easily users can guess the meaning and purpose of things with which they are presented.

Procedure

The twelve week long study was conducted from mid-September to mid-December 2014. The researcher participated in all iPad related activities. In an attempt to relate the study activities to the curriculum and class topics, the researcher co-designed the activities with the teachers and involved them in all planning and revision processes. The data collection was separated into three phases: 1) Familiarization phase, consisting of experimentation and explorative activities, 2) application phase including imposed and structured activities and 3) creative phase that allowed the children to use their new skills to create artefacts independently. Each phase consisted of three independent small projects that aimed to provide the children opportunities to develop and reinforce and apply the children's Book Creator competencies (see Table 2). The children's participation was voluntary and therefore not regular. Consequently, their familiarity with the different functions varied and the researcher decided on a day to day basis when a child was ready to learn about a new function.

Table 2: Intervention Overview

Phase and Description	**Theme and main function**	**Duration**
Familiarization Phase >Researcher led >Teacher-Centred	1. iPad: App Introduction (Drawing) 2. Weather and Weekdays (Photo Taking) 3. Autumn Songs (Voice Recording)	2 weeks 1 week 1 week
Application Phase >Researcher led >Student-Centred	1. Magazine (Multimedia) 2. Daily News (Multimedia) 3. Kids Talk – St. Martin’s Day (Video Recording)	1 week 2 weeks 1 week
Creating Phase >Researcher-Assisted >Student-Centred	1. Kids’ Creations 2. Advent – the time to reflect 3. Christmas	1 weeks 1 weeks 2 weeks

All activities took place within the ecosystem of the class and during the free play period. One iPad was shared throughout the study. Occasionally, the group also used two additional iPads, but the emerging findings indicated that it is more effective to use only one iPad with young children. During the familiarization and application phase the researcher joined the children every day to ensure that all children had time to experiment and familiarize with the Book Creator. The activities were a combination of child-centred free exploration and researcher-centred guided application and practice of newly acquired skills. During the creating stage the researcher joined the children only three times a week, because the children needed less time to plan and realize their ideas.

Data Collection Procedure and Analysis

The data was collected during participant observations (videos) and subsequently (narrative observation records and journal entries). Each session lasted for 30 to 45 minutes. The researcher made notes during the session, which she summarized after the class. These notes and her reflection of each session made up the narrative observation records. Once to twice a week the researcher video recorded the activities and completed rating scales that monitored the children's level of involvement, their level of tablet use and their actions to determine the role and level of self-initiated guidance. The assessment of the changes in the children's use behaviour was based on four elements of the unified theory of acceptance and use of technology (UTAUT; Venkatesh, Morris, Davis, and Davis's, 2003): the social influence, hedonic motivation, the child's attitude towards technology and self-efficacy.

Venkatesh et al. (2003) unified eight models that examine the acceptance of technology, among them the widely accepted and used Technology Acceptance Model (TAM; Davis, 1989). UTAUT was deemed more suitable for this study because McCoy, Galletta, and King (2007) found that the TAM assumptions do not hold in cultures that have low uncertainty avoidance levels, a more collective cultural orientation, high power distance scores, or high masculinity scores. According to Hofstede (2014) Hong Kong has low uncertainty avoidance, has a more collective cultural orientation, scores high in power distance and a high score at the masculinity, so TAM may not be the right instrument to evaluate use behaviour in Hong Kong.

Table 3: Overview of the evaluation areas to be collected and research instruments

Evaluation Area	**Time and Frequency**	**Research Instrument**
Children's use behaviour	Three times a week	Rating scales, which are based on Venkatesh et al.'s (2003) UTAUT were used to assess the children's use behaviour. Journal entries summarized and triangulated this data with the video observations.
Children's level of involvement	Three times a week	Laever's (1994) Leuven Involvement Scale, with involvement rated during a review of videos from observations.
Children's level of tablet use	Once a week for every child	Couse and Chen's (2010) classification of observed actions and interactions (review of videos from observations).

Adapted from Goodwin (2012)

This study evaluated four areas: children's tablet use behaviour, level of involvement and level of tablet use (see Table 3) to examine the suitability of the Book Creator for ECE. The Leuven Involvement Scale (LIS; Laevers, 1994) measures children's involvement in a given activity on a scale ranging from 1 (extremely low involvement) to 5 (extremely high involvement) to assess whether they have experienced deep learning (Laevers, 1994). Marsh et al. (2005) used LIS to good effect in an ECE study. The children's level of tablet use was coded according to Couse and Chen's (2010) three stages of tablet use—exploring/experimenting, investigating and creating. 'On-looking' (see Table 4) was added because children who watch their peers using the app have been observed to then apply their observational knowledge in their own use (Tavernier, 2013).

Clarke and Clarke (2009) suggest using Bloom's Digital Taxonomy (BDT; Churches, 2008) for technology-related student assessment and BDT was found suitable for the context of assessing young children's learning with tablets (Tavernier, 2013). Each level of tablet use was associated with at least one BDT stage and verbs that describe students' actions (see Table 4). These actions served as a means to determine the individual child's daily level of use and code it accordingly.

Table 4: Levels of tablet use

Level of iPad use	**Signals**
On-Looking **BDT**: Remembering	Child stands or sits close by another child using the tablet and watches attentively. Associated actions: recognizing, listening, describing, identifying, retrieving, naming, locating, finding
Exploring/Experimenting **BDT**: Remembering & Understanding	Child tries to figure out what the app can do, touching and activating different options/functions to see what happens. Associated actions: recognizing, listening, describing, identifying, retrieving, naming, locating, finding and explaining, classifying, exemplifying
Investigating (Intentional Use) **BDT**: Applying	Child tries to figure out how to use the options/functions to create a desired effect (e.g., How can I change the color to draw a yellow sun?). Associated actions: Implementing, carrying out, using, editing, loading
Creating **BDT**: Analyzing, Evaluating, Creating	Child produces desired effects even if the artifact is not a realistic representation of real-life objects described by the child. The child is content with, and clear about, what is being done. Associated actions: organizing, structuring, comparing, integrating and testing, critiquing and designing, constructing, planning, producing, making, mixing, video casting, podcasting

Note: Adapted from Couse and Chen (2010), with on-looking and BDT elements added

The qualitative data from the videos was analysed after tagging and coding critical incidents (Goodwin, 2012). The relevant video data was transcribed to reveal reoccurring patterns of use behaviour (e.g. experienced challenges, peer collaboration, ease of use and the provided type of support). This procedure transformed the qualitative video data into quantitative data that could be compared and further analysed. The original qualitative data was used to define and illustrate emerging phenomena (Yin, 2009).

Findings and Discussion

The Book Creator is an interesting and empowering that allows the user to progress from consuming content to producing content. The app is complex and the interface was designed for older users. However, after some familiarization activities children can also use to produce content. The combination of the app evaluation and the practical findings from the case study led to the final conclusion.

Post-Study Evaluation of the Book Creator for ECE

The evaluation of the Book Creator according to Diaz's (2013) matrix for the evaluation of educational eBooks indicates that the Book Creator is educational useful, because it scores high on richness, completeness, motivation, autonomy and flexibility. The use interface usability is less strong, because the app uses text and misses a speech-to-text function that read the words to users that cannot read it. The ease of use is reasonably high, once the children learned the meaning of the text element (see Table 5).

Table 5: Evaluation of Book Creator app for iPad for the young children's use

	Criteria	**Parameters and descriptive evaluation**
Educa	**Richness**	**Information volume**: The information provided one each interface is limited to a bare minimum. But the user's design of each page had no limits. The children

		could freely choose how they wanted to express themselves using photos, videos, voice recordings, or drawings. **Diversity of presentation and interaction style**: The range of functions allowed all children to express themselves. They could present their ideas through drawings, writing, scribbling, photos, videos and voice recordings. **Scope**: The app provides a 'white' platform that embeds various means of self-expression. Listening, speaking, reading and writing features can be created with the different functions.
	Completeness: the number of content and interaction mechanisms to cope with the goals of different kinds of users.	**Learning activities**: The app is open ended, so the learning activities depend on the teacher's planning and task design. **Authoring support**: All functions can be used freely. Therefore the user can personalize the design of the digital artefact. Communication support: The user can, at any time, share the artefact via email or cloud computing. **Collaboration support**: Users can co-author books, share them and continue working on the artifacts from difference devices with the same app and then share the new version.
	Motivation: how students are motivated, to use the system and to learn more about the subject being addressed.	**Self-evaluation mechanism**: The user can review and edit their work at any time. The content of videos, photos, and drawings cannot be changed or edited, but they can be resized, relocated, and deleted and replaced any time. **Adaptability**: The interface cannot be adjusted to the user's abilities. Instead the teacher needs to monitor the use behavior of the students and gradually guide the child to master the different functions. **Out-of-school activities**: The children can include their personal experiences and knowledge from out-of-school in their digital artifacts. The artifacts created in school can be shared as a video or PDF and reviewed in the home environment. If it is shared as a working file, the used can continue editing or further developing their digital artifact out-of-school.
	Autonomy: the degree of navigation freedom offered to the user and the degree of interaction freedom.	**Interaction freedom**: The user can freely decide when and how to make use and embed the different functions. **Autonomy degrees**: The user does not need to finish their work within one session, but start, stop and continue at any time. Once the user indicated that a drawing is down it cannot be further edited, but new layers on top can be used like a revision tool.
	Competence: the ability to navigate through the system and to reach a particular goal.	**Use levels**: There are no use levels within the app. Instead the teacher needs to determine how many functions a child should learn at a given time. A less experienced user will need more assistance and monitoring than an advanced user, because the app includes different functions and editing options. **Help mechanism**: There are no built-in help mechanism, instead the teachers or more experienced peers may provide help. **Adaptability**: The app interface cannot be adjusted. The user needs to learn, memorize and understand where to find the functions and how to use them (e.g. placing the video and voice recordings in the front to keep them activated).
	Flexibility: The ease with which the system can be used.	**Accessibility**: The app is easy to use once the user is familiar with the icons and text. The text is kept to a minimum (e.g. cancel, done, and delete). Users that cannot read need some guidance to memorize their look and meaning.

		Modularity and structure of the architecture: The function menu is separated from the editing menu. This is difficult for young users to comprehend. The main features just as adding a page and going from page to page are very intuitive.
User Interface Usability	**Aesthetic**: How the inclusion of multimedia information is harmonized and used to enhance the comprehension of concepts.	**Legibility**: The design of each page depends on the user and represents her or his capabilities. **Density**: Each page is white and the user creates designs and multimedia to fill it, there are no set limitations, so it is possible to embed so too many individual designs in one page that a cognitive overload occurs for the viewer. **Appropriateness**: The touch interface and the ability to use a special touch screen pen, replicates the feeling of using traditional utilities to draw. The option to create and embed multimedia transforms the look-and-feel of the book. The app uses a different gesture than the iPad itself to resize digital objects, which confuses the user. The ability to use drawings, writings, verbal expressions as well as gestures (video recordings) make the app very appropriate for the diversified needs and abilities of young children.
	Consistency: the extent to which elements that are conceptually similar are treated equally by the application, while those that are different are treated differently.	**Interface areas**: The interface is the same for every page. **Labels and messages**: The labels are the same throughout the app and functions (e.g. pressing done when the children are done with drawing or typing). **Buttons, icons and menu items**: The icons and words and sequence of use is the same throughout the app (e.g. starting and stopping voice and video recording, selecting a new function through the same icon and related menu). **Interface clues**: Since this is an open-ended constructive app, the user designs each page there are no fixed interface cues.
	Ease of Use: how easily users can guess the meaning and purpose of things with which they are presented.	**Self-contained pages:** The pages have a clear design and the user can see if it is a single or double sided page. The function menu and all else remains the same throughout the app. **Multimedia expressiveness**: The app uses common icons to illustrate the functions (e.g. a microphone for the voice recording function). **Meaningful naming of functions**: The naming is kept to a bare minimum and often comprises of one word only. The words are clear and unambiguous.

Adapted from Diaz, 2003

Suitability of the Book Creator for ECE

The app is complex and includes many functions and editing options that the children learned to understand and use over time. The children were interested in all functions, but experienced an overload of information first. The choice of functions overwhelmed them, hence each function was introduced separately function and in the context of an imposed task.

The app has two main interfaces: the main starting page which allows the user to create a new book or open a previously created book. On this interface created books can be combined, duplicated, deleted, and shared. The user can also add a title, an author and set display settings. Once a book is open, the interface changes. The user has access to three main menu bars: 1. functions, 2. editing options, and 3. sharing and publication options. The children in this project only made use of the menu bar of the second interface. Their used the functions menu and part of the editing options, which were challenging already. For example, to create a voice recording, the child selects the function menu icon, which is one out of three icons presented closely together in the right corner of the screen. Children need to know that the musical key is the icon for the voice recording. They touch it and a textbox opens, featuring text and a red circle. Children are prone to touch the red circle immediately and start the recording before they are actually ready to speak. They need to understand that they only touch the red circle once they are ready to talk and they need to remember to stop the recording when they are done.

During the recording, the red circle changes into a black circle with a red square inside. To stop the recording they touch the red square. Once the recording stopped, a textbox opens and asks the user in text form if they would like to use the recording. The child needs to remember which of the selection options means ‘yes’ or ‘no’, to avoid an accidental deletion of their recording. Next, the icon of a speaker appears on the current book page. The child can move it around or resize it. If another recording is added, the new speaker icon will appear again in the middle of the page. If the first recording icon was not moved to a new location, it will now be inactive, because the video and voice recordings can only be activated, if they are not covered by any other features. Considering all these steps, it is clear that three to five years old children require a substantial amount of help to familiarize, remember and master this complex sequence of actions. Nonetheless, the children were interested in all functions and experimented with them.

The minimalistic layout provides minimal distraction and no inspiration. The biggest issue remained the text elements within the app and the lack of verbal guidance (e.g. speech to text function). To make the app more suitable for young children it would be better to have some built-in verbal guidance that helps them decode the icons and remember the sequence of actions. The following two extracts show how children relied on the guidance of the researcher to learn and remember the meaning of the text elements.

Extract 1: The researcher is guiding the Silas through the app's photo functions

Silas would like use a self-portrait for the book cover of his book. He has used the built-in photo taking function before, but still requires some guidance to complete the action. The researcher provides verbal guidance:

Researcher "Press the cross (in the function menu bar)"

Silas looks at the screen, says "cross" and touches it. The action menu opens.

Researcher continues her verbal guidance "And now press the camera (icon)"

Silas follows the instructions. The camera function opens and the screen is black, because the back camera is covered by the iPad cover. Silas lifts the iPad and giggles. He looks at the screen and giggles, but seems puzzled, because the screen remains black and he cannot see himself.

Researcher monitored his action and waited to see if he can solve this issue.

Silas turns the iPad to the researcher and shows her the screen and saying "Look!"

Researcher reacts and provides him verbal guidance to troubleshoot the issue: "Oops, we need to press on this symbol (pointing to the small switching cameras icon). And then you press … Hold on, we need to turn the iPad around (otherwise Silas' hand would have been in front of the camera lens and the photo would have shown the hand that pressed the shutter release].

Silas looks at the iPad and presses the shutter release taking a photo of him smiling. (The app shows the photo and on the lower edge of the screen the app is asking the user to press 'take another photo' (lower left corner of the screen) or 'use photo' (lower right corner of the screen). Silas cannot read these instructions yet.)

Researcher points to the lower right corner of the screen and says "use photo".

Silas presses it and the app inserts the photo on the current page of the book.

Notes: Video transcription from Third iPad session.

Silas, four years old, was familiar with the letters, but he could not encode the text within the app alone. Early childhood education is special, because the children are often just starting to develop a reading awareness and reading skills. Decoding icons requires some degree of literacy awareness and experience. In this case, Silas used the photo function for the second time and relied heavily on the researcher's guidance. The next time he used it, he did not need the verbal guidance, but used eye contact to confirm that his actions are correct. Switching from the back to the front camera was an area of difficulty for all children during their familiarization with the app.

Extract 2: The researcher guiding the children through the written words

Carl and Max work together to compile a journal entry about their day's favourite activity. Carl would like to do a voice recording. The researcher asks Max and Carl how to start the voice recording. Both look at the screen.

Max says "cross"

Carl repeats "cross"

The researcher points to the cross and confirms the boy's suggestions.

Carl touches the cross and opens the function menu. "Then you click down there (pointing to the musical key). Then we can do the voice recording.

Carl touches it and a white box with a big red circle in the middle opens. His finger moves immediately towards the red circle.

The researcher notices this and says "Before you touch it, you need to think about what you want to say. What do we want to say?" The children and the researcher discuss what to say)

As soon as Carl knew what he wanted to say he touched the red circle and started the voice recording. The red circle changes to a black circle with a red square inside.

Carl finishes his voice recording, moves his head away from the iPad and pauses.

The researcher points to the black circle and touches it to stop the recording. Then she explains: "You should stop the recording when you have said what you wanted to say." Meanwhile, a text box appears in the middle of the screen, asking if we want to use the recording 'yes' or 'no'.

Carl's finger browses over the text box and he is ready to just touch any selection.

The researcher moves his hand over and says 'this is no (pointing to 'no'), meaning that we do not want to use the recording and this is yes (pointing to 'yes'), meaning that we want to use the recording"

Notes: Video transcript from the sixth iPad session

There is a high chance that three to six years old children just touch any of the of the selection options and accidentally delete a photo, voice or video recording or clear a drawing, because they are not yet able to decode the text. If they encounter situations as the one described in extract 2, they may experience frustration as they cannot realize their idea. This may reduce the joy they experience when they create and review their own book creations. Children that are less persistent and have short attention spans may quickly loose interest in the app.

The review of the journal entries, field notes and video footage showed that the children's need for guidance remained high during the familiarization and application stage, it decreased during the creation stage. During the familiarization stage all children were introduced to the drawing and photo taking function, to ensure that they can sign their works either with a self-portrait or with their written name. All other functions were introduced to the individual child, when he or she requested to use them or when the researcher felt that the child was ready to explore them. Table 6 provides an overview of the total number of activities for the main functions of the Book Creator app. One child could engage in more than one activity. It was not recorded how often a child used one function each day, just which functions he or she used during one session. Therefore, the table only indicates the most popular functions.

When this data is triangulated with the videos and analysed as a whole, from the beginning to the end of the study, it sheds some light on the learning behaviour.

Table 6: Comparison of the number of activities during each stage

Phase	**Drawing**	**Photo**	**Voice Recording**	**Video Recording**	**Text**
Familiarization	8	5	0		8
Application	0	0	2	4	4
Creating	8	2	2		7

For instance, during the familiarization stage, the children used mainly the drawing and photo taking function, and occasionally they explored the other functions. During the application stage they had a vague idea of the different functions experimented with most of the functions. These experiments were often unplanned and the result of a spontaneous urge or inspiration. The children felt comfortable with the drawing and photo taking function and were ready to shift their experiments to the voice and video recording function. Once the study entered the creating stage, the children's actions were less experimental and more focused. Instead of spontaneously using many functions, they now planned the design of their artefacts and selected the functions purposefully.

The use of the Text function is interesting, because only nine children could write their names or spell their name, but nearly all children experimented with the text function. During the familiarization stage the Text often consisted of chains of random letters, only Mia, Sara, Sonja, Victoria, Silas and Carl typed their names. During the creating stage all children tried to type their names or asked the researcher to help them find the letter to type their names. This explains the raise in the use of the Text function. The children also enjoyed the text editing functions. Most experimented with the font size and font style. Only two children changed the font colour or the background of the text box. This indicated that even though they are not yet able to write, this function may enhance their interest in writing and encouraged them to use text as a means towards creative self-expression. It could be a way to allow children to familiarize with letters and use them before being able to write.

Children's Artefacts

The artefacts presented in table seven to nine were selected, because these three students engaged in the iPad activities regularly, so there is more data available to evaluate their use behaviour and assess the suitability of the app. The learning path, their experienced difficulties and there technics to overcome issues is well documented.

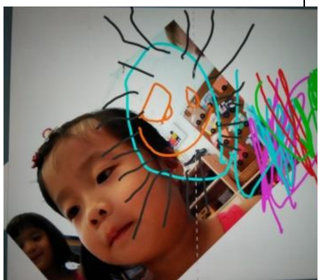
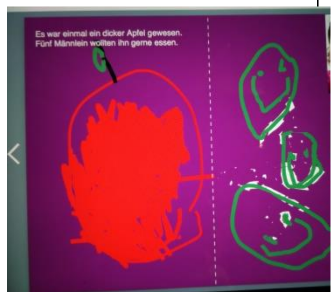
Lilian, three years old, showed a high level of interest in the iPad from the very first session. She approached the researcher often, stood close to her or a peer that was using the app and watched what they were doing. The researcher would ask her, if she would like to have a turn and work with her later. Lilian never explained any of her works to the researcher. She spent the complete familiarization stage taking self-portraits, scribbling over her photos, erasing her scribbles and scribbling again. She also used the voice recording function, but never spoke. This may have been due to the fact that the researcher was there to supervise the whole activity and she felt too intimidated to speak to a recording.

The researcher tried to involve her in conversations about her work. Lilian ignored these attempts to have a conversation. She ignored suggestions regarding the creative process and only accepted support regarding the operation of the app. Since the researcher wanted to see what she could do with her skills she interrupted Lilian's routine to introduce her to the individual functions of the app and asked her to perform small tasks (see the image associated with the application stage of table 7). The researcher was by her side during all activities and provided support when necessary. It appeared that Lilian knew how to use all functions purposefully, but she required some very direct instructions that provided her a goal towards which she could work. Without this goal she was lost and could not decide what to create and used the app as an augmentation of traditional drawing by making use of the photo function.

The screen shots of her work show how her ability to use the app to express herself improved over time. From self-chosen activity (photo and scribbles) to realizing a teacher imposed task, to being able to come up with her own meaningful designs (photo and drawing of her friend Emily). Over the course of the study, Lilian observed her friends Sonja, Carl, Mia, and Emily several times. Among the group of three years old children, she participated the most (seventeen times). She observed her peers during eight sessions, spent six sessions to familiarize with the app, experimented with the functions for three sessions and used three sessions to independently create works that were meaningful and could be decoded by the neutral viewer. Each of her last three works was a video sequence that explained her work, a voice recording or a caption that she dictated the researcher. Her confidence towards the use of the app and her self-confidence increased, so she was ready to record herself.

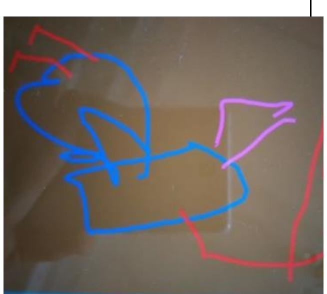
The analysis and comparison of journal records, videos, and artefacts of all three years old children indicate that they learn to use the basic functions of the app within five intensively supervised and guided sessions. They require a lot of opportunities to watch their peers, explore the functions, and receive creative stimulations. The most remarkable impression of this age group was the persistence with which Lilian, Elena, Callestine and Sophie learned to use the app and how much the quality of the artefacts improved.

Table 7: Work Samples of Lilian, 3 years old

<table>
<tr><th>Familiarization Stage</th><th>Application Stage</th><th>Creating Stage</th></tr>
<tr><td></td><td>
</td><td></td></tr>
</table>

Simon, four years old, participated in twelve sessions. He missed some of the familiarization sessions and started to use the app during the application stage. Simon spent six sessions watching his peers, at times unintendedly. All of his works were very expressive. He spent only one session to familiarize with the app (see first photo in table 8). In all other sessions, he applied his creativity and knowledge to express his ideas. He used the video and drawing function purposefully from the beginning. He completed the sentence “I am happy, if ..” with a video recording that shows him say “If, I can play with my father.” And his drawing relates to this answer. He combined two different functions to fully express his view.

Table 8: Work Samples of Simon, 4 years old

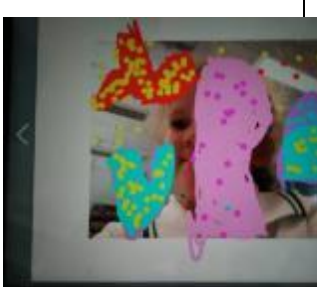
<table>
<tr><th>Familiarization Stage</th><th>Application Stage</th><th>Creating Stage</th></tr>
<tr><td></td><td>
</td><td></td></tr>
</table>

The analysis of journal record, videos and artefacts (see Table 8) indicated that four years old children tend to learn the operation of the Book Creator faster and may focus on the accurate representation of their ideas sooner. Simon progressed faster compared to other four years old children. On average, the four years old children participated twelve times, observed three sessions, spent four sessions each to familiarize with the app and created artefact purposefully. Their ability to link their drawings to video and voice recordings became meaningful earlier than in the case of three years old. This was to be expected, because four years old children are cognitively more ready to perform such task. As a result, the app empowers four years old children to better express their understanding of the world around them.

The participation of the three five years old children varied a lot. At the beginning of the study, their interest in using the iPad was high, but they lost some of the initial enthusiasm as they realized that they needed to wait for their turn and were limited to the use of the Book Creator. It appears that they did not like to be limited to the use of just one app. Their interest increased as they saw the works of their peers during group viewing sessions that were meant to demonstrate and recapitalize what we had done with the app.

Sonja’s keen interest stands in contrast to that of the other two. She participated 21 times, and her activities ranged from on-looking, to helping her peers and to creating her own artefacts (see Table 9). Sonja was not familiar with the iPad, so she needed extra time to familiarize with both device and app.

Table 9: Work Samples of Sonja, 5 years old

Familiarization Stage	Application Stage	Creating Stage
		

Sonja's observed the iPad activities four times, her peers only twice. When she watched her peers, she helped reinforced her knowledge of the Book Creator by reminding her peers of the sequence of actions. She also used her peers' creation as inspirations and tried to imitate them when she had a turn.

Sonja also spent seven sessions familiarizing with the app and applying and practicing her new skills, two more than her peers, before she went on to spent ten sessions creating meaningful works (see Table 10).

Table 10: Number of participations and activities of the three five years old participants

	Participation	**observing**	**familiarizing & applying**	**creating**
Maximus	8	2	3	3
Sonja	21	4	7	10
Viktoria	12	2	5	5

The result of her persistence was a deep understanding of the Book Creator. Compared to her peers, she took full advantage of the app, having understood that she can combine the functions to convey meaning or use them independently from each other. Her contribution to the "I am sad, if…" book includes the above displayed work of the application stage (see image 2 in table 9) and a voice recording. In the recording she said that "she is sad, if she loses something." When the researcher asked her why her drawing does not relate to what she said, she replied that "It does not have to. The answer to what makes me sad is provided in the recording, so now I can draw something that I like." She understood that the voice recording already conveyed the message that she wanted to send and that more means to communicate this message were not necessary.

Sara and Viktoria progressed in another direction. They created different artefacts and combined them within one page (see image 1). For example, Viktoria first drew a picture that covers the whole page and resized the final version. Second she took a photo of herself, resized it and added a voice recording explaining who she is and what her drawing represents. Third she photographed the class's artworks and voice recorded which of these works was important to her. At last she typed her name and formatted the size, font type and font color. When she designed this complex artefact, she planned the details, having in mind that a person, who does not know her, may look at it and may need the additional information. During the whole process the researcher looked on and was not asked to help. All of the above indicates that the Book Creator is very suitable for five years old children and empowers them to convey complex ideas in a way that others can understand and rely to.

Image 1: Work sample of a five years old (Creation stage)

The overall findings suggest that the Book Creator App has the potential to empower children to be creators of meaningful digital artefacts. The app is complex and includes many functions, which can encourage the children to fully express their thoughts and ideas by complementing their drawings of photos with audio or video element. But the range of functions may also hinder some children's ability to express their ideas, because they are overwhelmed by the choices they need to make and the procedures they need to follow to realize an idea. To unleash the full potential of the app and fully grasp all its functions, a substantial amount of practice is necessary. Practice will improve the level of mastery and understanding of the app over time.

Conclusion

The findings indicate that once the children overcome the barrier of decoding the text elements with the help of more knowledgeable other, they use the app more effectively as they get a feeling for the functions and understand that they can combine different function within one piece of work. Within a period of twelve weeks, the children's work became more meaningful and the use of the multimedia functions increased. They progressed from relying on the researcher's guidance through the functions and text to using the app independently to create. The support that the researcher provided changed from assisting the children with the operation of the app, to confirming that they were following the right sequence to achieve a certain outcome (e.g. editing their works), to providing resources that inspired them or helped them realize their own ideas (e.g. providing a real apple or a verbal description of how things look like). The children's questions changed from "How can I erase this?" to "Can you show me how to draw a mouse?"

Considering the intense time and attention that the researcher provided to prepare, monitor and support all iPad activities, it is worth looking for a similar app which is less complex and easier for the children to operate.

Impact for Practitioners

If ECE teachers decide to use the Book Creator App, they will need to plan activities that help the children to learn to operate and understand the app thoroughly. Such a familiarization period may last around two weeks per child and can be very time consuming. During this period, the teacher will need to monitor and manage the activities, support the children to operate the app, decode text, establish routines, understand technical rules (e.g. voice and video recordings only work if they are located in the front layer) and realize the creative opportunities that the app provides.

Considering the great interest shown by the children to design text and their growing confidence to voice and video record themselves, teachers may consider to include the app in their literacy learning repertoire. Listening to oneself may help realize weaknesses in pronunciation and facilitate a greater awareness of the speech, and the children actually loved watching and hearing their recorded selves. Additionally, the artefacts are a great source to capture, document and evaluate the learning of children, especially because teachers can create very closed or open-ended tasks and cater for the individual preferences of their students.

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e-Exams with student owned devices: Student voices

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This paper reports on what students think of using their own mobile devices, such as laptops, for examinations. e-Exams are an attempt to bring the pedagogical power of mobile laptop devices into the world of pen-on-paper high stakes exams. Trials of an open source, bring-your-own-device (BYOD) based e-Exam system were undertaken in six undergraduate courses during 2014 at The University of Queensland, Australia. Student voices were sought via surveys conducted prior, during and following a series of mid-semester e-exam trials. Opinions ranged from the enthusiastically positive 'I want it yesterday' to the negative 'not in my life time'. Impressions and concerns highlighted by this important stakeholder group included; typing proficiency, comfort with familiar keyboards, hand cramps from long writing durations, editing ability, reliability of technology, security, equity, cheating, familiar habits and apathy. Insights will prove useful to institutions looking to implement computerised exams using BYOD.

Keywords: e-exams, computer-assisted assessment, high-stakes testing, bring-your-own-device (BYOD), student voice.

Introduction

The idea of using computers for testing is not new with early computerised tests appearing in the 1960's for formative uses in medical, mathematical and language teaching (Swets & Feurzeig, 1965). Computer based tests are now available in many fields. Activity tends to be focused in the professional certification and training markets and remains relatively rare in institutions of higher learning where pen-on-paper exams still dominate. Computerised exams are used for the Australian Medical Council Examination (AMC MCQ) and the United States Medical Licencing Examination (USMLE MCQ) components, and for information technology certification such as the Microsoft Certified Systems Engineer (MCSE) and Cisco Certifications. The International English Language Testing System (IELTS) and most US state Bar Law exams also offer a typing option. However, the majority of computerised tests available today tend use 'selected' response questions rather then an open ended or constructed response format, although some proprietary exam tools in the IT industry do include simulated software and networking problems. The majority reliance on selected response question types serves to limit the 'pedagogical landscape' in the exam room with a tendency to replicate paper-based modes of questioning. An open or constructed response focused computer enhanced exam could include a wider range of activities, such as working though simulations, scenarios, manipulation of three dimensional images, building multimedia, computer aided design tasks and carrying out virtual experiments. The lifting of pedagogical limitations in the exam room also has the potential to encourage transformation in the broader curriculum (Fluck & Hillier, 2014). The potential for improved efficiency when using computer marked items and closer alignment with the increasingly common use of ICT in the formative stages of courses are further trends indicating that much greater use of computerised testing is set occur in the near future. However as we push for a greater numbers of students to be able to undertake such exams, the scalability of existing approaches to computerised testing that use equipment supplied by the examining authority are coming under pressure. The budgets of most educational institutions across the developed world are being constrained and so a large-scale investment in specialist computer equipped testing centres is becoming unlikely.

Mobile Devices for Exams

A possible solution is to co-opt the mobile equipment that a great many students already own. In particular there is high ownership rate of laptops by students at around 90% in the US (Dahlstrom & Bichsel, 2014) and little higher at the author's own University at 94%. This provides a potential source of hardware with which to run an e-exam. This is not without its problems because the exam authority must be able to secure these machines and any technical solution must be able to operate across a range of hardware and operating system types. Products are available in the marketplace such as ExamSoft (2015) and Safe Exam Browser (SEB 2015) that are installed into student owned laptops. Further developments are underway in a number of countries to make greater use of bring-your-own devices (BYOD) for exams, including in Australia (Hillier & Fluck, 2013), Austria (Frankl, Schartner & Zebedin, 2011), Canada (Peregoodoff, 2014), Denmark (Nielsen, 2014), Finland (Lattu, 2014), Germany (Schulz & Apostolopoulos, 2014), Iceland (Alfreosson 2014), Norway (Melve 2014) and Singapore (Keong & Tay 2014).

In addition to the technical hurdles for an e-exam programme, there is the problem of user and stakeholder acceptance. As we transition from pen-on-paper to keyboard the decisions we make about the approach to e-exams will impact students the most. The differences between a computer supplied by an institution and their own, familiar equipment could have an impact of student acceptance and performance in an exam.

Authors such as Dermo (2009), Frankl, Schartner and Zebedin (2012), Terzis and Economides (2011), Mogey and Fluck (2014) have written on the use of computers for exams and have raised issues such as integrity (minimising 'cheating'), reliability (stability of the equipment and software to perform error free), familiarity (as to minimise the distraction the computerised environment itself so that candidates can get on with responding to the exam questions to the best of their ability), efficiency (particularly when compared to hand-written exams) and psychology (the impact of stress and anxiety).

Bring-your-own-device (BYOD)

The use of ICT at higher education institutions has traditionally been based around institution supplied computers in laboratories and libraries. Over the last decade, students have been increasingly bringing their own equipment onto campus and connecting to campus networks. This has occurred due to the increasing ownership of suitable devices by students (from 1.3 devices per person in 2010 to a projected 3.6 in 2014 – Dahlstrom & diFilipo 2013) as well as the stagnation of available equipment on-campus while student numbers have been increasing. From the point-of-view of students the use of personal equipment for study purposes has a number of advantages. It provides convenience for students in that their own devices allows for greater availability of a computer at a time and place that best suits the student, allows for a consistent software environment between tasks, allows for a high availability of all working data files and further it allows the use of a more familiar keyboard and touchpad or mouse allowing for greater efficiency and comfort in equipment use.

When it comes to using this same equipment for high stakes exams there are potential benefits stemming from the familiarity of students with their own keyboard and mouse/touch pad such as a faster rate of text production in a time limited exam. Cost savings in hardware provision for institutions is also relevant due to the relatively infrequent occurrence of exams that would require a large number of computers – for example, at the author's institution this would mean that the 2500 seats available at any given time for exams would need to be furnished with a computer. Potential drawbacks of using student owned devices include variation in capability ('power' and capacity), reliability (against crashing, battery life), security of the exam environment and integrity (cheating) concerns.

Measures such as hardware certification, controlling the software environment, providing back-up power, and careful invigilation has the potential to over come many of the difficulties associated with using student owned equipment in the exam room; however we ultimately need to convince students that such a move is a good idea. It is at this point we examine the role of the student voice in technology acceptance for exams.

Giving Students a Voice

Exams, perhaps more then most other forms of assessment are the most stressful with high stakes outcomes for students. Further, students as one of the most significant stakeholders do not usually have the most powerful voice when it comes to the running of exams or when implementing changes. Any changes to the way exams are to be performed behoves planners to include the student voice into the change process. Much of the educational literature on the use of ICT for assessment is frequently written from the point of view of educators, administrators and educational technology experts (Andrews & Tynan, 2010). However, in many parts of the education system students do have input (Alkema, McDonald, & Ryan, 2013) normally via student unions, societies, representation on committees and via increasingly common course evaluation surveys (Blair & Valdez Noel, 2014). This style of representation is often removed from the immediacy of the assessment event and so lacks the richness of a direct consultation with students as part of a planning and implementation process. Research such as that by Andrews, du Toit, Harreveld, Backstrom, & Tynan (2014) is an example of a closer engagement with students at the coal-face of their learning. By consulting students on a range of issues related to the conduct of exams, as close as possible to the point of action or change, we can better appreciate their perspectives and include their concerns within the design of the change process.

The study

This study was undertaken at the University of Queensland, a multi-disciplinary university in Brisbane, Australia serving 50,000 students. The institutional ethics committee approved all data collection processes and instruments used in the study.

The study comprised two main phases as outlined in figure 1.

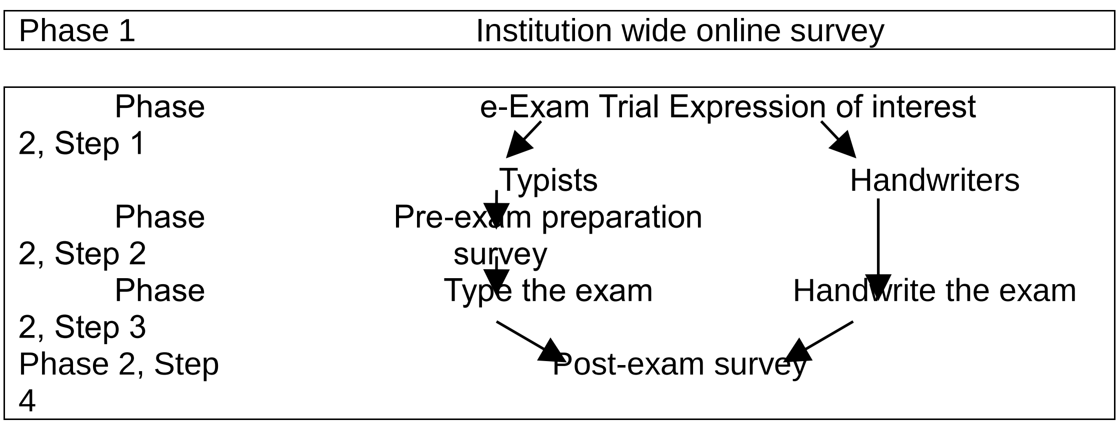


Figure 1: Study design

The first phase was an online survey conducted prior to the e-Exam trials. The survey was made available to all students within the university via the institutional learning management system (LMS).

The second phase was a series of six e-Exam trials that were broken down into four steps each. Students in six courses undertaking mid-semester examinations worth between 15%

to 25% of the course grade were provided the option to type the exam using their own laptop, with the fall-back being regular pen-on-paper. Those that elected to type were required to boot their laptop using an e-Exam 'Linux Live' USB storage device (Transforming Exams 2014) that contained a modified version of Ubuntu to prevent internet or local drive access along with Libra Office and an additional custom 'exam starter' wizard that guided the students to start their exam.

Within each of the trial courses students were asked to complete an online 'expression of interest' (and consent) indicating their preferred choice of exam mode. Those who expressed interest in typing were then asked attend a set-up / practice session to provide an opportunity to become familiar with the e-Exam system and to ensure that the e-Exam system was compatible with their laptop. Those that attended the session were asked to fill in a survey to collect data about their laptop and their first impressions of the exam system. Finally all students (both typists and hand-writers) undertook the exam and were asked to complete a post-exam survey.

Data collection and analysis

Across the series of surveys several open text questions provided an opportunity for students to voice their opinions on their ideas and experience e-exams. This data was collected as part of a wider study into e-learning, e-submission and computerised examinations. The focus in this paper is specifically on exploring the student voice with regard to use of student owned devices for typing examinations.

Pre-trial institution wide survey

In the first phase institution wide survey an open response question sought student opinions on the idea of computerised examinations. The vast majority of respondents have little or no prior exposure to e-exams and so opinions collected were 'preconceptions'. The question "What are your main concerns regarding computer based examinations at this time?" followed a series of Likert response items. An analysis of the Likert items was reported elsewhere (see Hillier 2014). Demographic questions such as age, gender, program level and program field (discipline area) were also included.

e-Exam Trials

At the beginning of each e-Exam trial the expression of interest form provided an indication of expected numbers electing to type within that course. Students were then asked to attend the set-up/practice session before being permitted to type the exam. We anticipated some attrition in numbers so we kept records of the students participating at each stage. The number of students who stated they would type (or did) at each stage of the trial process is displayed in Table 1.

Table 1 Number of typists at each stage of the trial

Stages of trial	**Yes will type**	**Maybe type**	**Total typists**	**Attrition**	**No (hand-write)***
1 EOI	201		201		361
2.1 Pre - before try	94	16	110	91	10
2.2 Pre - after try	86	15	101	9	23
3 Exam (after)	71		71	30	450

Note: not all respondents completed every question. A number of students electing to hand-write did not fill in the EOI and the post-exam survey so are slightly under represented. Similarly not all attendees at the pre-exam set-up session returned a survey.

There were just over 200 students (36%) out of approximately 560 students in the six courses who expressed interest in typing. Then 124 turned up to a set-up/practice session with 115 surveys returned. During the set-up/practice session, 94 said they intended on typing the exam before they had tried the e-Exam System. After trying the e-Exam System with their laptop, 86 said they still intended on typing their exam. Finally, 71 students typed their exam and 450 elected to hand-write.

During the set-up/practice session we collected technical data related to their laptop, compatibility with the e-Exam system, their initial impressions and intentions. The questions relating to student's impressions and intentions were comprised of the Likert items listed in Table 2.

Table 2. Selected pre-exam session survey questions (typists only).

Question	Type	N	Mean	SD
The written instructions were easy to follow	L	108	3.9	1.0
It was easy to learn the necessary technical steps	L	105	4.0	1.1
It was easy to start my computer using the e-Exam USB	L	108	4.1	1.2
I feel confident I will be able to do these steps in a real exam	L	106	4.0	1.1
The software within the e-Exam System was easy to use	L	105	4.1	1.1
I now feel relaxed about the idea of using the e-Exam system for my upcoming exam	L	106	3.8	1.0

Students were provided an opportunity to voice their opinions based on their initial impressions of the e-exam system via two open comment questions: "What are you main concerns regarding e-exams at this time?" and "Other comments - praise or suggestions for improving how the system works".

The last step in the data collection process was a feedback survey handed out at the time exam responses were collected. Again seeking student voices, three open ended questions were provided: "If you hand-wrote this exam: what were the reasons for handwriting (i.e. reasons for NOT typing) this exam?" or "If you typed this exam: what were the reasons for typing this exam?", along with "For you, what are the main differences between handwriting and typing an exam response?" and "What are your main concerns at this time regarding the use for computers for exams?"

By asking students to voice their concerns at each stage we were able to gain insight into the evolution of their thinking as they gained experience of this new way of conducting exams.

Results

Demographics of the 928 respondents to the pre-trial survey were 63% female and 37% male. This diverged from the intuitional norms of 55% female and 45% male enrolments meaning males were under represented in the survey. The vast majority of survey respondents, 83% were between the ages of 17 and 25, while 88% of respondents enrolled in an undergraduate program and 12% postgraduate. Institutional statistics show that 81% of course work students are undergraduates making for a small over-representation of this group in the survey.

Mobile device ownership (excluding desktop computers) was an average of 2.3 devices each (standard deviation of 0.8). Overall, 94% of students owned a laptop, 84% owned a smart phone, 41% owned a tablet, while 34% owned a desktop computer.

Student's Voices – Preconceptions of e-Exams

During the pre-trial institution wide survey we found little prior experience of computerised exams with 60% of respondents having never taken a computerised exam and a further 30% haven taken just a 'few'. The students spoke up with 541 comments or 'preconceptions' via the online survey. The students raised a number of issues; risk aversion relating to technology, cheating and current practices featured significantly.

> "Technical issues e.g. data loss, program crash, accidental deletion, slow loading, unrecognisable formats etc. – *Physiotherapy student*.
> "Internet connections, issues of copy-pasting, issues of access to other programs (including web browsers) while doing an examination, potential for easier reading of other people's answers when doing a computer-based examination" – *Arts student*.
> "The technology being unreliable stresses me out more than the thought of doing the exam." – *Law student*
> "My main concern regarding computer based exams is the level of preparation the supervisors have to fix a technical problem that may occur during the examination." - *Agricultural Production student*
> "Hiding the screen from other student's prying eyes." - *Environmental student*
> "I also am not convinced of the administrator's ability to prevent cheating by students. I want to compete on a level playing field whereby knowledge is tested against others in the field of study not on who has worked out how to violate the system." – *Business student*.

Computer literacy also featured in student's rationale:

> "As a mature aged student, I would feel at a disadvantage doing a computerised exam as I am not as computer literate as many of the younger students." - *Chemistry student*.
> "It's true that 'computerised exams favour some students more than others' - i.e., the ones that are proficient typists over the ones that aren't - but the same is true of paper-based examinations, which favour those with the ability to work through strong pain in their writing hand. Any set-up will be to the advantage of someone!" – *Arts student*.

Students were also attune to the suitability of keyboard entry with respect to the typical assessment questions set in their discipline:

> "A real programmer would be looking up the APIs for their language every time they wanted to do something, but they can't because they're forced to only use paper-based notes they have on hand. It's infuriating." - *Computer science student*.
> "For a maths or science courses it's very tedious to type up equations and symbols." - *Chemical Engineering Student*.
> [It] "would be difficult to create an exam based on typing musically (creating scores/sheet music)…[It] is different for each program and most of the time taken during the exam would be trying to work out how to use the program." – *Arts/Music student*.
> "I need to be able to draw sketches and write formulae conveniently." – *Civil Engineering student*.
> "It is hard to write Chinese characters on a keyboard and the keyboard becomes a dictionary using current software so it is a bit unfair." - *International Studies and Languages student*.

Students also trained themselves for paper based exams and this had lead to sense of investment in the approach.

> "In engineering assignments it is still important to be able to practice 'pen and paper' type questions for assignments because this helps in studying for exams and remembering important facts." - *Electrical Engineering student*.
> "I have a history of performing exceptionally well with written exams, not getting less than a 7 [the highest grade] on my final exam papers. I don't want to risk this historic performance by introducing a new method of exam delivery." – *Business student*.

Others were positive about the idea of computerised exams.

> "I would strongly support a shift to computer-based exams, regardless of format (e.g. multiple choice, short answer, essay). A computer-based examination would be considerably more convenient for both the student (write more quickly, easier to modify answers) and the examiner (MCQ marked faster, examiners wouldn't struggle with illegible handwriting, less missing exam papers)." - *Medicine, Surgery student*.

While there was those that avoided typing due poor keyboarding skills, there were others that avoided hand-writing due to poor penmanship or physical discomfort when writing for an extended period of time.

> "I feel that I am always at a disadvantage because I write ever so slowly. ... Hand cramps, pen clicking and ink smudges are inconvenient too. I would love the chance to be able to type all my answers out on a computer." – *Psychological Science student*.
> "I'm left handed and writing continuously for an hour and a half in my law exams leads to a huge amount of mess on my hand from pens/pencils smudging. I feel that computer based exams would allow me to actually achieve better." – *Law student*.
> "I hate paper based exams. Hand cramps are the worst, especially for me. I've had years of wrist injuries." - *Health Sciences student*.

While there were those that complained of hand cramps from writing there opposing views expressed:

> "I feel the question about hand cramps definitely speaks volumes about how soft students can be." - *Civil Engineering student*.

Students also identified that the majority of their work during semester was computerised, along with claims that they are being disadvantaged by being forced to use pen-on-paper for exams.

> "Students are at a disadvantage these days with written exams: we do not use paper based methods as much and many students have illegible handwriting." – *Social Science student*.
> "Given that computer use is assumed knowledge in higher education settings, it would be a weak argument to suggest a student would be disadvantaged any more than a student is disadvantaged by using pen and paper." - *Law student*.

Some students raised the impact of using familiar or unfamiliar keyboards on their writing efficiency:

> "A large concern is the type of keyboard used. To have someone who has used an Apple keyboard all their life use a different type of keyboard for an examination (especially since it's timed and the quantity of work plays a part) it would be a disadvantage to the person." – *Arts student*.
>
> "As a Dvorak typist, being forced to use the QWERTY keyboard if electronic exams were taken on university computers would be a significant disadvantage." – *Software engineering student*.

Students perceived a trade-off between the familiarity of BYOD and the risk of cheating:

> "I'd rather use a familiar keyboard in an exam, but it's easier for students to cheat using their own computer." – *Chemistry student*.

Some argued that university supplied equipment should be used but this would not be without issues too;

> "In a university as large as UQ computer based exams would be extremely hard to organize, particularly in large courses like psychology, but if students could use their laptops they will have a higher chance of being able to cheat." – *Communications student*.

Some students expressed concern over potential damage being done to their equipment by the e-exam system:

> "How is my computer shut off so that I can't access my documents while completing an exam. What kind of lasting effects will it have on my computer?" – *Business student*.

The need for students to be familiar with the environment is highlighted:

"Simple interface problems (short-cut keys not working, mouse buttons not working as expected) could cause BIG problems and frustration under time pressure." – *Electrical Engineering student*.

The overall distribution of comments provided via the pre-trial phase survey across a set of emergent categories is shown in figure 2.

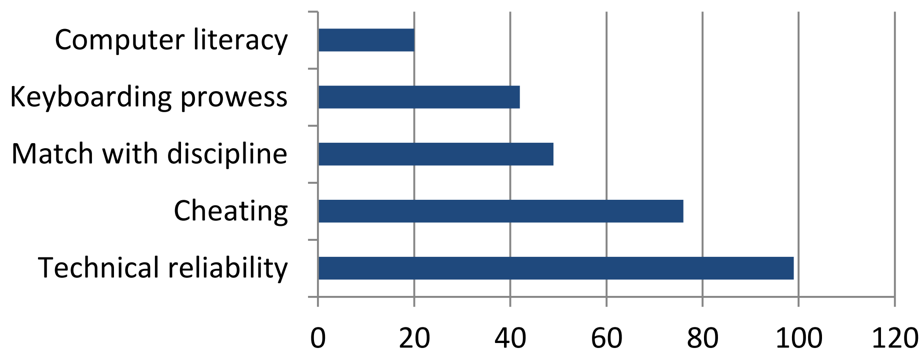


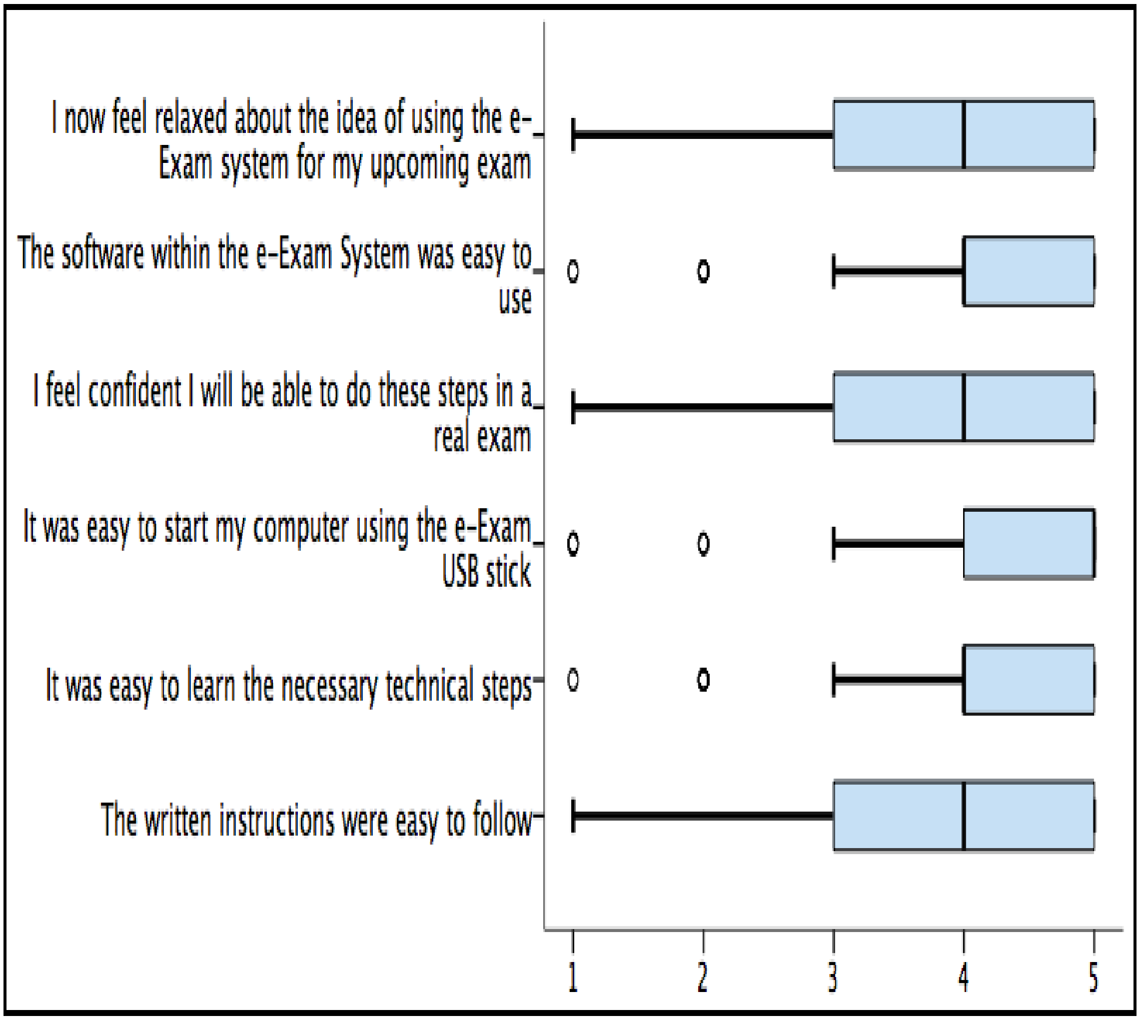
Figure 2 Emergent themes from pre-trial survey comments.

Further exploration of the preconceptions of students towards computerised exams is available in Hillier (2014).

Student's first look at an e-Exam approach using BYOD

During the set-up/practice session 115 surveys were returned by students who had just tried the e-Exam System with their laptop for the first time. Students were asked to rate the e-exam system using Likert items including the ease of following set-up instructions, the ease of undertaking the start-up steps, the ease of starting their computer with the USB stick and the ease of using the exam system software. They were also asked about their confidence in their ability to perform the necessary steps in a real exam and if they were 'relaxed' about the idea of using the e-exam system in their upcoming exam. The ratings assigned by students are displayed in figure 3 and tended to be rated as 4 on a 5 point scale (5 being strongly agree/positive).

Figure 3 Ratings of the BYOD based e-exam



system (5 = strongly agree)

There were 69 respondents who provided comments, with the main themes presented in figure 4. The technical test focus of the session was reflected in the larger proportion of related comments. A general fear of a technical mishap during the exam was of concern to 24 students. Concern about forgetting how to use the e-exam system was expressed by 10 students. Eight students identified difficulty or differences in the behaviour of touchpad and scrolling behaviour as a concern. The loss of power was a worry for 7 students as was the loss of data. General praise was received from 13 students and 9 students commented on the ease of use of the system.

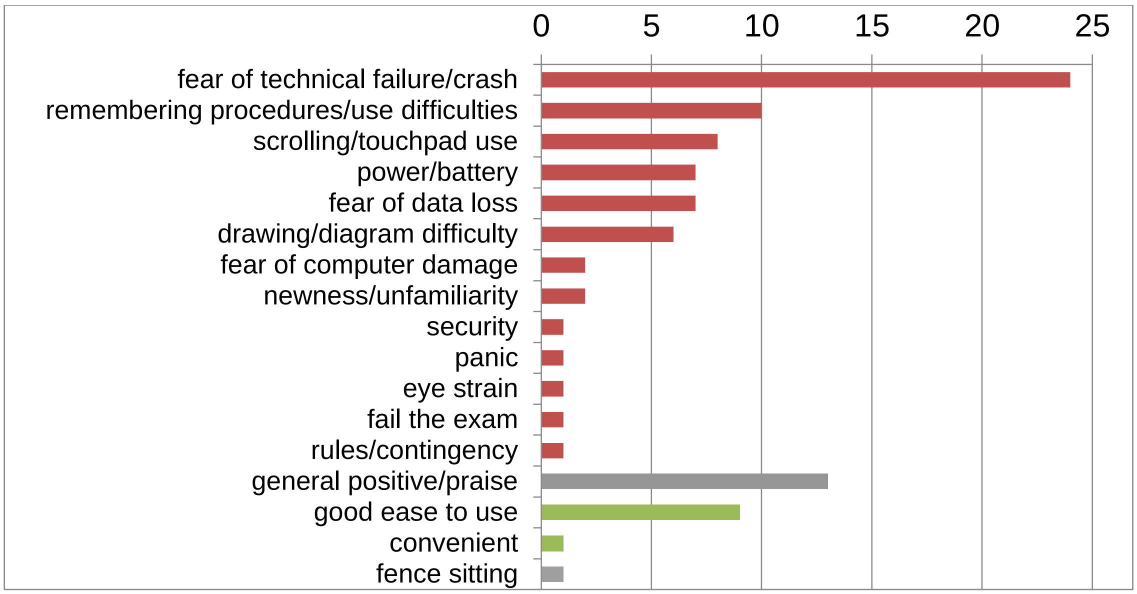


Figure 4 Emergent themes from student comments on the pre-exam survey.

Students were also asked to report any technical difficulties or issues. Some issues prevented them from using their laptop for the exam while others were minor inconveniences that could be overcome by providing a power socket, adjusting the software or further practice. Nineteen laptops were found to be incompatible with the e-exam system due to either a graphics hardware incompatibility (8 machines) or some other unknown reason (11 machines); the latter was likely due to BIOS/EFI firmware limitations. The range of technical issues identified is shown in figure 5.

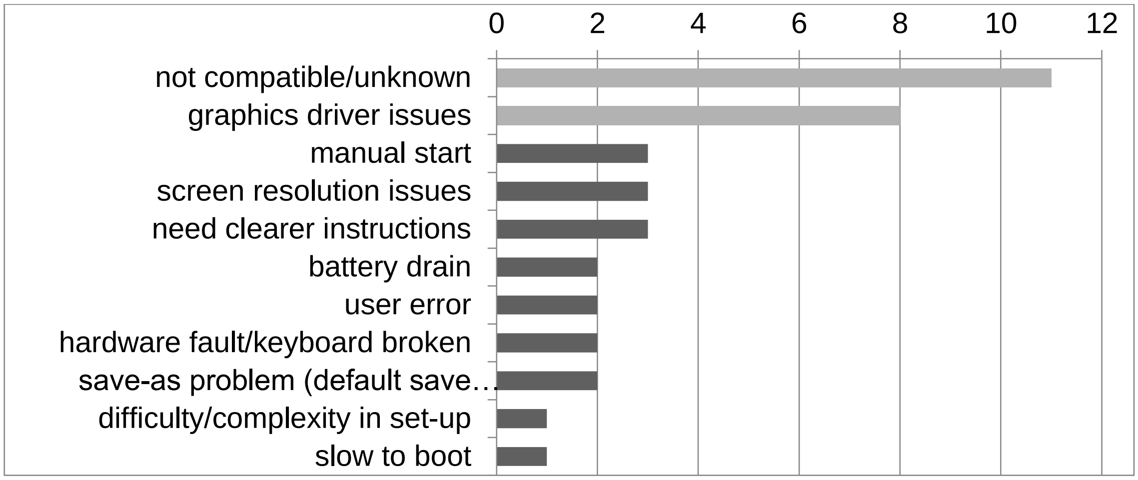


Figure 5 Count of technical issues encountered during set-up sessions

Following the exam

Immediately following the exam students were asked to comment on the exam they had just experienced via three open-ended questions. Those that chose to type gave reasons including their good typing skills affording more time in the exam while allowing easier editing and making up for messy handwriting:

> "Quicker typing and the ability to edit or completely delete my answer without compromising on space." "I knew I would be able to go back and change my answers easily. I type faster than I write - I would have more time to answer questions." "I could get info down faster and examiner could read it." "It is cleaner, I make lots of mistakes when I'm writing and it usually ends in lots of scribbles everywhere." "I have ridiculously messy handwriting."

The avoidance of sore hands was also mentioned by several students:

> "You can write as much as you otherwise would but don't get a sore hand when typing."

Some students felt that typing was more 'natural' and it helped them think:

> "Much easier to construct arguments and to think clearly when typing." "Typing is more natural for me. I think best when I am typing and I feel I am able to work faster as well."

It was noticeable that those who chose to type were not particularly concerned about technical issues or the merits of using their own laptop. This may be due to the relatively few technical issues experienced during the trials. Those that chose to hand-write gave a broader range of reasons for their choice. Their fear of technology failure and a lack of confidence in the capabilities of their own laptop were expressed. Comments from students on their fear of technology failure include:

> "I was initially planning to type this exam but decided against it due to the unpredictability of machines." "Expecting initial issues with new system." "I prefer to handwrite my exam as there is less opportunity for potential technical difficulties and computer glitches." "Don't want to risk losing data & programs on my computer." "I felt more comfortable handwriting as nothing can go wrong & I wasn't relying on the computer system to complete my exam."

Then there were those that were torn between their fear of technology failure and the avoidance of sore hands or messy writing.

> "I think more about what I'm writing when I handwrite but my hand gets sore and it isn't fast." "More stressful on computer, sore handwriting."

Students stated that they were accustomed to handwriting and its dynamics, particularly for exams:

> "I have done three years of prior exams writing so stick with what you know." "I've done all previous exams by handwriting. Don't want added stress in exam." "As an English as a second language speaker, I use drawings a lot to represent some words that I can't spell

perfectly". "When doing a rough copy I find the ability to cross out mistakes or write all over the page useful for organising arguments."

Students also use handwriting for taking notes in lectures and in their study:

"I study and revise by writing notes, flash card and drawing pictures. Because of the method I practiced with it is easier to remember content when handwriting." "It is also what I'm used to as I handwrite most of my notes and I prefer it that way."

Some students also stated that they 'think better with a pen':

"I feel if I write something out by hand I think clearer … it feels more solid than something on a screen." "I feel I think more carefully when writing and find it easier to read over my answer." " I connect better with my answers when writing."

Some students also chose to hand write despite acknowledging their messy handwriting.

"It's easier to handwrite. Though probably not easier for you to read my writing."

Others acknowledged trade-offs such as:

"If I were to type, my responses may be written better in terms of language. However I feel that under exam pressure, I do not have time to think as much and I would not be able focus when looking at a computer screen."

Apathy regarding the e-exam trial was also a contributing factor.

"Lazy to bring laptop." "Bringing a laptop to today's class was inconvenient." "Less hassle, didn't have to lug my computer around."

A lack of access to suitable equipment was raised (although 'loan' laptops were made available).

"I do not own a laptop so did not think it was possible." "My laptop battery is not good enough to sustain for half an hour of the exam. If desktop is provided I may consider using typing exam." "My computer didn't support the software."

Uncertainty about the practicalities of typing was also expressed.

"I was unsure I would like typing under pressure." "I didn't know if the computer would work and I didn't how I would react."

A couple of students highlighted the different behaviour of the e-exam system that follows Windows conventions compared to their regular operating system OSX (having tried at a set-up session). This caused issues for these students:

"The e-exam resets the shortcuts, too confusing to figure out in 15 minutes."

Overall the majority of students who typed stated that they felt their good typing skills would afford them a time advantage. Student comments included "Typing is an easier quicker way to write paragraph long answers" and "Thought it would be more time efficient." This was mirrored, although to a lesser extent, by around one fifth of those that hand-wrote who felt they had poor typing skills.

Around 40% of those who typed also said they felt that their handwriting was not up to par. One typist remarked: "I have terrible handwriting. Felt bad about it". The potential to edit work after initial writing was also nominated by 40% of typists. Of those that chose to handwrite their exam, the top two reasons stated were a fear of technology failure (30% of hand writers) and a preference for the familiar mode of hand-writing exams (25%). A count of the reasons given for their choice of exam mode is displayed in Figure 6.

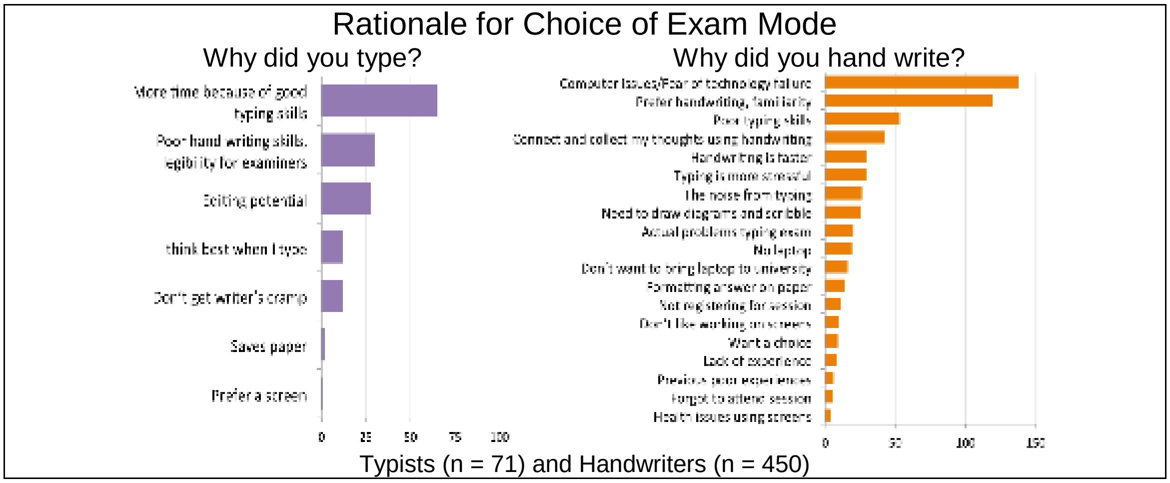


Figure 6. Rationale for choice of exam mode.

Trends across the phases of the study emerged. There were many similarities between the comments of those that chose hand-writing and the comments obtained in the pre-trial institution wide survey from students who were sceptical about computerised exams. This is not surprising given that the vast majority of both groups were commenting from positions of inexperience of computerised exams.

A general trend was noted in the comments of students who elected to type in that they were still cautious having just tried the e-exam system at the pre-exam set-up session but were then much more positive in their comments following the exam.

We also noted the preponderance of shorter comments on the hand-written surveys conducted during the trial phase versus the online survey conducted in the pre-trial phase, this somewhat supports the notion that typing engenders more verbose responses than does handwriting (Mogey & Peterson 2013).

Conclusion

Despite the commonality of using computers for assignments and reports during semester, a large majority of students in these trials choose to hand-write their exam. They provided a range of reasons why this was so, from a fear of technical failure and poor typing ability, to their comfort with the status quo. We could speculate to a degree, that the preponderance of hand written exams has become a self-reinforcing phenomena. It to be expected that students will take steps to enhance their chance of success in exams by training themselves to work with a pen using techniques such as hand-writing notes in lectures, re-writing notes for revision and using outlines to structure their work. A study by Mueller and Oppenheimer (2014) examined the impact of using a laptop to take notes in lectures on student success in exams and found that handwriting led to better test results in their experiments. The rationale given by Mueller and Oppenheimer (ibid) was the performance differences were due to the different way in it becomes necessary to reprocess messages being recorded by slower handwriting versus the ability to type verbatim with very little processing by the brain. However, their study only tested students using pen-on-paper quizzes and did not utilise any computer based testing. We can speculate that in a world where the keyboard is a dominant means of examining, students may take deliberate steps to train themselves in this mode of production, adjusting their exam preparation strategies accordingly. We are still in the very early days of using computers for high stakes testing, yet the common use of keyboards in other areas of study may already be leading to some changes in the way students work best. Students who chose to type their exam clamed a higher proficiency with a keyboard, felt better able to compose their responses and felt that they thought better with a keyboard. It was noted earlier in this paper that the introduction of computerised exams has the potential to lead to downstream changes to the overall curriculum (Fluck & Hillier 2014), it may yet lead to changes in the way students study for exams too.

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Using a Chinese Remote Associate Game to identify interest in gameplay and its relation to learning attitude and continuance intention to play

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A Chinese Remote Associate Game (CRAG) was used to understand the role of interest and its relation to learning attitude and continuance intention. The game requires players to identify the missing character common to a set of 3 to 5 phrases. To level up, players must use their prior knowledge and convergent thinking skills to identify the missing character. 70 samples were collected from 5th grade students and subjected to confirmatory factor analysis and structural equation modeling (SEM) with partial least squares regression (PLS).Though direct correlation between learning attitude and self-confidence was not observed, the results indicated that a positive learning attitude leads to greater learning interests. The same interests then positively affected the learners' continuance intention and their self-confidence during game playing. Finally, self-confidence in playing CRAG can predict the continuance intention to play.

Keywords: Chinese remote associate application, attitude, interest, confidence, continuance intention

Introduction

People love to play games. Games undoubtedly entice the attention of both children and adults. According to Prensky (2001), games are the most favored learning method by human brains. Squire (2003) also pointed out that by using teaching techniques that guide the learning process and by introducing learners to challenging association games, leaners' curiosity and interest can be inspired and cultivated. These methods also encourage learning feedback. By allowing players to explore the gameplay designed and make decisions accordingly, learning abilities can be improved. This type of comprehensive problem-solving strategy has a positive impact on learning results (Kiili, 2005).

However, the benefits of educational games are not limited to this. Piaget (1962) suggested that games are a means for young learners to practice and consolidate their newly acquired skills. As suggested by Bruner (1972), they may even increase learners' competency and adaptability. Similarly, Vygotsky (1978) pointed out that games improve children's creativity and problem solving skills by exerting positive influences on their learning behaviors. Giannakos (2013) pointed out an advocator for learning through games, also stated that games could become an active learning tool. Further, Hong and colleagues (2009) claimed that games are the most active learning activity and that learning through interesting game-like processes is the most ideal learning method. By inciting interest, computer games subtly teach learners the attitude of solving problems by actively seeking the experience and skills needed (Chang & Yang, 2010; Lowrie & Jorgensen, 2011). Thus, it is believed that greater learning results ensue from this type of game-based learning.

When language learners begin to learn a new language, they often take a word (or character for Chinese learners) and compound it to create phrases. However, in the remote associate games, the process is reversed. They require students to associate stimulus words or characters to find a common element among them. This is a fundamental way of language learning because it asks the learners to make use of their prior knowledge or experience and of their logical thinking ability to form a concept. It deepens learners' impressions of the phrases and progresses language learning. How this Chinese Remote Associate game affect learners' emotional respone has not been studied. Thus, this study intended to use a Chinese remote associate game to explore the relationship between affective factors, such as learning attitude, interest in gameplay, confidence in game playing, and continuance intention.

Attitude toward learning Chinese (ATLC)

In terms of learning attitude, Biggs (1996) considered learning attitude as an attitude towards learning activities. He defined it as a psychological response to teachers, materials or exams in an individual's learning process. On the other hand, Towel (1982) considered learning attitude an implicit lesson that affects students' learning results. It is a learned mental readiness that guides learners through their learning processes. Trigwell, Prosser, and Waterhouse (1999) believed that learning attitude can be seen as either an attitude towards the learning process itself or the attitude towards the learning environment. The ATLC as affective component that the leaners' emotional response to learn Chinese components. Accordingly, this study design a learning activity that may satisfy learners' needs evoke positive attitude which in turn lead to greater resonance for learning. They aimed to uncover whether students had the motivations to actively learn and solve problems when facing difficulties.

Interest in gameplay

There are two types of interests, which are individual interest and situational interest (Hidi, 1990). Because of the fact that this research was centered on the language field and how interest elicited in certain learning situations affected language learning performance, the main discussion focused on situational interest. Situational interest is the type of interest that is evoked by the environment. It is an immediate but temporary response to the stimuli in the environment and may manifest as an emotional response or as a fluctuation in attentiveness. To educators, stimulating situational interests is the key factor in inspiring learners' participation (Chen, Darst, & Pangrazi, 2001). Not only are the impact and effectiveness of situational interest more easily observed, situational interest can also be controlled and improved by the educators. Harackiewicz and colleagues (2008) pointed out that situational interest may encourage the growth of individual interest over time. Even though a learner may begin with a lower individual interest, an elevated situational interest may lead to long-lasting individual interest in the subject (Hidi & Renninger, 2006). Thus, the research inferred that if situational interest was improved during learning and game playing, learners' interest might be maintained as a consequence. Thus, the research employed the Chinese remote association application to raise learners' situational interest and to further research into the relationship between situational interest and continuance intention.

Self-confidence in game playing

Shavelson and Bolus (1982) argued self-confidence as an individual's collective self-perceptions that are formed from experiences with the environment and heavily influenced by experience. Self-confidence is an individual's belief that he or she has the ability to produce results, accomplish goals, or perform tasks competently (Schunk, 1991). From educational perspective, self-confidence is a student's perception of whether or not they will be successful at the activity, and is the motivation variable that addresses the need for a student to have a sense of success in challenging tasks, which is also intended to be positively affected by playing a new device (Kebritchi, Hirumi, & Bai, 2010). In line with this, students' expectation of challenging Chinese Remote Associate Game is a component of their confidence in competition against other students. However, in this game students cannot be pre-game learning in pursuing ways to become proficient in the skills before they actually involve in this game. As such, self-confidence measures the different level after playing game.

Continuance Intention to play game

Past researches indicated that the key to success for many information systems is the consumers' willingness to repeat use of or purchase of the service after their first exposure to the system. In a research done by Bhattacherjee (2001), the researcher concluded that the users' continuance intention to use information systems is very similar to consumers' decision to repurchase. Users' willingness to use a certain information system for a second time depends on their experience in the initial trial. He further suggested that users will continue certain behaviors if they believe that the said behaviors can be beneficial or helpful. The willingness of members to continue interacting on a site significantly influences intentions to revisit the site (Elliot, Li, & Choi, 2013; Okazaki & Yagüe, 2012), and this reaction can be affected by the expectation as well as user experience (Lin & Hsieh, 2007).Hence, this research assumed that students' continued intention in using the gaming application should be under similar guidelines. If the students believed the game to be beneficial, or if they enjoyed the gaming process, the students' continuance intention would also be strengthened.

Research Hypotheses and Model

Based on the mood-as-information model (Schwarz & Clore, 1983, 2003), which states that individuals use their current mood as input when making various kinds of judgments in information processes, this study examined whether competitive game playing related to affect change that perceptions may shape subsequent affect (Carver & Scheier, 1998). Marton and Saljo (1997) argued that with information on things, people make changes on attitudinal and behavioral level, which means that a generally favourable attitude towards learning translates into a high probability of manifestation of sustained learning behavior. The greater the learners' interests and the higher their motivations were in the game, the more positive their learning attitude was. The relationships between the learners learning attitude and the interest in gameplay, self-confidence in game playing, and continuance intention were then examined in this study. As seen in Figure 1, the interrelatedness of the four affective factors in CRAG was presented. The hypotheses were as follows.

- H1: Learning attitude significantly correlates to interest in gameplay.
- H2: Learning attitude significantly correlates to confidence in game playing.
- H3: Interest in gameplay significantly correlates to self-confidence in game playing.
- H4: Interest in gameplay significantly correlates to continuance intention
- H5: Self-confidence in game playing significantly correlates to continuance intention.

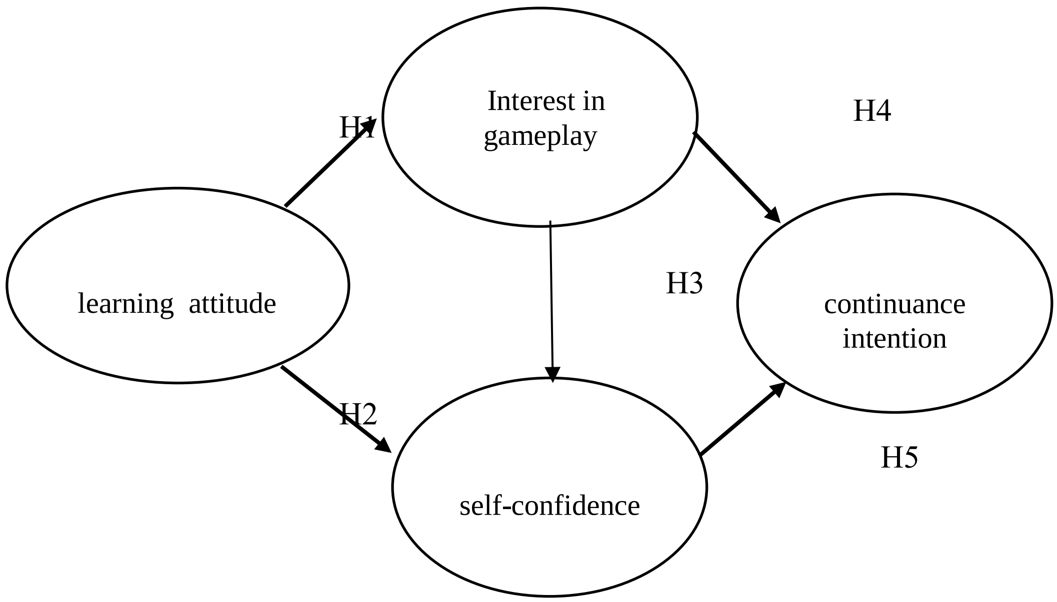

Fig. 1 Research model

Research Design

The research aimed to amplify learner's sensitivity to language and consolidate their thought process with a Chinese remote associate game based application. There are various levels in the game, starting from the easiest associates to the hardest. Each problem must be solved with learners' prior knowledge within the allotted time. In the game, the players are presented with three phrases, each with a blank that represents a character common to the phrases. To score, players must identify the common character represented by the blanks. The research was conducted on 70 5th grade students in Taiwan. Questionnaires were administered prior to the experiment to understand the learning attitude possessed by the sampled students. This was then followed by 5 gaming sessions using the Chinese remote associate application. After each session, another questionnaire was administered to acquire data regarding players' situational interest, confidence in game playing, and their continuance intention to play for further analysis.

Research Context

The present research consisted of a single group quasi-experimental study. It explored the relationship among ATLC, situational interest, confidence in game playing, and continuance intention of 5th grade students after 6 trials with the CRAG.

Research participants

The participants of this study were 5th grade students selected through purposeful sampling in an elementary school in New Taipei City. A total of 70 students from 2 different classes were chosen to participate in the study, including 39 male participants and 41 female participants. The participants were then presented with the Chinese remote association application.

The Chinese Remote Associate Game

The Chinese remote associate application: The application used in this study was an App learning platform developed and designed by National Taiwan Normal University and can be used with Ios and Android system. The CRAG requires learners to utilize both prior knowledge and associated thinking to identify the common missing Chinese character represented by "□" in 3 to 5 phrases. The participants had 1 minute to solve each problem.

Fig 2. Interface of CRAG


Fig. 3 A question screenshot in CRAG

Procedure

The research administered questionnaires regarding learners' learning attitude before the experiment began and maintained the same learning instruments and instructions throughout the experiment. Gameplay regulation: The participants were exposed to the application for a total of 6 times, twice a week and 10 minutes each time. However, the research was divided into three stages.

(7) Pre-experiment questionnaire measurement: Before the first game trial, pre-experiment questionnaires, which took roughly 3 minutes to complete, were filled out by the participants.

(8) Gameplay implementation:10 minutes per trial. Students were allowed 1 minute per question to solve the problem. After 6 trials, each student's correct answer is tallied.

(9) Post-experiment questionnaire measurement: After gameplay, students were given questionnaires lasting roughly 3 minutes.

Measuring questionnaire

The present research used questionnaires specifically designed for the experiment on ATLC, situational interest, and self-confidence during game playing and continuance intention. All questionnaires were designed with typical five-item Likert scale. For response options, each question encompassed five Likert scale, which were strongly agree, agree, neutral, disagree, and strongly disagree. The participants circled the item that best described their opinions.

Attitude toward learning Chinese measurement: This research was concerned with learners' willingness to solve problems when facing difficulties in language learning. For example, whether the students actively sought help from others or consult the dictionary when they saw words or phrases that were outside of their lexicon was a reflection on their learning attitude. The questions in the questionnaire administered concerned the conative component of learning attitude. Adapted from Robbins and Judge (2007), the study looked at the attitude towards learning Chinese in terms of self-assessment statements concerning aspects pertaining to the Chinese academic learning. As favorable attitudes towards learning leads to an increased level of engagement in the learning process, associated with a deep approach to learning (Marton & Saljo, 1997), the attitudes towards learning Chinese that are considered favorable become objective in statements such as: "I`m looking for opportunities to learn new Chinese words.

Interest in gameplay measure: Regarding situational interest, previous research suggests that such feelings as liking and enjoying an activity may be related to a person's interest and a heightened psychological state that accompanies engagement in learning for a given period of time (Roeser & Peck, 2009). Accordingly, the present study adapted Hong et al.'s (2014) online learning interest scale to semantically measure the state interest in the formation related to liking, enjoyment, and engagement.

Self-confidence in gameplay measure: The present study adapted Wehr-Flowers's (2006) confidence scale which was designed to measure a person's confidence in their ability to learn and perform a task well. .

Continuance intention to gameplay: Adapted from Bhattacherjee (2001) and Bhattacherjee et al. (2008), continuance intention occurs when individuals develop positive attitudes and an overall attachment to a Chinese Remote Associate game content. This study defines continuance intention as the continuous revisiting the App of Chinese Remote Associate and the development of new Chinese phrases through that App.

Results

The questionnaires in this research were divided into 4 constructs, totaling 26 question items were verified through utilizing confirmatory factor analysis with Partial Least Squares (PLS) to analyze reliability and validity. Then, structural equation modeling was applied to understand the pathway of research model.

Reliability and validity analyses

From the statistic results compiled in the study, the mean was determined to be in between 3.884 and 4.324. The confidence in game playing construct received the highest mean of 4.324, followed by ATLC's 4.2 in second place. The standard deviation fell between 1.006 and 1.375, with the continuance intention construct's 1.375 being the highest. The situational interest construct received the second highest score of 1.197 in standard deviation. The factor loadings for questions in every construct were all greater than 0.5 except for the 5th question in the language learning construct.

As seen in the reliability and validity analysis in Table 2, the mean, standard deviation, Cronbach's alpha, Average Variance Extracted (AVE), and composite reliability were analyzed. From the results, Cronbach's alpha was used to determine the consistency and reliability. The ATLC construct (6 questions) had the lowest Cronbach's alpha of 0.823. The situational interest construct (9 questions) had the second lowest value of 0.966 followed by the continuance intention construct's (5 questions) 0.972. The confidence in game playing construct had the highest Cronbach's alpha of 0.978. From Table 2, it was clear that the AVE of the construct varied between 0.547 and 0.9. The continuance intention construct had the highest AVE of 0.9, followed by the confidence in game playing construct's 0.899. The AVE for all constructs was all above 0.5. Thus, the results were further analysed in terms of the questionnaires' convergent validity and discriminant validity (Hair et al., 2009).

The composite validity of the 4 constructs was between 0.875 and 0.982. The confidence in game playing construct had the highest composite validity of 0.982, followed by the continuance intention construct's 0.78 in second. Every construct's composite validity values were all above 0.6. Overall, the results fell within the constraints of sound composite validity (Hair et al., 2009).

Table 1. Factor Loadings, Mean, and Standard Deviation

	Mean	Standard Deviation	Factor Loadings
Attitude toward learning Chinese			
1. **When I watch the television, if a character says a word or phrase that I do not understand, I would look it up.**	3.972	1.134	0.860
2. **When I read, if I see a word or phrase that I do not understand, I would look it up.**	4.169	1.014	0.856
3. **When I speak to others, if I hear a word or phrase that I do not understand, I don't pretend to**	3.972	1.253	0.638

know it, but would rather look it up.			
4. **When I speak to others, if there is a word or phrase that I want to use but do not know how, I would ask the person whom I am speaking to.**	4.338	0.940	0.765
5. **When I am writing, if there is a word or phrase that I want to use but do not know how, I would ask for other people's advice.**	4.704	0.641	0.468
6. **When I post anything online, if there is a word or phrase that I want to use but do not know how, I would look it up online.**	4.042	1.325	0.775
Interest in gameplay			
1. I really liked the CRAG.	4.296	1.224	0.929
2. I really liked the interactions in the game.	4.268	1.171	0.935
3. I wanted the teacher to let me play the game some more.	4.197	1.203	0.943
4. I felt very excited because of the game.	4.254	1.105	0.966
5. I was very happy after playing the game.	4.282	1.098	0.950
6. I thought the game was very fun.	4.183	1.187	0.925
7. I wanted to keep playing the game. I did not care if I had gotten the wrong answers.	4.239	1.101	0.733
8. I was focused when I was playing the game.	4.225	1.136	0.831
9. I was so involved in the game that I did not realize that the time was up.	3.577	1.546	0.765
Self-confidence in Game Playing			
1. Compared to the first time I played the game, I was more confident in navigating through the game interface.	4.366	0.960	0.970
2. Compared to the first time I played the game, I was more confident to strategically achieve higher scores.	4.310	0.965	0.964
3. Compared to the first time I played the game, I was more confident to overcome the pressure that came with time limitations.	4.310	1.050	0.950
4. Compared to the first time I played the game, I was more confident to play the game without distractions.	4.324	0.953	0.944

5. Compared to the first time I played the game, I was more confident to receive improved scores.	4.352	0.958	0.927
6. Compared to the first time I played the game, I was more confident to get the correct answer.	4.282	1.149	0.934
Continuance Intention			
1. I think the game was worth my while.	4.056	1.319	0.950
2. I would like to continue playing the game if I have the chance.	3.986	1.439	0.974
3. I would continue playing the game.	3.958	1.336	0.963
4. I would spend more time playing the game in the future.	3.732	1.362	0.963
5. I would recommend the game to my friends.	3.690	1.420	0.891

Table 2. Reliability and Validity Analysis

	Question Number	Mean	Standard Deviation	Cronbach's **α**	AVE	CR
ATLC	6	4.200	1.051	0.823	0.547	0.875
Situational Interest	9	4.169	1.197	0.966	0.793	0.971
Confidence during Game Playing	6	4.324	1.006	0.978	0.899	0.982
Continuance Intention	5	3.884	1.375	0.972	0.900	0.978

Path analysis

The structural equation modeling (SEM) was applied to the data obtained from questionnaires for analysis. After examining and verifying the validity and reliability of the theoretical model with PLS, the theoretical model was analyzed. The path coefficient and whether the hypotheses were supported by the results are as follows.

The influence of ATLC on interest in gameplay was significant (β=0.465; t = 4.653***), and thus, H_1 was supported. The influence of ATLC on confidence in game playing was not significant (β=-0.044; t = 0.360), and thus, H_2 was not supported. Under the theoretical model of the present research, the influence of situational interest on confidence in game playing was the most significant (β=0.757; t =6.134***). There was a significant positive correlation, and thus, H_3 was supported. The influence of situational interest on continuance intention was significant (β=0.597; t = 3.633***), and thus, H was supported. The influence of confidence in gameplay on continuance intention was significant (β=0.323; t = 2.043*), and thus, H_5 was supported. Further, the explanatory power of interest and confidence in game playing versus continuance intention was 74.4%.

Under the theoretical model of the present research, the influence of situational interest on confidence in game playing was the most significant (β = 0.757; t = 6.134***). There was a significant positive correlation, and thus, H_2 was supported. The influence of situational interest on continuance intention was significant (β = 0.597; t = 3.633***), and thus, H_1 was supported. The influence of ATLC on interest in gameplay was significant (β = 0.465, t = 4.653***), and thus, H_3 was supported. The influence of ATLC on confidence in game playing was not significant (β = 0.344, t = 2.661), and thus, H_4 was not supported. The influence of confidence in gameplay on continuance intention was significant (β = 0.323; t = 2.043*), and thus, H_5 was supported. Further, the explanatory power of interest and confidence in gameplay versus continuance intention was 74.4%.

Table 3. β coefficient, T-statistics, R^2

Path	β coefficient	t	construct	R^2
ATLC→ situational interest	0.465	4.653***	situational interest	0.216
ATLC→ confidence in game playing	-0.044	0.360	confidence in game playing	0.544
situational interest→ confidence in game playing	0.757	6.134***	continuance intention	0.744
situational interest→ continuance intention	0.597	3.633***		
confidence in game playing→ continuance intention	0.323	2.043*		

note: ***p<0.001，**p<0.01，*p<0.05。

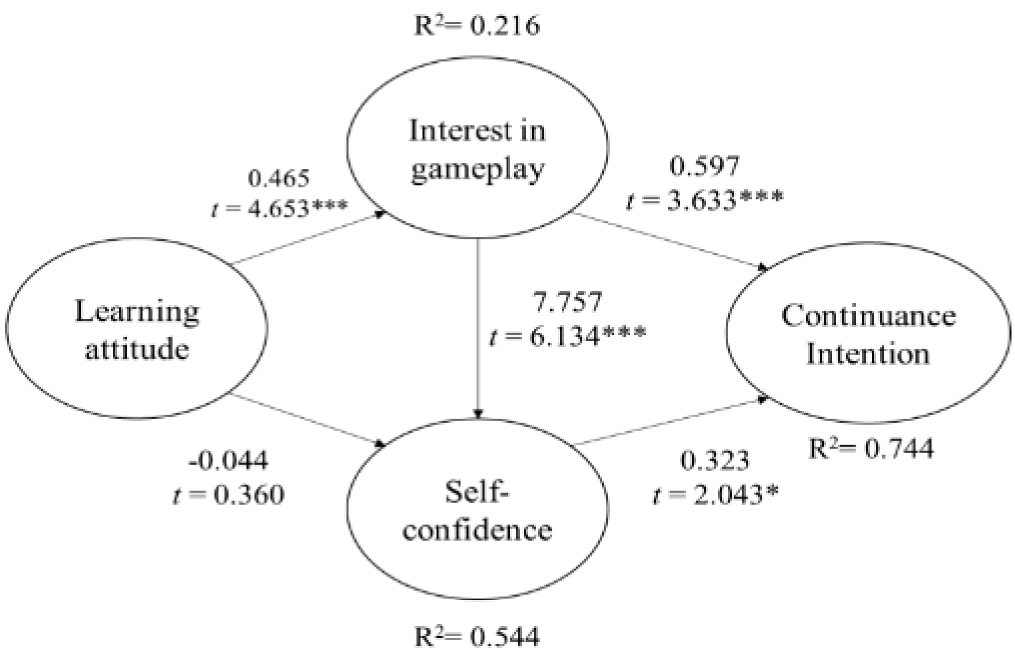

Fig. 2. SEM picture of β coefficient

Discussion

From the results of the study, it shows that ATLC would have a significant influence both on interest and confidence during game playing. Furthermore, it was clear that interest and confidence during game playing had a significant influence on continuance intention. Thus, to inspire the students' continued use of CRAG, not only did the content have to be fun and engaging, the learning environment also had to be ideal to promote self-confidence in gameplay.

The fact that the game questions in CRAG gradually increased in difficulty allowed the students to familiarize themselves with the structures of the game. This made leveling up in the game easier, which in turn, helped raise the students' self-confidence in game playing. Future educational applications can refer to this application in creating interesting scenarios which promote learning interest. The gradual increase in difficulty and the leveling up mechanism helped retain students' continuance intention in learning effectively.

By using the mood-as-information model (Schwarz & Clore, 1983, 2003) to explore individuals use their current mood as learning input when playing CRAG. Though learning attitude is acquired, and has the tendency of being persistent and consistent, it still varies in terms of its subject and magnitude (Ramsden, 2003). Bearing this concept in mind, the research limited learning attitude to "the attitude towards the learning Chinese" in hopes of understanding the degree of influence that the learners' interests and self-confidence in gameplay and had on willingness of continue playing CRAG. Consistent with this idea, this study revealed that the higher level of ATLC the participants had; the higher level of interest in gameplay. The higher levels of interest and self-confidence in gameplay the participants had; the higher level of continuance intention to play CRAG. But, ATLC could not significantly predict self-confidence in gameplay.

Wigfield and Eccles (2000) considered learning attitude as either a positive or negative disposition towards the person who provides guidance, the materials taught, and the general learning environment. Learning attitude can generally be seen as the continued and consistent view of learning. The attitude and motivational aspects involved in the learning process, from design to implementation to assessment and evaluation.

There were only 70 samples collected. Future studies should be meticulous in collecting larger samples from different classes, and especially classes with different academic foci. Practically, the present research confirmed the notion that interest in gameplay and self-confidence in game playing helped students retain continuance intention to use the educational application. Future applications of the results of this study in classrooms and student counselling should also be discussed.

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Mobile Learning in K-12 Education: Personal meets Systemic

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This paper details one school's approach to mobile learning. It provides a model for approaching such learning that takes into account the cultural contexts, dynamic nature of digital change, and school structural challenges that all play a part in determining worthwhile education appropriate for the Digital Age. Through detailing several stages that the school has undertaken to build deep teaching and learning opportunities, insights into how mobile learning is part of an evolutionary approach that educational institutions can take on is provided. Case Study analyses are included to provide practical perspectives. This model is adaptable, but contains a core commitment towards incorporating digital learning through mobile devices as an integral part of any school's teaching and learning approach.

Keywords: mobile; school; digital age

Introduction

All K-12 schools contain common characteristics, consideration of which can assist others to widen understanding. As well, there are particular aspects that are the product of unique historical and cultural developments. Digital meanwhile continues to evolve in depth, breadth and preference. Bringing Digital and School together means both opportunities and challenges as personal learning interacts with systemic education in new ways.

When considering the impact of mobile learning on any educational institution, as with any technology, it is important to first obtain cultural understanding. Recent history is littered with new technologies that have failed to meet advocate contentions for schools. Cuban (1986, 2001, 2014) has summarised such shortfalls. Yet within the wider community smartphones are in the ascendancy (Columbus, 2014) and consequently are likely to demand increasing educational consideration.

Defining Mobile Learning

Differing interpretations of mobile learning, and what effect mobile devices will have on teaching and learning, have been an on going discussion for over a decade (Liu et al, 2014; Laouris & Eteokleous, 2005; Craig & Van Lom, 2009). Some see mobile devices as distinct from personal computers because of their ubiquity and portability (Shuler, Winters, & West, 2013). Laouris and Eteokleous (2005 p. 2) identified use of the term mobile "as synonymous to a mobile phone." They went on to differentiate between e-learning as relating to "multimedia, interactive, hyperlinked, media-rich environments", with mobile learning referring to the "spontaneous, intimate, connected, informal, lightweight, private, personal." They conclude that mobile learning leads to new relationships of time, space, learning environment, content, technologies, user attributes, and process. Liu, Navarrete and Wivagg (2014) updated this to focus on affordances available through mobile devices: flexibility, accessibility, interactivity, and motivation and engagement. Baran (2014) lists mobility, access, immediacy, situativity, ubiquity, convenience and contextuality as overlapping characteristics of mobile learning. Churchill and Churchill (2008) provide a good list of affordances that mobile learning could promote: multimedia access tool, connectivity tool, capture tool, representation tool, and analytical tool.

But, as McFarlane (2015) points out, technology cannot do this on its own, and as Baran (2014 p. 17) concedes, "the diversity of research on mobile learning has made it difficult to generate a single definition or to determine generally added benefits." Laouris and Eteokleous (2005 p. 1) warn that the term can depend on "who is asking, and what the context is." While there is a distinction to be made between laptops and phones, there is also a strong overlap, although Sharples (2009) draws a clear distinction between mobile learning and classroom use of desktops. He goes on to provide a strong framework for defining mobile learning:

- may be mobile (but not necessarily if mobile devices are being used in designated spaces)
- may involve learning in non-formal settings
- may be extendable and interleaved across time and space
- may involve use across a variety of personal and institutional technologies
- presents ethical challenges if shared access a requirement
- can be evaluated by addressing "usability (will it work?), effectiveness (is it enhancing learning?) and satisfaction (it is liked?)" (p. 22)

Sharples (2013) also identified critical success factors as technology availability, institutionalised support. connectivity, (curriculum) integration, and (learning) ownership.

This is complemented by McFarlane (2015 p. 25), who points out that personal mobile devices can

- "facilitate individual, cooperative and interactive work in class

- enable sharing of ideas, knowledge, ideas and responses
- increase participation in whole-class settings
- enable learners to revisit prior learning
- provide opportunities for autonomy and independence
- permit storage of work and resources in one place at hand"

Mobile Learning in Schools

There remains strong support for the potential of mobile learning in schools as reflected in recent New Media Consortium (2013, 2014) *Horizon Reports*. These identify mobile learning as within twelve months of general adoption in 2013, going on to identify such learning as a key element of BYO adoption, personalised learning, cloud computing, gamification, and wearable technologies in 2014. Here no distinction is made between the level of device mobility.

Clarke and Svanaes (2014) provided an updated review on research into the use of tablets in education. They concluded that while there is need for more research, some common themes are emerging. These include the portable nature, access to information, interaction with personalised learning content, cost advantages, and ease of use. They drew on the UNESCO (2012) definition (Shuler, Winters, & West, 2013) as learning arising from use of mobile technologies such as mobile phones, smart phones, e-readers and tablets. However Clarke & Svanaes (2014) also point out that within K-12 schools context can vary depending on the student stage of development.

While mobile learning has been primarily concerned with personal mobile devices such as phones and tablets, there remains both significant overlap with other mobile devices, as well as some particular affordances that increased mobility can provide. However, the differences between personal learning afforded by mobile devices and educational focus on systemic learning can make mergers difficult and value arising difficult to clarify.

Research in school environments has to date not obtained significant traction. But as McFarlane (2015) notes, "could it be that the final step change in personal access to online resources and communications by young people using smartphones and tablets will be the factor that changes policy and therefore school attitudes to computer use?" (p. 141)

The Role of the Teacher

Seipold and Pachler (2011) refer to socio-cultural orientated approaches as a key to evaluating mobile learning. They see not only different kinds of learning, but also different environments for learning. K-12 Schools are institutions that operate with a strong set of social obligations that impact on what is possible and what is valued. They also deal with a wide range of maturation, from five year olds or below, to 17-18 year olds in their final stages before high-stakes testing leading hopefully to further study. As Laouris and Eteokleous (2005) remind us when they looked at mobile learning, context is critical.

Within K-12 schools a key determiner is the teacher. John Hattie, in the *Forward* to Bain and Weston's (2012) study of personal digital device use in schools, identified teacher mind frames as the most important enhancer and barrier to student learning. Bain and Weston agree with Hattie, that within schools there exists a fundamental issue of conservative standardised-based systems up against personal digital learning devices geared to support connection, reflection and construction. Teachers have the potential to risk and build value if they see positive possibilities, or negate if they feel educational value is wanting. Any school's approach needs to take this into account. As I found in my post-graduate studies (Turner, 1999) even when teachers are supportive, school structures can limit what is achievable. Socio-cultural considerations are therefore a key consideration.

The School

The school referred to in this paper is a K-12 co-educational international school located in Hong Kong. Nearly all of its students progress to tertiary education, often to universities spread across the world. It has high academic expectations. There are also many students who move in and out of the school, although a strong core percentage remains through most levels. It has a traditional timetable, teacher allocations and hierarchical curriculum through the International Baccalaureate (IB), Primary Years Programme (PYP), Middle Years Programme (MYP) and Diploma Programme (DP).

It is important to look deeper into any school to understand its digital ecosystems. There are many international schools spread across the world with similar surface characteristics. And as stated previously there is much that can be learned from other schools. But if one is to progress digital within a school an understanding of where the school is at, where it wants to go, and what it is willing to take on, is paramount. This includes taking into account the effect of legacy decisions. As Watters (2014 p.3) reminds us “the future of ed-tech is shaped by the history of ed-tech - whether we realise it or not.” So too the future of any school’s use of ed-tech.

A Short History of Mobile Learning in the School

Already acknowledged is the importance of understanding the cultural contexts of a school.

With this in mind, I first start by detailing where the school has come from to reach its current position.

For the school mobile learning has been defined as learning accruing through access to digital devices at-hand within the school and beyond. Historically this has been based on the school's 1:1 laptop program. Increasingly this is being widened to consider personal mobile devices such as phones and tablets.

A 2006 plan, **Sustainable Human Networks** led to the establishment of a group of educators tasked to help drive and support change, the introduction of a 1:1 laptop program from Grade 5 onwards, and a series of recommendations affecting curriculum, infrastructure and teacher training. The 1:1 laptop program was embedded for all Grade 5 through 12 students, who own and manage their own laptop with a school provided image.

A 2011 review led to a **Digital Learning Infusion (DLI)** plan built around infusion, as defined by the Florida Centre for Instructional Technology (2011) Technology Integration Matrix (TIM). This sought to infuse beliefs and practices that would improve student achievement, teacher practice, and support for the school's curriculum objectives and mission. A vision that "*digital technologies enable opportunities for greater active student learning that is valued, visible, connected and progressive*" provided a focus and driver for educational technology considerations.

The DLI led to the development of teacher digital learning certification and professional learning networks, more active student involvement, digital portfolios as more visible learning journeys, online learning environments, a digital literacy curriculum, global and environmental objectives, and strengthening of research.

The 2011 plan has been updated to take on new or emerging technologies deemed to have teaching and learning potential, such as those provided through Google Educational Apps suite, eBook construction, social media developments, and iPads as mobile personal learning devices. Digital Literacy curriculum development (Turner, 2014) drew on Meyer and Land's (2003) threshold concepts approach to help progress teacher and student digital learning capacity. A reaffirmation of the 1:1 laptop program to support inquiry-led learning, digital portfolios, and the infused approach to digital supported or enhanced learning constituted a continuing strong commitment to the role of digital teaching and learning in the school.

The school's commitment to mobile learning is evident in

- The student relationship with their laptop as a personal mobile learning device
- The use of digital devices to advance new and established learning
- Support structures and leadership commitment for progressing such learning

The extent to which this has been successful will be evaluated later in this paper against both the school's vision and affordances attributed to mobile learning.

The Current Situationg

The school is seeking greater use of mobile learning through 1:1 iPads in early years, extending the 1:1 laptops to include Grade 4, and supporting multiple mobile device use by senior students and teachers. Student digital portfolios in younger grades are replacing paper portfolios. This will enable younger students and their families to communicate and connect through blogging, build up a media based record of learning, and connect to wider audiences. Already increased engagement through personal ownership has been observed. Research insights are being developed within the school's in-school programs.

The laptop remains the primary digital device for all students from Grade 5 onwards, although iPads are being increasingly integrated in earlier years and Grade 4 is moving to each student having their own personal laptop. eBook construction and apps within the school link in with the use of mobile device. Chinese eBooks, with their use of audio and interactive media, are a good example of this. An updated vision to include "*constructing visible, connected and progressive learning journeys to support reflection, feedback, ownership and conceptual depth (for teachers and students)."* reflects a desire to go deeper into constructing and supporting learning of value at all levels.

Evaluating Mobile Learning

How then to best see if a school's use of mobile technologies is leading to better educational value? The OECD (2013) case study methodology identifies analysis of primary documents, interviews of key stakeholders, discussion with focus groups of stakeholders and a discourse analysis of relevant media as an appropriate investigative approach. Sharples (2009), in the Mobile Learning Organisers Project, called on diary and interview methods. Traxler and Kukulska-Hulme (2005) defined a good evaluation as enabling quality sharing, reporting, and embedding connections that are consistent, rigorous, scalable and ethical. The school has used all this to underpin examination through

- support for individual teacher explorations of possible value as part of team considerations
- discussion within team groups and departments, including recording through collaborative tools such as Google Docs.

- incorporation of formal research projects
- community discussions and reviews

A critical feature in the school's digital ecosystem is each student from Grade 5 onwards having a personal digital portfolio, which is used to publish digital work, gain peer and teacher feedback, and chart learning against school curriculum objectives. Earlier grades are also developing similar portfolios. This can provide a visible record of each student's digital learning journey, while help to connect teacher digital pedagogy.

The following case studies are connected by the use of personal digital learning devices; using digital portfolios to provide insights into ways that might progress mobile device affordances and the school's vision for use of such devices. The following affordances identified earlier in the paper will be used to review up against the school's stated vision:

- increased access to learning
- building personal relationships with learning
- personalisation of learning choice and pathways
- increased accessibility to content
- increased learning interactivity
- connecting across contexts

Convenience, ease of use, mobility and ubiquity, can be evaluated through the extent of use, depth of tasking and interaction, and formation of teaching and learning connections. These fall outside the focus of this paper.

Case Study One: Grade 11 Parent Conferencing

Since 2013 all grade 11 students have developed and used a digital portfolio as part of their conversations with their parents on the progress they had achieved within the IB DP (Grades 11-12).. This conversation covers the Community and Service, Theory of Knowledge (TOK) and Extended Essay aspects of the DP. This is bound by the IB's focus on developing Approaches to Learning (ATLs). In addition to sharing with parents evidence of achievement through personal construction, the folios also link with other subject portfolios (such as in Digital Art work) and support possible university interest in a student's school performance. Students choose their own digital publishing medium and put together a personal selection of materials.

The student use of a personal school digital portfolio to help support parent conferencing meets the following mobile learning affordances:

- *Increased access:* parents could access and engage in the conversation both in-school and beyond, thus widening student learning interactions and parent understanding of their child's progress
- *Building personal relationships with learning*: students develop their own digital portfolio as a reflection of their learning journey
- *Personalisation of choice and pathways:* students choose what to put in their digital portfolio to best reflect their own learning achievements and the medium for publishing
- *Increased accessibility to content:* students could link to other learning and draw on

digital tools such as Google Educational Apps to provide examples

- *Increased learning interactivity:* student developed their own links and can get feedback from parents and teachers through the comments feature. TOK is one area that draws heavily on student discourse with others.

- *Connecting across contexts:* Subject connections can also be included, and wider use, such as for university selection, is available

School objectives are supported by

- *Valued*: The use has continued through a change of DP Coordinator
- *Visible*: The digital portfolio is a visible window into student learning appreciated by parents, peers and teachers as a means to celebrate progress and identify areas for support
- *Connected*: Students can draw on digital folio work created in-school in previous years as well as informal digital learning to enhance their digital portfolio
- *Progressive*: The addition of parental understanding of the non-academic subject aspects of the IB is progressing.

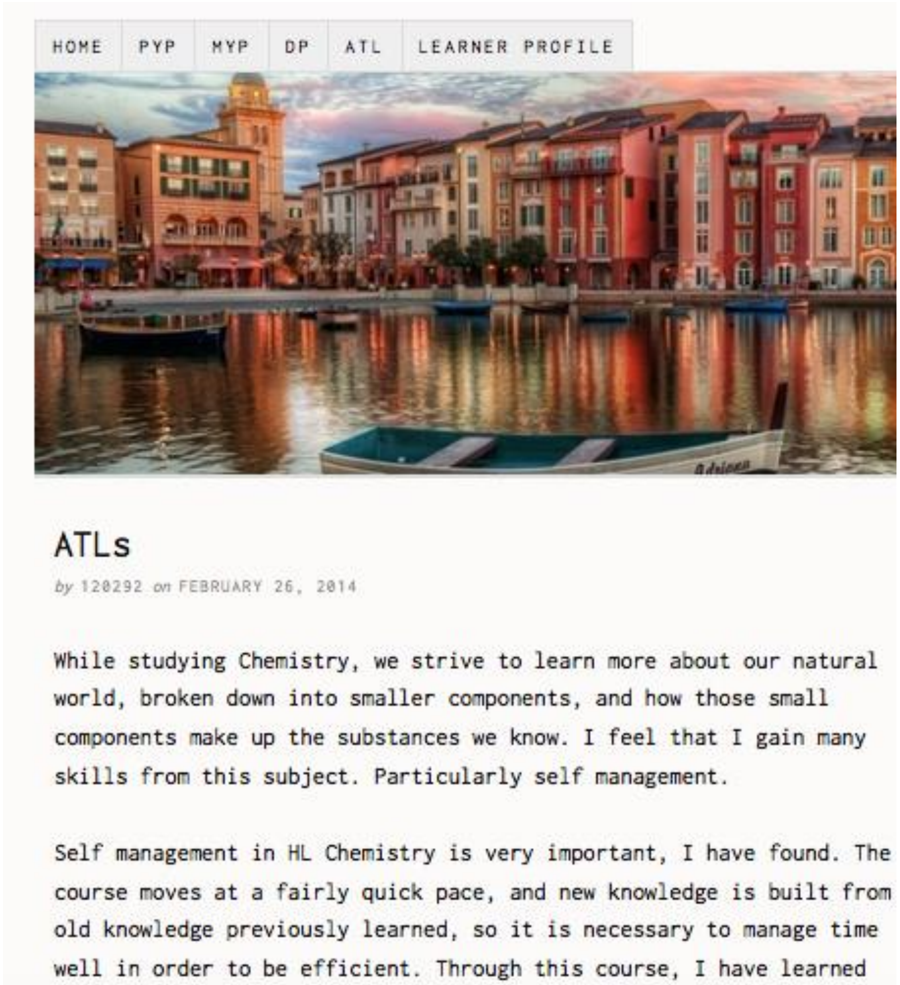

Figure 1. *Grade 11 digital portfolio example*.

Case Study Two: Grade 8 eBook and Process Journal

All Grade 8 students as part of their Science studies create an eBook on a designated authentic Science topic. This project has developed over the past three years, with this year's eBook on Diseases developed and evaluated with Grade 5-6 students as the intended audience. Each Grade 8 student team of three to four students complete a chapter, which is then joined into a grade-wide book. Google Docs is used to connect student group discussions and unite knowledge on both personal and group levels. The project satisfies the following mobile learning affordances:

- *Increased access:* students can work on the joint aspects even when group members are elsewhere (a critical part of group work in digital domains). Access to their work is extended through the school's Management Learning System.
- *Building personal relationships with learning*: students develop a valued relationship with software and its capabilities. The student learning of new software, iBook Author, was student led and supported by teacher understanding of student digital literacy development needs.
- *Personalisation of choice and pathways:* Book design was personalised by each group within stipulated book requirements. Student choice of widgets (iBook Author internal apps) and supplementing sites such as Bookry.com were personal choices in accordance with design processes and subject standards.
- *Increased accessibility to content:* students drew on Web 2 information sources such as Bookry.com and infogr.am, as well as through their own investigations
- *Increased learning interactivity:* students evaluated and created personalised interactive widgets available in iBook Author or Bookry. This included quizzes, galleries and interactive graphics.
- *Connecting across contexts:* Students appreciation of learning as seen through younger students, which was a key part of the design process, was progressed. The use of iBook Author also has been extended to other Grade 8 subjects.

School objectives are supported by

- *Valued*: Assessed as a formal school subject project (in MYP Science and Design subjects) with learning valued extended to other students (Grade 5 and 6 students)
- *Visible*: Published within the school's Virtual Learning Environment, and available as pre-learning for future projects
- *Connected*: Group learning and problem-solving approaches supported. Collaborative publishing approaches progressed
- *Progressive*: Forms basis for learning to build deeper knowledge through publishing formal science work to different audiences

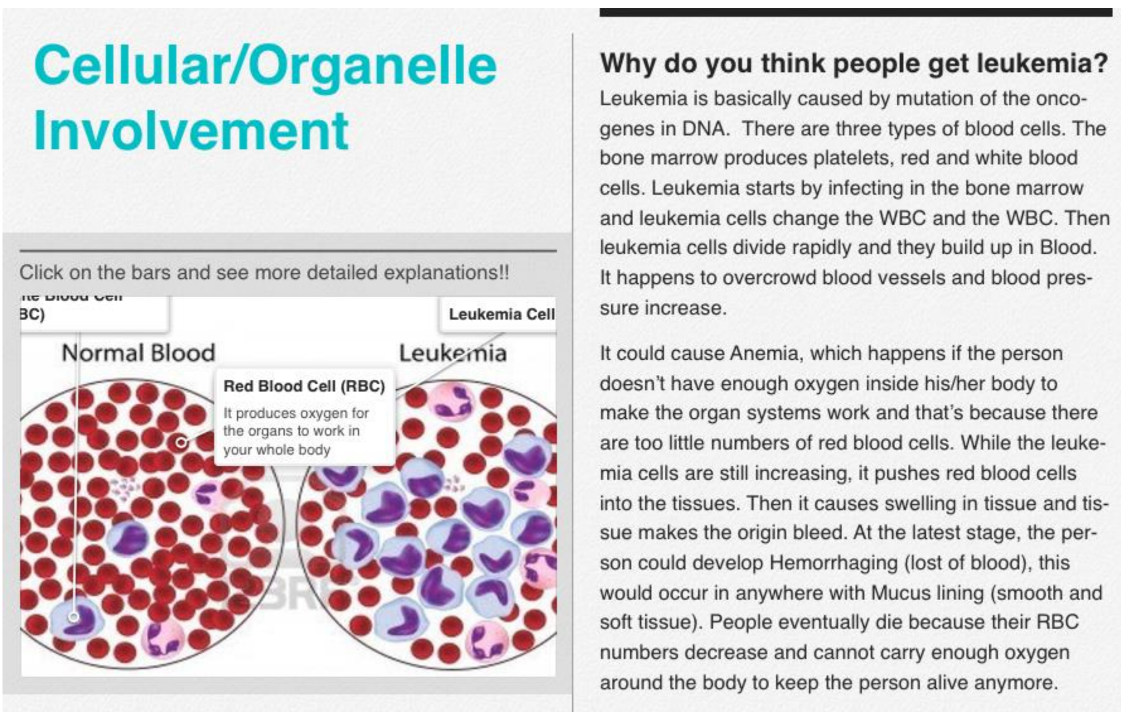

Figure 2. Grade 8 Science Diseases eBook example

Case Study Three: Grade 6 Digital Literacy

All Grade 5 and 6 students manage their own digital portfolio (iFolio) that is used to report on their learning progress. In support of this a Digital Literacy evaluation approach was developed, whereby teachers can provide feedback through the iFolio to each student on their digital literacy development. A digital literacy rubric applicable for teacher feedback has been developed, with a student version to support personal learning evaluation being customised by teachers.

Teacher feedback of student digital literacy through their iFolio satisfies the following mobile learning affordances:

- *Increased access:* teachers, peers or parents can access student development at any time. Teachers and students can identify areas for further work as well as celebrate progress.
- *Personal relationships with learning*: students can personalise within educational boundaries and develop for sharing focused areas on inquiry.
- *Personalisation of choice and pathways:* Each iFolio provides avenues for personal exploration and choice, as well as a basis for further development in later years (which uses similar iFolio approaches).
- *Increased accessibility to content:* links to new knowledge can be shared and inquiries shared.
- *Increased learning interactivity:* widgets such as Flags can be used to share levels of interaction. Feedback provides strong learning support. Parent feedback is likewise accessible.
- *Connecting across contexts:* Projects can be documented to provide an ongoing learning journey. This includes personal media collections. Can also be evaluated against Digital Literacy and IB PYP expectations.

School objectives are supported by

- *Valued*: As one teacher recently commented, iFolios support digital literacy through generating "*possibilities for curriculum planning, teaching and providing students feedback. This also supplies teachers with a framework of how to 'move on' students to the next level and provides a common language to describe the differing areas we need to focus on.*"
- *Visible*: iFolios available for teacher, parent and peer review
- *Connected*: Literacy journey available for subsequent years. Forms basis for understanding of design project approaches further developed within IB MYP Design.
- *Progressive*: Adjustable to include more advanced concepts as students encounter iFolios and digital literacy opportunities at earlier years.

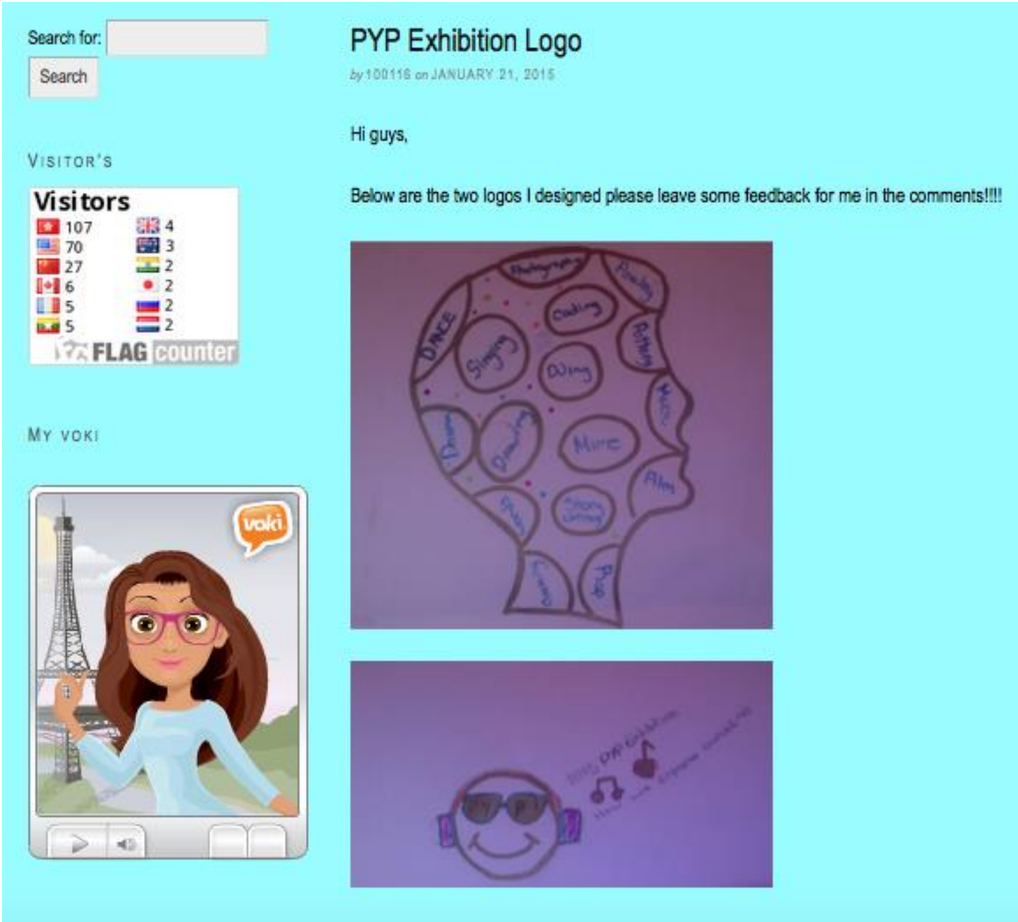

Figure 3. Grade 6 iFolio example demonstrating digital literacy development.

Case Study Four: Grade 1 iPad as iFolios

The recent availability of larger screen tablets has opened up new possibilities for younger students who cannot master keyboard technologies, enabling use of touch-screen mobile devices to engage in wider learning. While cognisant of appropriate time exposure and balance with non-digital environments critical to the young person's social and emotional well being, teachers have increasingly found that the tablet supports valued learning in new ways. While grades for younger students work with a set of six or seven iPads to support learning stations, one class has been trialing the difference each student having their own personal iPad at-hand might provide. This has formed the basis for an extension to an iPad as a personal learning device for all Grade 1 students next year, building into following years as teacher, student and school preparedness allows.

A core selection of apps was selected to support literacy, numeracy, communication, collaboration, and media construction. For example, EasyBlog is a WordPress based app that enables young students to photograph and record through a simple click method. Apps are selected by teachers according to student needs and learning value.

As detailed in a draft letter from the school to parents in February 2015, "*by personalising the iPad and building an iFolio the student can*

- *develop confidence and competence through structured play and inquiry*
- *build up a portfolio of learning through media (audio and visual) constructions*
- *better engage in personalised literacy development*
- *better communicate to teachers and parents.*
- *obtain more timely and focused feedback from a wider range of people"*

This will, though, not change the balanced approach needed for whole child development, but rather extend through personal student ownership and access the following mobile learning affordances:

- *Increased access:* teacher and parents can access student learning development anytime from multiple devices.
- *Personal relationships with learning*: Students can directly take up their iPad whenever a worthwhile learning opportunity presents.

- *Personalised of choice and pathways:* Teacher app choice is available around the core apps selected to support student creativity and personalise learning pathways. Students can form their own learning pathways through apps.
- *Increased accessibility to content:* students can generate and access media information
- *Increased learning interactivity:* students can report, reflect and communicate in more accessible media. Feedback is likewise recorded and accessible.
- *Connecting across contexts:* iFolio tags create a documented journey of curriculum value, extending classroom learning beyond the classroom

School objectives are supported by

- *Valued*: Teacher driven as worthwhile education and learning, supported by school leadership
- *Visible*: Accessible across the school community
- *Connected*: Connected to the school's iFolio approach that extends through to the DP level
- *Progressive*: iFolio moves with the student to subsequent years. New digital opportunities can be embraced and integrated.

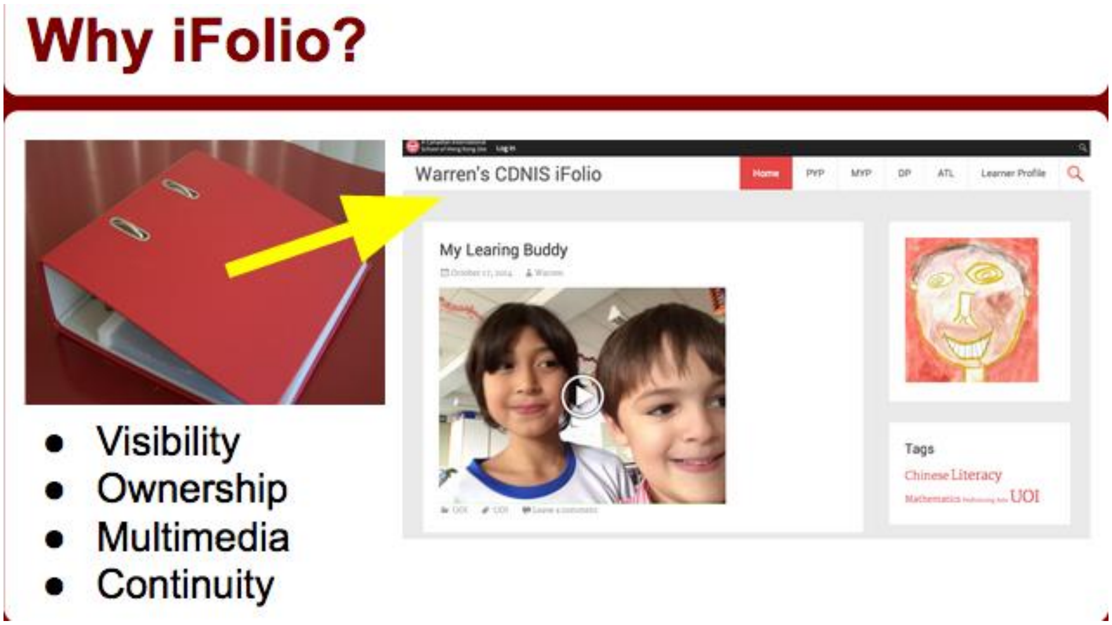

Figure 4. Grade 1 iFolio example taken from Parent Workshop, February 2015.

Discussion

These case studies demonstrate that for mobile learning, as with any change in technology use, key considerations are

- embedding digital technology changes in line with a school's vision
- making learning made visible
- aligning technology to add curriculum value
- focusing on sustainability and connectivity
- teacher inclusion
- evaluating against both digital affordances and school expectations

Mobile learning in the school was premised on seeing laptops and tablets not as digital add-ons, but as devices with the potential to increase learning opportunities of value, if not help to redefine values in-line with societal changes. It is early days for integrating personal learning from outside the designated curriculum, but flattened learning environment built around inquiry and open pedagogical approaches are helping locate and define value. As examples, Grade 1 students are actively involved in evaluating and recommending iPad apps, while Middle School students are increasingly making more personal choices of preferred software to meet curriculum tasks.

These case studies provide evidence of a school coordinated approach to technology integration in line with what mobile learning research has identified as learning potential. Teacher development and inclusion, school support and leadership, and a culture of worthwhile, evaluative risk taking are all critical aspects.

Mobile Learning: Moving Forward

There continues to be new opportunities identified and new challenges to respond to. The first lesson is that digital connects and impacts across three levels: personal, curriculum and systemic. With mobile devices there is more personal opportunity and challenge as each student’s personal mobile learning device creates unique learning relationships. Curriculum as formal requirements continue to provide direction, boundaries and opportunities as learning is connected, flattened and constructed. Systemic considerations provide infrastructure challenges and organisational responsibilities.

At the heart remains the belief that digital adds value to learning, as also contended by Laouris and Eteokleous (2005) and going as far back as Papert (1980). With mobile learning this is opening opportunities to increase parent access to support student learning (through digital portfolios), extension of audience feedback, and utilising digital products to streamline thinking processes such as reflection and collaboration.

But an accompanying lesson is that this can be at odds with traditional expectations, many of which schools continue to have to satisfy. Hand-written exam essay are a good case in point. Common testing can also impact on personal learning choices. The debate on the effect of digital devices on young brains continues (Greenfield, 2015 p. 14). Therefore appropriate balances and ongoing pedagogical conversations remain critical cultural requirements. As Watters (2014 p. 4) reminds us “while building new technologies is easy (or easy-ish), changing behaviors and culture is much, much harder.”

Issues of potential distraction (Duncan, Hoekstra & Wilcox, 2012; McCoy, 2013) need to be considered; related to both pedagogical and personal identity development issues (particularly with adolescents). This is an important mobile learning consideration for schools (Bjerede & Bondi, 2012).

McFarlane (2015 p. 27) also highlights the importance of teacher buy-in, pointing out that “professional development of teachers in the effective use of connected devices to support learning is fundamental to a successful implementation of 1:1 mobile computing”, and that the “frequency of use of digital technologies overall was (still) dependent on school policy, access to technology and teachers’ practices.” (p. 34) Tablet use in education is strongly aligned to teacher perceptions of the affordances of technology (Churchill, Fox, & King, 2012). We need to constantly remind ourselves, though, of Fullan’s (2007 p. 21) observation on educational changes, that “all real change involves loss, anxiety and struggle.”. The case studies in this paper all include a commitment to engage and build teacher commitment and understanding.

The School's Approach

At the school the changing dynamic of digital requiring personal, team and system considerations is reflected in

- At-hand support for personal questioning and interaction
- A digital teaching and learning support team
- Representative groups from across the school community informing and debating the role of digital for learning. This can cut across budgeting and business responsibilities

Bringing this together, the school's vision - constructing visible, connected and progressive learning journeys to support reflection, feedback, ownership and conceptual depth (for teachers and students) - reflects that learning can be enhanced by appropriately focused use of mobile devices. This is important, because as Clarke and Svanaes (2014, p. 15)) identify, "tablets specifically must be supported by a pedagogical vision in order to reach its potential impacts on learning." They refer to Cochrane, Narayan & Oldfield (2013), in that ignoring the importance of a pedagogical vision has impeded gaining academic worthwhile research on the impact of tablets on education.

The school's approach looks to encourage innovation through inquiry, connection and depth building. The value perceived by an individual needs to be tested by whether his or her peers share this view, and ultimately whether it can fit in and add value to systemic approaches.

Depth of learning is being built through three levels: Literacy and Inquiry, Concept Building, and Enterprise. As an example, teaching coding can use mobile devices to connect to coding sites such as code.org, link with specialist teachers to advance understanding of coding concepts, and finally to produce authentic apps as artifact evidence valued within the community (and perhaps beyond). Digital portfolios tread a similar path, from personal blog publishing, to specific posts allied to curriculum offerings, and finally personal responsibility and choice at senior years to support connection beyond the school.

Allied to this, a comprehensive teacher learning program ensures all teachers are supported to keep abreast of opportunities. Part of this involves enhancing teacher and team adaptability, and generating more flattened learning environments (and related pedagogical approaches) so that student expertise can likewise be developed and supported. This is as recognised by Clarke and Svanaes (2014) as crucial for effective integration. Depth of change is supported through groups that bring together bottom-up and top-down drivers. School leadership by example also plays an important part in this.

In Closing

Mobile learning within school systems is at a crucial point (McFarlane 2015). Using digital to add value in education is an evolving phenomenon. Evolutionary thinking warns against unsustainable defensiveness if changes that will enhance survival and prosperity are on offer. How this will unfold by its very nature is unclear. But what it does tell us is that in order to progress we need to innovate and take calculated risks, particularly in fast-changing, dynamic environments. To this end the school continues to seek to create new opportunities to be tested and integrated to the level that reflects its balanced, forward-looking focus. All schools as Digital Age social institutions should share this trait.

The mobile learning approach taken on in the school recognises several characteristics as central to progressing any school's productive use of mobile learning to meet educational objectives. These include:

- Understanding institutional cultural and contextual foundations
- Identifying institutional intentions as a learning organisation
- Clarifying what is understood by emerging concepts such as mobile learning, digital literacy and so on
- Understanding the adaptability requirements of dynamic digital systems
- Developing support structures that help facilitate a united approach to advancing personal, curriculum and school system objectives
- Looking for opportunities and challenges to be embraced and embedded as an integral part of institutional decision making
- Maintaining a student learning approach appropriate for the Digital Age

Perhaps it would all be just so much easier to attempt to cocoon within closed systems built around closed knowledge and minimal change controlled by individual hierarchical decision-making. But would that be doing justice to our students, our institution, and our communities? Mobile learning is about the approach, the intent and the willingness to be open to the opportunities mobile device can provide to school education through taking into account the personal nature of the relationship between the user and their digital device. It starts with a conversation; it includes risk, evaluative processes, and recognition of the challenge and power of difference, from personal to systemic.

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Access Moodle Using Mobile Phones: Student Usage and Perceptions

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This study investigated how often students used mobile phone to access various activities on Moodle. A survey on self-reported usage was filled by 252 university students in courses offered by four different Faculties. Follow-up interviews were conducted to solicit students' perceptions of mobile phone access to Moodle and the underlying reasons. The results show significant differences in students' usage of various Moodle activities via mobile phones. Further study on the Moodle pages of the courses and student responses suggest the most important reason for the differences is pedagogical designs that take advantage of Moodle functions and consider the characteristics of mobile phone access. Student responses also suggest that mobile phone access to Moodle is a necessary complement to computer access but its limitation on usability and reliability may have restricted its potential in enhancing teaching and learning.

Keywords: mobile phone access; Moodle activities; usage frequency, perceptions

Introduction

The learning management system (LMS), Moodle, has been adopted by many higher education institutions around the world. To date, Moodle has been registered in more than 1800 sites over 120 countries, and is available in more than 60 languages (Kennedy, 2004). Despite the increasing use of Moodle, concern has been expressed as to how Moodle is being used (Carvalho, Areal, & Silva, 2011).

With the rapidly increasing use of handheld mobile devices among staff and students in higher education, it has become more and more common for them to access teaching and learning related information and services using mobile devices (Peters, 2009). A 2011 survey on mobile services in academic libraries in Hong Kong and Singapore reveals that the possession rate of mobile devices was 93.4% among Hong Kong college students, and 61.9% of them used smartphones to access the Internet (Ang, 2012). It is not uncommon to see university students use smartphones to access learning resources on Moodle and other LMSs. However, how students use Moodle via mobile phones and what their perceptions of mobile access to Moodle have rarely been formally investigated. The current research aims at filling this gap by examining which Moodle activities students would use mobile phones to access and exploring possible reasons behind the usage patterns.

Related Work

Use of LMS

Research has been conducted to describe and analyse the use of LMS in higher education. Francis and Raftery (2005) defined three levels of LMS usage. The first level is for depositing materials and distributing information; the second is for enhancing teaching and learning by using various tools in LMS for communication, collaboration, assessment, and quiz tests. The third and highest level is for supporting fully-fledged online courses where most learning takes place on the LMS. It is indicated that even though an e-learning platform is available, the institutions might not make full use of it (Nichols, 2008). Carvalho and her colleagues (2011) surveyed around 15,000 students for their use of two LMSs, Blackboard and Moodle. They found that for the majority of students, the use of the LMSs was still in the low level, that is, for accessing learning materials and course announcements. Only some of them used LMSs for sending emails or taking quiz tests. The course forum, course chat room and virtual classroom are among the least used functionalities.

On the other hand, the importance of learning through social interaction and collaboration has been confirmed repeatedly (Tu & Corry, 2003). Interaction plays a crucial role in academic success and persistence (Shea, Sau Li, & Pickett, 2006), and it is believed that knowledge construction begins when a student has engaged in a collaborative activity, because knowledge is created in situation (Chavez , 2011). Therefore, educators increasingly make efforts to bring the use of LMS to a higher level that involves more interactions and collaborations among students.

Mobile learning

Mobile learning is thought to enhance opportunities for building a learning community, interaction, and collaboration among students (Donaldson, 2011). Cavus, Bicen, and Akcil (2008) investigated students opinions of mobile learning by surveying 317 undergraduate students. They found that students' learning greatly benefited from using e-mails, forums, and chat via mobile devices, and mobile learning was thought effective by students during their communication with other students and instructors. In their study, there was no statistically significant difference in mobile learning across departments, gender, or nationality. In this study, we attempt to find out how mobile learning and LMS can be integrated to support students learning activities.

Methodology

The LMS and the courses

Moodle (version 2.6) was used in all the courses included in this study at the University of Hong Kong. Although there is a mobile app for Moodle, it cannot be integrated into the Moodle installation due to the university policy on information security. Alternatively, the Moodle installation provides a Mobile Theme, which is a display custom-designed for smartphone browser screens. When users use smartphones to access Moodle, the Moodle server can detect the access device and will automatically display the Mobile Theme. Students can use the Mobile Theme to view course content page, submit assignments, and access a number of the Moodle functions including Forum, Choice, Feedback, Quiz, URL, and Wiki.

Seven courses of four instructors were selected for this study. The instructors were in four different disciplines, Education, Engineering, Social Sciences, and Humanities and Arts. The four instructors used Moodle in different levels. The instructor from Social Sciences used Moodle as a repository of teaching materials and a platform for making course announcements. Besides uploading teaching materials, the instructor from Education also used discussion forums for student-student and student-instructor interaction. Links of external websites were also put on Moodle of this course. As for the course in Engineering, the instructor used Moodle as a platform where students can read/download learning materials, submit assignments, take quizzes, conduct group projects, and receive feedbacks from the instructor. The instructor from Humanities and Arts used Moodle to host learning materials, send announcements and messages to students, answer questions students raised, as well as Wiki and Glossary activity where students posted course-related information they collected off-class. The Engineering course was a Common Core course that could be taken by any year-1 and year-2 students across the university. As the class size was big, there were six teaching assistants in this course. The Education course was a Master level course and the other courses were on the undergraduate level.

Participants and procedure

This study adopts a mixed method with survey and interview data collected and analyzed.

The survey

The survey was conducted in the last class of the courses. 389 students from the seven courses in the main study were invited to participate in the survey. 253 students in total responded to the questionnaire with valid answers (65% response rate). The responses were collected partially online (n = 142) and partially on paper (n = 111). Table 1 presents the sample demographics.

Table 1. Demographic information of questionnaire respondents

	N	Gender		Moodle experience		IT competency	
		Male	Female				
		N	N	Mean	Medium	Mean	Medium
Education	17	3	14	1.71	1	2.88	3
Social science	57	25	32	2.41	3	2.93	3
Engineering	125	91	34	2.16	2	2.74	3
Arts	54	15	39	2.93	3	3.19	3
All	253	134	119	2.35	3	2.89	3

Notes: Ratings of “Moodle experience” are based on a 4-point Likert-type scale: 1 – “less than 3 months”, 2-“ months to less than 1 year”, 3-“1 year to less than 2 years”, and 4-“2 years or more”; Ratings of “IT competency” are based on a 5-point Likert-type scale: 1 – “not competent”, 2-“ of little competency”, 3-“somewhat competent”, 4-“ competent” and 5-“ very competent”.

The interview

After the survey data were collected, emails were sent to 80 survey respondents (20 from each discipline) to invite them to the follow-up interviews. Twelve of them accepted the invitation and participated in the interviews (3 in the Education course, 3 Social Sciences, 5 in Engineering, and 1 in Humanities and Arts). The interviews were conducted partially face to face (n=2) and partially through phone (n=10). After the interviews, each interviewee was paid 30HKD for their participation.

Instruments

A questionnaire asking about the experience of using Moodle of the selected courses (Appendix 1) was used for collecting quantitative data. It included two parts: demographic information and frequency of course Moodle use. Part 1 asked for basic demographic information as well as their experience with Moodle and self-perceived IT competency level; Part 2 asked about the frequencies of using different categories of Moodle activities with variables in a 7-point Likert scale: ranging from 1 (never) to 7 (several times a day). A semi-structured interview protocol was designed to collect interview data. The main questions included: What did you do when you access Moodle via mobile phone, when did you do them and why?

Results

Questionnaire responses

Table 2 shows the statistics of student self-reported usage of Moodle via mobile phones. Access to learning materials was the most frequent activity while interacting with instructors and other students was the least frequent. It is noteworthy that students' responses varied from "never" to "several times a day" in all activity categories.

Table 2. Descriptive statistics of frequency of using Moodle via mobile phones

Moodle activities	N	Minimum	Maximum	Mean	Std. Deviation
	Statistic	Statistic	Statistic	Statistic	Statistic
accessing resources	252	1	7	3.70	1.526
submitting assignments	251	1	7	2.22	1.553
taking tests	252	1	7	2.30	1.567
interaction	251	1	7	2.06	1.457
collaboration	252	1	7	2.08	1.508

Notes: Ratings are based on a 7-point Likert-type scale: 1 – “never”, 2-“ Once a month or less”, 3-“ Once every 2 weeks”, and 4-“1-2 times a week”, 5 – “3-6 times a week”, 6-“ Once every day”, 7-“ Several times a day”.

Statistics across different disciplines are presented in Table 3. Students in the Engineering course reported the highest frequency across all Moodle activities accessed via mobile phones among all participating students. As the data are in ordinal scale, the non-parametric Kruskal-Wallis test is used to compare the frequencies across courses. The significance levels (*p* values) are reported in Table 3. Statistically significant differences were found in all five categories of activities: accessing resources submitting assignments, taking tests, interaction, and collaboration.

Table 3. Statistics of frequency of using Moodle via mobile phones across disciplines

Moodle activities		Humanities and Arts	Education	Social Science	Engineering	Sig. Kruskal-Wallis
accessing resources	N	54	17	56	125	.002**
	Mean	3.35	3.06	3.39	**4.08**	
	Median	4.00	4.00	4.00	4.00	
submitting assignments	N	53	17	56	125	.000**
	Mean	1.38	1.53	1.50	**2.99**	
	Median	1.00	1.00	1.00	3.00	
taking tests	N	53	17	56	125	.000**
	Mean	1.41	1.00	1.50	**3.22**	
	Median	1.00	1.00	1.00	4.00	
interaction	N	53	17	55	125	.000**
	Mean	1.69	1.35	1.62	**2.52**	
	Median	1.00	1.00	1.00	2.00	
collaboration	N	54	17	56	125	.000*
	Mean	1.43	1.24	1.55	**2.71**	
	Median	1.00	1.00	1.00	2.00	

Notes: Ratings are based on a 7-point Likert-type scale: 1 – “never”, 2-“ Once a month or less”, 3-“ Once every 2 weeks”, and 4-“1-2 times a week”, 5 – “3-6 times a week”, 6-“ Once every day”, 7-“ Several times a day”. ** indicates significance at $p < 0.01$ level.

Experience of using Moodle may have affected students' usage of Moodle via mobile access. Kruskal-Wallis tests revealed that students with different Moodle experience reported significantly different usage frequency in taking tests and collaboration ($p < 0.05$, Table 4). Follow-up pair-wise tests revealed that, for both activity categories, students with "2 years' or more" experience with Moodle actually reported lower frequencies than those with "less than 3 months'" or "1 year to less than 2 years'" experience ($p = 0.02 \sim 0.04$). There was no significant difference between other pairs of experience values.

Table 4. Descriptive statistics of frequency of using Moodle via mobile phones across experience of using Moodle

Moodle activities	less than 3 months		3 months to less than 1 year		1 year to less than 2 years		2 years or more		Sig. Kruskal-Wallis
	N	Mean	N	Mean	N	Mean	N	Mean	
accessing resources	86	3.65	35	3.94	85	3.86	45	3.29	0.164
submitting assignments	86	2.48	35	2.29	85	2.15	44	1.82	0.155
taking tests	86	2.51	35	2.37	85	2.40	45	1.67	0.020*
interaction	85	2.13	35	2.29	85	2.14	45	1.64	0.069
collaboration	86	2.19	35	2.29	85	2.22	45	1.47	0.015*

Notes: Ratings are based on a 7-point Likert-type scale: 1 – "never", 2-"Once a month or less", 3-"Once every 2 weeks", and 4-"1-2 times a week", 5 – "3-6 times a week", 6-" Once every day", 7-" Several times a day". * indicates significance at $p < 0.05$ level.

Besides, difference in the frequency of using Moodle via mobile phones across IT competency was also analysed. Table 5 indicates a statistically significant difference of access frequencies in interaction and collaboration activities ($p < 0.05$). For interaction, a follow-up pair-wise test found that students who rated themselves as "not competent" reported significantly more frequent access than those who rated themselves as "somewhat competent" ($p = 0.02$) or "competent" ($p = 0.03$). For collaboration, students who rated themselves as "not competent" reported significantly more frequent access than those who rated themselves as "competent" ($p = 0.04$). There was no significant difference between other pairs of IT competency values.

Table 5. Descriptive statistics of frequency of using Moodle via mobile phones across IT competency

Moodle activities	Not competent		Of little competency		Somewhat competent		Competent		Very competent		Sig. Kruskal-Wallis
	N	Mean	N	Mean	N	Mean	N	Mean	N	Mean	
accessing resources	29	3.83	54	3.91	96	3.75	59	3.44	12	3.58	0.5
submitting assignments	29	2.83	53	2.21	96	2.08	59	2.19	12	2.25	0.145
taking tests	29	2.76	54	2.31	96	2.17	59	2.27	12	2.50	0.26
interaction	29	2.79	54	2.09	96	1.96	59	1.93	11	1.82	0.018*
collaboration	29	2.69	54	2.22	96	1.97	59	1.90	12	1.92	0.032*

Notes: Ratings are based on a 7-point Likert-type scale: 1 – "never", 2-" Once a month or less", 3-" Once every 2 weeks", and 4-"1-2 times a week", 5 – "3-6 times a week", 6-" Once every day", 7-" Several times a day". * indicates significance at $p <$ 0.05 level.

The study also compares the difference of reported usage frequency between genders, and the statistics and results of Mann-Whitney tests are shown in Table 6. There are statistically significant differences in all activity categories but accessing resources.

Table 6. Difference of frequency of using Moodle via mobile phones between genders

Moodle activities	male		female		Sig. Mann-Whitney
	N	Mean	N	Mean	
accessing resources	33	3 .79	19	3 .61	.34 1
submitting assignments	18	2.55	18	1.85	.002**
taking tests	33	2.74	19	1.80	.000**
interaction	32	2.31	19	1.79	.040*
collaboration	33	2.38	19	1.75	.003**

Notes: Ratings are based on a 7-point Likert-type scale: 1 – "never", 2-" Once a month or less", 3-" Once every 2 weeks", and 4-"1-2 times a week", 5 – "3-6 times a week", 6-" Once every day", 7-" Several times a day". * indicates significance at $p <$ 0.05 level. ** indicates significance at $p < 0.01$ level.

Themes from interviews

All interviewed students answered that they used mobile phones to access Moodle of their courses, because mobile phone allowed them to access Moodle at any place and any time. They could read learning materials and important information such as assignment deadlines when no computer or Wi-Fi connection was available. Mobile access also enabled them to read announcement, comments and feedback as soon as they were available online. The students from the Engineering course (n =5) also mentioned that they used mobile phone in class to access Moodle because one of the course requirements was to complete a short quiz within 4 hours after each class. Therefore, when the students did not bring laptop to the class, they would use mobile phone to finish the quizzes.

However, students also indicated that mobile phone was not a preferred method to access Moodle. Most of them referred to usability issues such as small screens and awkward keyboard. As a result, they would only be comfortable to conduct simple and low-stake tasks using mobile access. It was a common theme among the students that the Mobile Theme of Moodle was inconvenient. To start a Moodle session on mobile phones, they needed to launch a browser window/tab, type in the URL, and log into the system. As the session expires after a short period of idle time, students had to log in again virtually at each time of access. Besides, the display of Moodle course pages on mobile phone was mentioned quite often during the interviews. All the course pages contain rich information. While the texts on the course pages were well displayed on computer screens, with proper headings and indentions, the format could become cluttered on the screen of mobile phones. Last but not least, several students mentioned that they did not know how to upload files to Moodle from their mobile phones or to find files downloaded from Moodle.

Discussion

Both the survey and interview data indicated that students used mobile phones to access Moodle for learning materials much more often than for other activities (Table 2), which indicates that the use of mobile access to Moodle was still at the lowest level as suggested in Francis & Raftery (2005). One possible reason is that the usability limitations of mobile access discouraged the students from using it for complicated tasks (e.g., wiki edits, discussion posts) or activities that were deemed not urgent. In addition, depositing learning materials is the most widely used function of Moodle across all courses in this study, and there were much fewer Moodle activities related to interaction and collaboration (Table 7).

Table 7. Distribution of Moodle activities across courses

Moodle activities	***Education***	***Social science***	***Engineering***	***Humanities and Arts****			
	Course 1	***Course 2***	***Course 3***	***Course 4***	***Course 5***	***Course 6***	***Course 7***
accessing resources	***69***	***48***	***62***	***30***	***9***	***58***	***68***
submitting assignments (assignment, turnitin assignment)	***2***	***0***	***12***	***0***	***0***	***0***	***0***
taking tests (quiz, questionnaire)	***2***	***0***	***15***	***0***	***0***	***0***	***0***
interaction (discussion forums, feedback, chatroom, choice)	***9***	***0***	***3***	***3***	***1***	***6***	***0***
collaboration (wiki, glossary)	***5***	***0***	***1***	***4***	***0***	***4***	***0***
Total	***87***	***48***	***93***	***37***	***10***	***68***	***68***

Notes: * the instructor in Humanities and Arts taught four courses each of which had a Moodle page.

The distribution of Moodle activities shown in Table 7 could partially explain the significant differences on students' self-reported Moodle usages via mobile phones presented in Table 3. For accessing resources, a pair-wise test following the Kruscal-Wallis test reveals that the only significant difference (p = 0.02) lied in between the Engineering course and the courses in Humanities and Arts where much fewer learning resources were hosted in two of the courses. The Moodle of the Engineering course had substantially more assignments and test activities than others, and this is probably why the frequencies of using these activities reported in this course were significantly higher than those of all other courses ($p < 0.01$). In addition, the quizzes in the Engineering course were designed in small sizes, with 3-5 multiple choices questions in each, and students reflected that they were comfortable to access those quizzes via mobile phones since they only took a little time to complete and did not involve much typing on the keyboard.

For interaction and collaboration activities, even though the Engineering course did not have the highest number of activities in these two categories, the reported usage frequencies were still significantly higher than those in other courses (Table 3). This result suggests that creation of Moodle activities that are designed for interaction and collaboration does not necessarily result in more frequent access to those activities via mobile phones. Students from the Engineering course reported that they felt there was a learning community built on the course Moodle. There were a variety of learning activities that involved interactions and collaborations, including a group project, a group presentation and peer-assessments (inter- and intra- groups) (Lei, Wan & Man, 2013). In addition, the instructor and teaching assistants responded to students' posts in a timely manner. These may all have contributed to the stronger motivations of the students in accessing the course Moodle via mobile phones.

Interestingly, the results also revealed that students who have used Moodle for a shorter period of time tended to use mobile access more often to take tests and collaborate on Moodle than those who have used Moodle for two years and more (Table 4). In addition, students with low self-perceived IT competency used more mobile access to Moodle for interaction and collaboration activities (Table 5). These seem to contradict with many studies where experience and IT competency are positively associated with technology usage (Venkatesh & Bala, 2008). We conjecture that the statistics might have been dominated by the students in the

Engineering course who rated higher usage frequencies and lower Moodle experience and IT competency than other students. However, this would need further analysis to be confirmed.

The study also found male students used mobile access significantly more often than female students in all listed Moodle activity categories except for resource access. During the interviews, some female students complained about the complexity of some Moodle activities and expressed the need of instructional help on using those activities. Such gender difference has also been found in other studies (e.g., Heemskerk & Dam, 2009). The implication is that providing instructions on how to use Moodle activities, especially with mobile access, would be helpful. On another note, student gender distributions vary a lot across the courses and the Engineering course was the only one with much more male than female students (Table 1). Therefore, it is possible that the observed gender difference may be partially affected by the higher ratings among students in the Engineering course.

Conclusion and Future Work

This study compared the usage of Moodle activities via mobile phone among college students enrolled in courses across four disciplines, and analysed the reasons behind the usage patterns. In general, students in this study did not prefer to use their mobile phones to access Moodle, due to the limitations of mobile access on usability and reliability. However, most of them indeed used mobile phones to access Moodle when it was necessary. In addition, it was found that students preferred to do easy and low-stake Moodle tasks on their mobile phones. The students expressed the need for a more user-friendly mobile access. In comparing survey responses from students across the courses, it was found that good pedagogical design could at least partially mitigate the limitations of mobile access and encourage students to use Moodle more often including activities involving interaction and collaboration. Future work will include analysis of students' perceptions on usefulness of mobile access to Moodle and the factors that might affect the perceptions.

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Appendix 1: Questionnaire

Part 1: Demographic information

What is your gender?
How old are you?
Where did you spend most of your life?
How long have you used Moodle?
Have you ever used any other learning management systems?
What is your IT (information technology) competency level?

Part 2: Frequency of using different Moodle functions

I used Moodle of this course via mobile phones to access learning materials (e.g., slides, notes, readings, assignments)

I used Moodle of this course via mobile phones for submitting assignments.

I used Moodle of this course via mobile phones for taking tests/quizzes/exams.

I used Moodle of this course via mobile phones for interacting with instructors/classmates (e.g., replying to posts, sending messages, chatting, etc.).

I used Moodle of this course via mobile phones for collaborating with classmates (e.g., editing wikis, contributing to glossary, discussing group projects, etc.).

Understanding self-directed learning in the context of mobile Web 2.0 --- case study with workplace learners

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This paper presents the findings from a multiple case study which has investigated the impact of mobile Web 2.0 technologies on self-directed learning (SDL) of workplace learners by exploring participants' learning experiences with a mobile App. Drawing on existing literatures, we examined learners' SDL personal attributes and process in the context of mobile Web 2.0. Results show that learners' personal attributes could benefit from the latest mobile Web 2.0 technologies, which have increasingly been utilized during the learning process and have the potential to enhance learning outcomes. The findings within cases are provided, followed by a discussion of the overall context. Directions for future development are suggested at the end of the paper.

Keyword: Self-directed learning, mobile Web 2.0, workplace learning

Introduction

It is widely acknowledged that adult learners take on more responsibility for their learning, which is usually problem based in most circumstances, especially in the context of workplace. According to Cross (2003), nearly 80% of what people learn at work comes from flexible and self-regulated informal learning activities. As a major form of informal learning, self-directed learning is considered as the process that leads to successful learning (S. B. Merriam, 2001).

SDL—as interpreted by Knowles (1975)—occurs within the process of diagnosing and formulating goals, identifying resources, selecting and implementing suitable strategies, and evaluating learning outcomes. In fact, self-directed learners take the initiative to learn and the responsibility for completing the learning process. Such a process could be enhanced through the introduction of appropriate Web 2.0 tools. Today's learners are able to obtain information more quickly and efficiently using various Web 2.0 tools (McLoughlin & Lee, 2010; Selwyn, 2007). Benefiting from the latest Web 2.0 technology, knowledge on the Internet is aggregated into rich digitalized contents, such as text, image, audio, and video, and can be retrieved by a variety of Web 2.0 applications, such as rich site summary (RSS), podcasting, instant messaging (IM) and video conferencing. The mobile technology has made everything easier on the go. Now learners are able to gather information, make social interaction and solve problems anytime and anywhere via wireless connected mobile devices.

This paper describes how mobile and Web 2.0 technologies support the process of SDL for workplace learners. A multiple-case study is conducted for six months with the purpose of identifying changes in participants' learning behaviors via the use of a mobile App integrating a number of most adopted Web 2.0 applications.

Self-directed learning

The adult education roots of SDL make it possible for learning to happen outside classroom settings. Knowles (1975) defined SDL as "a process in which individuals take the initiative, with or without the help from others, in diagnosing their learning needs, formulating goals, identifying human and material resources, choosing and implementing appropriate learning strategies, and evaluating learning outcomes." SDL has been often conceptualized as a method of instruction in adult education literature (Fisher, King, & Tague, 2001) as well as a process of learning (Candy, 1991). The importance of learning contexts have been recognized in the research area. As Candy (1991) pointed out, learner's level of self-direction may vary in different learning situations. Generally speaking, SDL environments are designed to foster self-direction that learners will carry into subsequent learning situations.

Researchers hold various perspectives on SDL. Candy (1991) considered SDL as a goal as well as a process and he defines four dimensions of SDL: personal autonomy, self-management in learning, the independent pursuit of learning, and the learner control of instruction. According to Candy (1991), personal autonomy represents one of the principal goals of education in all settings and all ages. Self-management is the willingness and the ability of the learner to manage his or her own learning. In this manner, self-management refers to the exercise of personal autonomy in the process of learning. In Candy's model, learner control is distinguished from the independent pursuit of learning. The former deals with control over aspects of the instructional situation, while the latter concerns learning outside formal educational settings (Loyens, Magda, & Rikers, 2008). Besides, Candy's model was the first to state that a learner's self-direction might be different in different contexts. Brockett and Hiemstra (1991) combined both the process and personal attribute perspectives in their Personal Responsibility Orientation Model. They also emphasized the importance of social context, which at their time mainly referred to physical institutions where learning took place. Song and Hill (2007) proposed a conceptual model for understanding SDL in online environments. Except for incorporating SDL as a personal attribute and a learning process as pointed out by previous studies, they added online learning context as a third dimension to the model and focused on the impact that environmental factors have on SDL. According to the authors, SDL can be further elaborated from three perspectives: personal attributes, process and context. Personal attributes deal with learners' motivations for and capability of taking responsibility for their learning (Garrison, 1997). Personal attributes also include resource use and development of learning strategies. Process refers to the practice of personal autonomy, which mainly includes planning, monitoring, and evaluating one's learning (Moore, 1972). Context focuses on environmental factors and how those factors influence learner's level of self-direction.

In this study, the learning environment shift again from online context to a more flexible and individualized one, which is the mobile context. Drawing on Song and Hill's conceptual model, this study further elaborates how the mobile Web 2.0 learning environment influences SDL, which is shown in Figure 1. The design elements of the learning context mainly refer to resources, structure and nature of the tasks in the learning environment (Song & Hill, 2007). Part of the learning resources are provided to the learners at the beginning of the study, while the rest are relied on each learner according to his or her learning situations. The provided resouces are degisned as instructional support. According to Song and Hill (2007), the support elements come from the instructor's feedback, peer collaboration and communication. However, in the context of this study, participants take full responsibility without any instructors or peer communication. In this manner, the support mainly comes from the improvement of the design of the learning context, which is based on learners' demands and resrarcher's observation on learner's behaviours. In the meantime, the interaction between personal attributes and SDL process is important to understand as it provides information on how learners take control of their learning. The following of this paper reports the findings from a multiple case study to illustrate the impact of mobile Web 2.0 on SDL in workplace environment.

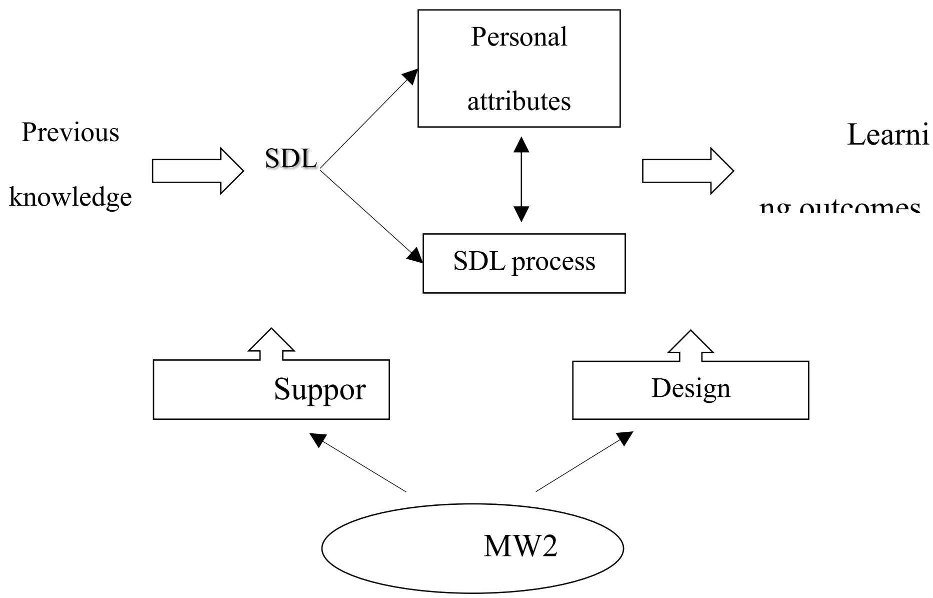

Figure 1. The relationship between SDL and MW2 context

The study

Research questions

The aim of the whole study is to investigate how mobile Web 2.0 technologies support workplace informal learning. As a major form of informal learning, SDL deserves an in-depth understanding in the mobile Web 2.0 context. Therefore, in this paper, we seek for answers to the question of "How mobile Web 2.0 technologies support SDL and how learner's self-directedness is fostered in this context?"

Participants

Five participants (three males and two females) were purposefully selected from five companies in China. Their positions include technical sales, computer engineer, accountant, human resource specialist, and magazine editor. All of them expressed the need for continuous learning for career development. Each participant owned at least one of the most up-to-date smartphones. Participants' profiles are presented in Table 1.

Table 1: Profile of participants

Participant	Age, Occupation	Knowledge of ICT	Knowledge of Smartphone	Training time at workplace
Aaron	35, technical sales	Familiar	Familiar	0~1 hr/year
Claire	32, account	Basic	Basic	6~8 hr/year
Jensen	31, editor	Familiar	Basic	4~6 hr/year
Sandro	32, computer engineer	Expert	Veteran	2~4 hr/year
Yan	23, HR specialist	Basic	Weak	1~2 hr/year

Data collection and analysis

Both quantitative and qualitative data collection were carried out over the period of six months. At the beginning of the study, each participant was interviewed face by face with the purpose of obtaining their current workplace learning status and demands for career development. The results of the interviews helped to guide the design and improvement of the App. The case study was conducted afterwards. In addition, a log system has been implemented to record users' activities and time spent on the App, which contributes to the majority of quantitative data of the study. Weekly statistics and feedback are collected from participants in order to improve the App constantly for better user experience. At the end of the study, a second interview was taken to find out participants' achievements and experiences. All the data was analyzed to conclude the whole study and to generate suggestions for further research in the area.

The App

There are four major functions – micrblogging, RSS, podcasting and mobile web-searching – included on the start page, as seen in Figure 2. With a click of the feedback button, an automatically generated email attaching the user log report is sent to the designer. The microblogging site was set up via an open source software tool called 'Sharetronix'.

Figure 2. Use case and screenshot of MOBLEARN@WORK

RSS and podcasting service work similarly through web syndication. The App features a pre-installed list of feeds, according to participants' preferences as identified during the initial interviews. Basically, when participants click the RSS/Podcasting button, they see a list of feeds. Once they choose to read a specific item, they will find several option buttons at the bottom of the page: previous item, next item, original link, Web searching, return to homepage, share internally (to the MobLearn@Work microblog), and share externally (any external services installed on the mobile phone). Users are able to add or delete any feed items as needed. The App provides two ways of adding RSS feeds: adding by search and adding manually.

Unlike traditional mobile searching on a mobile browser, this App provides a parallel Web searching function which returns Web, image, video, news, blog and wiki simultaneously for a single query, thus strongly improving the searching experience. This means that when the user searches for something, he/she may get results on all of these six aspects at the same time. Details of the searching activities can also be found in Figure 1. There are basically two kinds of searching activities in the study. One is initiated by clicking a keyword from the search list, and the other by adding a new search item. MobLearn@Work provides a series of online open courses for users. For example, the financial open courses from MIT and Yale are collected as recommendations to help users to get started with the App.

Results

The overall results of participants' use of MobLearn@Work are reviewed before the case-by-case study. Figure 3 shows the weekly time spent on the App of each participant. There is an obvious increase of usage at the beginning when the participants started to use the App. Then the curve is relatively smooth, with fluctuations occurred during holidays.

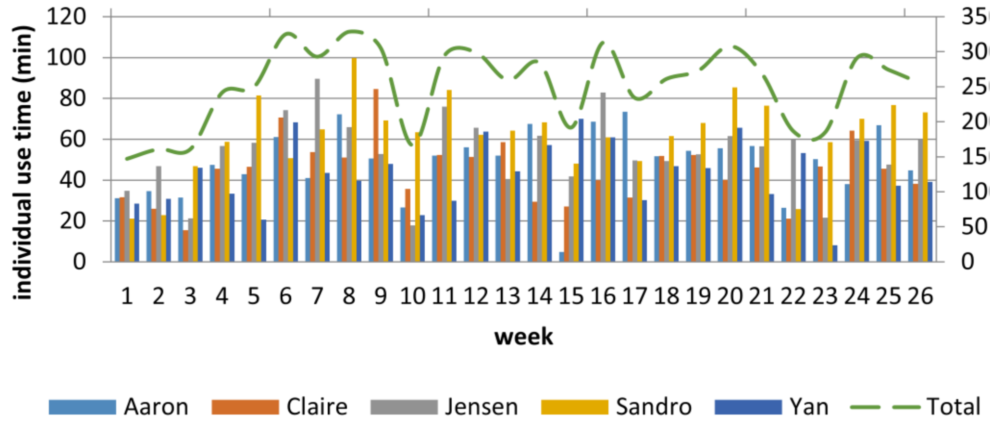

Figure 3. Participant's time spent on MobLearn@Work on a weekly basis

In fact, the logged time does not equal the actual time spent on informal learning. It is difficult to measure the accurate time of informal learning. Therefore, this study assumes a ratio η between the logged time t and the estimated time $\tilde{t}$ for each participant, denoted by

$$\tilde{t} = \eta \times t \tag{1}$$

The ratio was obtained by a questionnaire. The contents were classified into different categories, such as professional knowledge, communication skills, finance, business, politics, technology, entertainment, etc. Participants were required to mark the relevance of the use frequency of each category. Final result of the questionnaire was quantized into a number of 0~1. Average learning time μ_t and estimated average learning time $\tilde{\mu}_t$ are summarized in Table 2. The average learning time per week is approximately equals the time of a training session.

Table 2. Weekly use times of MobLearn@Work (min/week)

Participants	μ_t (min)	r_i	$\tilde{\mu}_t$ (min)
Aaron	49.19	0.89	43.78
Claire	43.87	0.85	37.29
Jensen	52.95	0.87	46.06
Sandro	61.49	0.90	55.34
Yan	42.33	0.89	37.67

Sandro

Sandro is an expert in ICT and a veteran user of smartphones. It took less time for Sandro to familiarize himself with MobLearn@Work than the other participants. According to the data, Sandro spent an average amount of time on each function of the App except for microblogging (see Figure 3). After the study, Sandro explained, “I like the idea of combining these Web 2.0 services together in a single App so that I don’t need to switch from one application to another.” Sandro also emphasized the ease of use of the mobile search function. For him, the most frequently used search form was “image” (see Figure 3). Sandro used the app to share his learning outcomes with his personal social networks during the study period. The most frequently shared places were Sina Weibo and WeChat, which are the top social networks in China. His purpose in sharing was mainly (1) to show his current areas of interest and (2) to strengthen his social networks by sharing something that he believed to be helpful.

Yan

Yan was not very confident of using mobile technologies before the study. She was not satisfied with on-the-job training program offered at her company, and she usually relied on the Internet to resolve problems by accessing an online discussion group concerning human resource issues. After receiving basic training on how to use MobLearn@Work, Yan began to explore the App actively. The most used function was podcasting, which accounted for 60% of her total usage of the App. Yan told the researcher that she had found quite a few podcasting feeds on learning Japanese and business English, which were very helpful. She used the podcasting service most frequently in the morning on the bus, at dinner time, and at night before bed. A two-dimensional histogram extracted from Yan's log data, illustrated in Figure 4, shows that Yan formed the habit of using podcasting to learn foreign languages during the period of the study. Yan had never used the RSS service before the study. During the second interview, she explained, "RSS has become one thing that I can never live without." Yan thought the mobile web-searching tool was very convenient, and the paralleled search results offered her a much better experience compared to traditional web browsers.

Aaron

Aaron traveled abroad a lot and, thus, often missed the opportunities to attend training programs carried out in the company. The Internet was the major resource of information for Aaron to resolve any problems on site. He frequently used mobile devices in various situations. Keeping updated with the latest industry news had remained a major requirement in his career. He most often used the RSS function in MobLearn@Work. He explained, "I often take out my Note II and check my RSS subscriptions wherever I am. It's like I'm used to doing this even unconsciously." At the time of the study, Aaron had decided to learn some Cantonese due to the needs of his work. Both Podcasting and web searching helped him in this respect, and he spoke especially highly of the web-searching function. During the interview, Aaron said that it provided him with more comprehensive and vivid search results on the mobile device than traditional search engines. He indicated that he would continue to use the App in the future.

Claire

Unlike the other participants, Claire did not have any particular learning requirements during the study period. However, she was happy to be introduced to a different way of obtaining information using new technologies. The findings showed that Claire explored each function, except the microblog, for an average amount of time. During the second interview, Claire told the researcher that she had had good experience using the RSS reader to obtain the latest information and the podcast reader to learn something she was interested in by subscribing to open courses online. She found that these technologies had changed her life and broadened her outlook. She believed that she had become more confident, which would benefit her in the development of her career.

Jensen

The accumulation of knowledge was the essence of Jensen's job, which meant he had to learn in order to work and work in order to learn. Sometimes, his work left him with little free time, so he required a flexible learning environment that helped him achieve self-improvement. MobLearn@Work provided Jensen with an integrated information-retrieving tool to obtain industry news. He used RSS much more than the other participants. By subscribing to several English feeds related to his job, Jensen benefitted significantly, while simultaneously improving his professional English. The web-searching function was helpful when he was running errands. During the second interview, Jensen told the researcher that he was very satisfied with the App as it offered him an easy and laid-back way of learning something anytime and anywhere.

Discussion

Self-directed learning was the major form of participants' learning activities during this study. Learners are challenged to take more responsibilities for their own learning and development in the workplace (Ellinger, 2004). Mobile Web 2.0 has provided a number of tools that could effectively support self-directed learning process in the workplace.

Personal Attributes in mobile Web 2.0 Context

Personal attributes include the learner's motivation to obtain new knowledge, his or her ability to use resource and develop strategies to learn. Table 3 provides information on the impacts of mobile Web 2.0 technologies have on participants' level of personal attributes in this study. In SDL, the notion of autonomy has been given special attention to (Candy, 1991; S. Merriam & Caffarella, 1999). There are four variables that influence the extent to which learners exhibit autonomous behavior in learning situations: (a) technical skills related to the learning process, (b) familiarity with the subject matter, (c) sense of personal competence as a learner, and (d) commitment to learning at that particular point in time (S. Merriam & Caffarella, 1999).

Table 3 Participants' SDL personal attributes in the context of mobile Web 2.0

	SDL Personal attributes		
	Motivation	**Resource use**	**Strategy use**
Aaron	Obtain industry information; problem solving	RSS, Podcasting, Web searching	Browse industry news at spare time

Claire	Obtain general information	RSS, Podcasting, Web searching	Learning by exploring each function of Moblearn@work
Jensen	Keep up with the industry trend; discover new ideas	RSS, Podcasting, Web searching	Check RSS updates anytime
Sandro	Be familiar with the latest industry technology	RSS, Podcasting, Web searching, Microblogging	Check RSS updates and switch to search function for more information
Yan	Language learning; problem solving	RSS, Podcasting, Web searching	Use podcasting every night

The biggest challenge to motivation in online learning is “procrastination” (Elvers, Polzella, & Graetz, 2003). The situation is the same in the context of mobile learning. However, for workplace learners, most of their learning requirements are task-oriented. That means learning in the workplace is often driven by learners themselves. For example, in this study, Sandro said that he always use the search function whenever there is something needs to be clarified. He also share contents with his colleagues and discuss with them at a later stage about the issue with the purpose of solving problems occurred in project tasks. Another example informs how learners effectively use a variety of online resources via mobile Web 2.0 and adopt appropriate strategies to learn. Aaron was invited to a business dinner and quickly needed to learn how to tie a necktie. After he entered the search keywords “tie a necktie”, MobLearn@Work returned answers in various forms simultaneously, including web pages, images, videos, news, blogs, and wikis. Aaron identified images and videos as the most effective ways to solve his problem. Tacit knowledge is a know-how that is not easily articulated and transferred to others (Polanyi & Sen, 1983). Tying a necktie is considered as tacit knowledge because it is usually difficult to share by simply writing it down or verbalizing it. However, new technologies based on multimedia can make the interpretation of “tie a necktie” much easier to transfer than before. The learning cycle was therefore greatly shortened in this issue. In this manner, we say technologies are able to change people’s way of learning. It could be concluded that mobile Web 2.0 tools could effectively enhance the self-directed learning process by providing new possible ways of identifying resources and implementing strategies to achieve the desired learning outcomes.

SDL Processes in mobile Web 2.0 Context

There are basically three areas being explored in SDL process in online context: planning, monitoring, and evaluating (Song & Hill, 2007). Similarly, the introduction of mobile Web 2.0 technologies provides learners with a flexible learning environment to schedule their learning activities at the time and the place that are most convenient for them. By end of this study, Claire informed the researcher that she had been enjoying the comfortableness of deciding all by her own on when and where to initiate an online open course program related to her specialty. Unlike in a traditional classroom setting where the instructor can easily monitor learners’ activities, in an online learning environment, the monitoring responsibilities are mostly left to the learner (Shapley, 2000). In the context of this study, the participants take full responsibility for their learning in understanding the learning subject and making sure that they are heading the right direction. However, the high level of self-monitoring has led to the difficulty in evaluating the learning outcomes in the context of mobile Web 2.0. Therefore, it is essentially important to ensure that the learners have sufficient familiarity with the subject matter, and attainment of a sense of learning competence. Another note that should be made is that learning is not an individual affair, but it implies relationships with others (Candy, 1991). In many situations, learners work together in groups and they formulate their learning needs collectively. Further research is required to investigate how the unique characteristics of mobile learning influence the processes associated with SDL.

Apart from increasing the amount of control that is given to learners, the mobile Web 2.0 learning context also impacts a learner's perception of his or her level of self-direction. As Shapley (2000) pointed out, self-regulated learners are more likely to benefit from online learning contexts. For example, all the participants in this study have expressed that MobLearn@work has enhanced their responsibility and initiative towards learning. They reported they had more control of their learning and used online learning resources more effectively.

Conclusion

Self-directed learning is a dominating philosophy in adult education (Garrison, 1997). Current research on SDL has established a good understanding of SDL as a personal attribute and a learning process. It is significant to integrate the learning context in the study of SDL, as the context influences the level of learner autonomy, as well as how learners utilize resources and strategies, and become motivated to learn. To explore workplace informal learning, the self-directedness of workplace learners is worth investigating. Mobile Web2.0 technology has provided new possibilities for self-directed learning in workplace and may have changed learners' behaviors accordingly. This study was conducted from the perspectives of individual employees, with their learning demands taken into consideration in developing an effective mobile Web 2.0 learning environment. The study of SDL in the context of mobile Web 2.0 has identified unique personal attributes, which not only enables better learning experiences, but also inspires future design of mobile learning. However, more work on SDL is required, especially regarding the issues of monitoring and evaluating learning outcomes of individual learners in informal and mobile learning contexts.

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Effectiveness of eLearning through MOOC: Grounded theory approach

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Effectiveness of eLearning has been identified as an important aspect. It determines whether the stakeholders achieve the goals of eLearning. Unlike earlier, eLearning rapidly changes with the introduction of Massive Open Online Courses (MOOC). Since many students got access to experience eLearning via MOOC, perceptions of the factors leading to an effective eLearning changed according to current needs. Many users drop out of eLearning courses due to the fact that it is ineffective in many aspects. It is timely and necessary to address the needs of the users in order to achieve success in eLeanrning. Finding solutions to the above problem, this research used Grounded Theory (GT) methodology in finding the factors affecting an effective eLearning. We found 10 dimensions which affects a successful eLearning while actively participating in 16 eLearning courses in 5 different platforms in 2 years. This paper explains the process of Grounded Theory approach which ultimately resulted in the dimensions and the explaining factors in the dimensions leading to a successful eLearning.

Keywords: effectiveness; grounded theory; qualitative; MOOC; eLearning

Introduction

eLearning has been practiced in the world for many decades. The technological requirements, infrastructure and lack of readiness of users and fewer acceptances by the society led to ineffective eLearning (Aydin & Tasci, 2005). But timely due to the improvement of ICT in world demand for the eLearning increase in the community. Although there is a demand for eLearning, it faces challenges due to the fact that users encounter many problems. Many researchers argue and introduce success factors to provide effective eLearning. Many of the factors are in dimensions such as technological, learner, instructor, environment, and design of course factors (Ehlers, 2004). However the introductions of Massive Open Online Courses (MOOCs) are changing the view of eLearning stake holders (Viswanathan, 2012).

MOOC is a practice of eLearning, which is open to the world; any interest participant attends and accesses courses and materials for free of charge. This leads thousands of participants signing up to MOOC courses every day. At the same time number of MOOC providers increases due to the demand and interest in this rapidly emerging concept. Due to this demand many universities and institutions attempt to provide eLearning courses. At present with users being exposed to many eLearning platforms and pedagogical designs, their perception of factors affecting effective eLearning is changing. Researchers claim that the MOOCs approach of eLearning is successful and therefore it attracts many students to study online (Adamopoulos, 2013). eLearning effectiveness is meeting the users learning goals and needs. Due to the open platforms students learning behaviours and expectations of an eLearning course are affected in terms of effectiveness. Our research attempts to identify the latest dimensions which affect the effectiveness of eLearning from the perspective of the user.

Our research is unique in that we incorporated Grounded Theory (GT) method to explore the dimensions which users see as important factors to provide an effective eLearning experience. The GT, which was introduced by (Glaser & Strauss, 1967) is a powerful theory to identify social aspects of research. Our goal is to understand the behavioural process that leads students to choices and thus we take a causal perspective to provide an overall deep view of a novel phenomenon. We claim that the introduction of MOOC changed the behaviours and expectations of students in eLearning context and therefore we provide the dimensions after processing the data gathered from Grounded Theory (GT).

In this paper, first we identify the work related to identifying problems and worked through GT methods to find the solution. As a result we revealed 10 dimensions which will affect an effective MOOC platform as per students view. Finally we discuss the criteria in the dimensions and conclude with further remarks.

Review of Literature

This research used grounded theory (GT) methodology in order to identify the latest dimensions in students' perspective of eLearning effectiveness. It is not common that researches use GT in educational research. However the researchers done by Crittenden (2006) found that GT is important to eLearning researches since the data produced by Grounded theory gives the best possible insights into the students and their experiences. It also provides flexibility to the researcher as it does not assume hypotheses. Nevertheless, GT was a challenging opportunity to learn something new and at the same time discover some pedagogical implications of what it is like to learn online. Also the researcher claims many GT researches are challenging as it consumes more time but the output data will contain trustworthy valid theory which has emerged from the process (Crittenden, 2006).

Researchers identified that the nature of grounded theory approach to educational research is not built upon a structured and pre-determined methodology, but rather it represents a strategy for continually redesigning research in the light of emergent concepts. This kind of flexibility not only aids the creative generation of a conceptual framework, but it also ensures that it is intimately linked to data. For educational researchers, then, this anthropological strategy provides one opportunity whereby they can become more closely attuned to empirical data (Battersby, D The First Year of Teaching : A Grounded Theory - Part 1 , 1984).

Grounded theory approach was incorporated in a few eLearning researches. One such research was to understand the social context of the UK online community and issues around the creation and exchange of knowledge within and between online communities (Cook & Smith, 2004). Another research was carried out using qualitative method focus groups to investigate and analyse critical success factors (CSFs) that are required to deliver eLearning within higher education (HE) courses and programs. Their results revealed from the Grounded Theory (GT) approach were staffing issues, pedagogically sound delivery models and training of both tutors and students. Also they claim that the institution must play a leading role in order to achieve successful eLearning (McPherson & Nunes, 2008). However in this research authors focus only on the experts drawn from administrative, educational, technology and research domains (Sun, Tsai, Finger, Chen, & Yeh, 2008). Another research done by Ehler (2004) to find the reasons for successful eLearning emphasizes the importance of learners' perspective than the experts view in the eLearning field (Ehlers, 2004). However Ehlers research was based on quantitative methods.

The research conducted by (Gilbert, Morton, & Rowley, 2007) also attempted to identify the eLearning experience in students using Grounded Theory. They defined the experience in terms of satisfaction & claim that the criteria used by students when expressing satisfaction are: synergy between theory and practice; specific subject themes; discussion forums and other student interaction; and, other learning support. However the process of Grounded Theory was carried out only to analyse the comments generated in a questionnaire where they incorporated quantitative methods as well. The following similar steps in the GT research approach by Adamopoulos (2013) presents a novel analysis using user generated online reviews to find the factors which make a great MOOC. At the same time they claim their process of Grounded Theory was used in a quantitative study. However the Grounded Theory introduced by Corbin & Strauss (1994) is based on qualitative study and argue that it is not appropriate to apply criteria ordinarily used to judge quantitative studies. At the same time Strauss (1987), empathizes with the importance of active human involvement in the study rather than being a passive data collector (Strauss, 1987). We claim that our methodology is solely conducted with active human participation in the courses and based on the process of the Grounded Theory analysing behaviours and patterns stated by the participants and we have reasoned and depicted the detail process.

Apart from that in terms of effectiveness, the literature supports a wide range of reasons to high dropouts in MOOC (Daniel, Making Sense of MOOCs: Musings in a Maze of Myth, Paradox and Possibility, 2012); (Koller, Ng, Do, & Chen, 2013); (Lewin, 2013). According to Wang (2013), three major areas affect retaining students in MOOC. Those were explored under social and cognitive perspective, namely lack of self-efficacy, lack of self-regulation and lack of self-motivation. But another research by Liyanagamuwa et al (2014), claims dropping out is often challenged by different viewpoints and suggested that it is merely failing to achieve personal aims. Nevertheless the student retention problem was researched by (Cook & Smith, 2004); (Russell, et al., 2013) to identify the key values of a course in an education system and at the same time Mackness & Williams (2010) writes about the question of how to design a course which will provide satisfaction to the participants. Among other works in this direction, Masters (2011) discusses how the roles of instructor have changed while (Xu & Jaggars, 2013) examines the extent to which student's performance in online & face to face situations. However Fox claims MOOCs represent the latest technology opportunity where the potential pedagogical impact needs to be researched stresses the importance of understanding participant's perspective of eLearning (Fox, 2013).

Methodology

This research was conducted using a qualitative design Grounded Theory (GT) methodology. The aim was to understand the eLearning culture after introduction of MOOCs which may have affected the previous behaviors and expectations. Our focus will be on individuals live experience of events in continuing eLearning. It is important to understand the depth of social reality, contextual importance in the new web.2.0 era. In a qualitative method, researcher is involved in every step listening to human needs, and is responsive and adaptive to explore what actually the users in eLearning find as effective (Corbin & Strauss, 1990).

Grounded Theory studies begin with open questions and researcher presumes that they may know little about the meaning that drives the actions of their participants. In this case, we sought to learn from participants, with many MOOCs or open learning environments. We decided to gather data from MOOC participants after a preliminary search of where the students found effective eLearning experience. We began to explore online students and inquire whether the MOOC is effective to the learner, why it is effective and what students in massive learning environments perceive as effective to the learning.

First questions initiated by us were open ended and focused on the social aspect and the back ground of the study. The few initial questions were as follows –

- What courses do you study in MOOC?
- How do you manage your life while participating in courses in MOOC?
- What is your general view of the courses you have taken?
- What are your likes and dislikes in these courses in MOOCs?
- Which features in MOOC provided an effective learning experience?
- Why do you say it is effective?

Sampling

Generally, in processing with GT, students are characterized by the theoretical sampling. However to proceed with theoretical sampling, it requires some data to collected and analyzed thus initiated with purposive or judgment of the researcher. The total participants in all the MOOC platforms as at now provided the population for our study. Some of the platforms are Coursera, edX, Udacity, NovoEd, Udemy, Iversity, future learn, Open2Studyect. For example 2 million users from more than 196 countries enrolled in at least one course (Bremer & Weiss, 2013).The sampling techniques evolved and changed during the period of the research, often using the purposive sampling technique. Therefore we selected very active users of eLearning where they have carried out the practices at least 6 months.

Data Collection

In order to formulate the theories grounded on data, we enrolled in 16 MOOC courses from 5 different MOOC platforms over a 2 year period of time. The 5 platforms were Coursera, NovoEd, edX, Iversity & open2study. Data was collected and gathered through observations on forum postings, social media postings, formal and informal interviews. Beyond that we selected a few very active users in every platform and connected with them informally and spent time apart from the course to observe the livelihood of an active user. We processed our data collection through 41 very active online participants. Qualitative researchers have recommended sample sizes ranging from as few as six participants to as many as 30 for a grounded theory study; however, no rationales exist for those recommendations (Creswell, 1998).

As we were participating in the courses, we were building relationships with students during the courses in order to be actively engaged in gathering data. At least one course was selected from 5 platforms. Initially data was gathered by observing the problems students face in the platforms, how they react to the problems, what they post in forums, what the threads inside the course consist of and also outside the course via social media and Coursetalk (a network of sharing information reviews of courses). Then we selected students who contribute to the course very actively. Generally the active students are those who submit assignments, take quizzes and contribute to the forum much more than an average student. At least 30 mints in depth interviews were designed with 1 participant or a group of participants. Though the interviews were semi structured, we provided casual movements as not to restrict the open answers. Number of participants was more than 30 and all the interviews were conducted via skype or Google hangouts. Participants were from various countries such as US, Europe, India, Egypt and Mexico.

Data Analysis

Coding

The coding process occurred in stages; in the initial coding process we gathered as many ideas as possible inductively from early data of the initial questions. In focus coding, our research selected some central codes& explored a meaningful pattern from the entire study based on the selected codes. In order to select such central codes, we were required to take decisions about which codes will contribute more in providing a meaningful relationship or which is very important & contributes more to the study.

After the initial coding we refined the categories, dimensions and factors in the theory & identified the relationships to one another. This process was initially introduced and carried in the research by (Glaser & Strauss, 1967) and also lately was emphasized by Charmaz (2006) to improve the actions to produce codes where it reduces the time and improves the quality of the findings. By this process the data will be more similar to codes and will support theory efficiently.

In this research we developed a framework of codes in order to categorize the raw data collected from interviews & observations. After the initial coding, our research resulted in focus codes as depicted in Table 1 where it will group the evidence of what students refer to as an effective eLearning.

Theoratical Sampling

Theoretical sampling is central to the GT. As states by Bryant & Charmaz (2010), a theoretical sampling is performed by coding, comparison and memo writing. It is designed to serve the developing theory. The analysis or the researcher in this case, raises questions, suggests relationships and models, highlights gaps in existing data and reveals what the researcher did not yet know and what sort of questions needed to pay attention to.

We already described the initial sampling derived from the population. Our population is the total participants in the MOOCs. Our sample was initially gathered from students in Coursea and later edX, NovoEd, Iversity, Open2Study students were selected. After the initial data collection & analysis, we practiced theoretical sampling to determine which kind of participants to select next and what kind of questions to interview and what kind of data to observe deeply.

Table 1. Focus Codes.

Focus Code	**Description**
1. How users engage	How they talk communicate keep them engage with peers, Material/Content, Instructor
2. The Technology support	How was the introducing new technology changed the eLearning perception
3. The way the course arranged	Manner that course was designed to support the needs of the user
4. Motivation to do the course	How motivated the student to take courses online
5. Usability of the whole system	Is it user-friendly to access the platforms and media
6. Slides , resources,	Do the system or the platform accommodate users' needs and

	teaching material	support
7.	Evaluation of the course	How the evaluation of courses carried out

However we did not realize in the initial observation that some students conceptualized or desired to have features that would make the platform more effective. In other words they conceptualized if they thought of some features, which the platform did not support or never considered. Those concepts arise at the time they really participated in a course and are those which they feel would be effective as if they are integrated in a particular MOOC they take. On that occasion, we added questions to the interviews focusing on what they would desire or conceptualizing features which could bring more effectiveness to the MOOC. We conducted the questions until we found a course which really supports our concept of effectiveness. Then we focus more deeply on the feature and ask questions from the participants who experienced it. For an example students were unclear about the direct benefit from the participation of the courses in MOOC. Many of the students happen to participate merely to improve their knowledge and as a result it could benefit them in their daily chores or the institution they work. Students claim the ineffectiveness mainly arises because as at now there is no standard recognition or accreditation on the MOOC courses. Nevertheless, Entrepreneurship 15.390X changed this situation by introducing bridges between the course and the real world industry through third party platforms (i.e., Coursolve) in its edX platform. . This introduced a new direction to our focus code model.

While participating more in courses we identified that when students state about the engagement, the activities could be well explained by interactivity and collaborativeness.

Theoretical Coding

After defining the focus codes in theoretical sampling, our approach was to process theoretical coding. We finished the major focus codes, which contributed to describe most of the data. At this time our study researched theoretical saturation. This often interpreted as the situation when the researcher does not hear anything new from the participants (Charmaz, 2006). Table 2 describes the theoritical codes.

Table 2. Theoretical Codes.

Theoretical codes – dimensions	**Factors supports to dimension**
1.Technology	HW support SW support Media & Mode of delivery
2.Pedagogy	Student interaction with faculty/ tutors/ students Learning pace Methodology followed by lecturers design
3. Motivation	Attention Relevance Confidence Satisfaction
4.Usability	interface design learning environment navigation feedback
5.Content/ Material	Relevancy Updated Rich collaborative information
6.Support for Learners	Psychological and social support for students Administrative support Student complaints procedure
7.Assesment	Martial assessment Collaboration assessment Periodic course/program evaluation by various means

	Periodic review of faculty/staff performances Evaluation of student satisfaction levels Regular review of student achievements
8.Future Directions	Recognize by the industry Direct to opportunities Expose to other Networks
9.Collaboration	With learners With instructor's With Faculty With industry
10.Interactivity	With peers, Material/Content, Instructor

Validity of the Dimensions

The results from the GT study was expressed as a substantive theory, that is a set of concepts related to each in cohesive manner. In our findings, we fleshed out each major code, examining the situation in which they occurred and why it occurred. At the same time we reached theoretical saturation where we were able to cover the aspects of effectiveness according to the student participant's perspective. We did the diagram of design, written memos and rigorously searched for dimensions which we have not so far identified as influencing eLearning. Our theory of 10 dimensions affecting eLearning related to one another in a cohesive manner, now accounts adequately for all the data we have collected. We have presented the developing theory to very active MOOC participants and found it was accepted and resonated the dimensions. At the same time the dimensions were presented to experts in the eLearning field intending to have the results validated. Since the process is conducted through ethnographic qualitative research method GT, we intend to conduct a statistical analysis as the future work for this research.

Discussion

We provide an answer to the main research problem, “what are the factors affecting effective eLearning?” The research used a qualitative method GT and found 10 dimensions affecting effectiveness in eLearning. The main argument of the research is that there have been many success factors identified in the field of eLearning; however after the introduction of MOOC, the perception of the users with regard to effectiveness has not being identified. At the same time we used GT which is a powerful qualitative method for identifying the changes in new phenomena’s (Charmaz, 2006).

Out of all 10 dimensions, our research found network of opportunity is a very important dimension which was not identified in any research. It is a very important fact that student’s value, which has not been considered in any occasion earlier, has been identified. This is not merely employment, but the students valued the introductions of further groups where they can practice what they learn or keep in the network. They valued the relationships built during their online courses. It was found that students learn more of the interests ‘topics through the interests groups they found online while learning in a course. Since many of the platforms of MOOC do not provide a feature or do not facilitate or promote the network culture of learning, often students find social media as their learning space. However during our participation in courses & interviews we found that this culture of network being able to publish the work to the outside via social media was facilitated by the NovoEd platform. From time to time some of the courses in Coursera platform allowed students to share the work with a link provided where other interested students can provide feedback on the work; but often students were not encouraged or their behaviors are somewhat different from the intention of building a relationship for further learning. We recommend to the platforms or the instructors to initiate the culture where students build relationships among other students who exhibit common interests in academic work and facilitate them through their learning journey to build the network of interest groups to study.

…." *I really like the connection we had while we were doing the team work, most of us had the same interests in common and we even worked beyond the group work, sometimes we gathers in hangouts to talk about the work we do and learn from each other sort of like brainstorm… "*

It is understood that there is a gap between the learnings and the needs in the industry. Students valued the path to contribute to the needs of the industry. They often complained that it is very rarely that they get a chance to implement or practice what they learn in a course in the real world. Some courses in the MOOC platforms catered to this in many ways, which students found very helpful and effective for their learning. For an example the Entrepreneurship 15.390X, the course offered by Massachusetts Institute of Technology in edX platform, bridged the gap between learning and the industry needs by facilitating students to take part in the industrial needs published in a platform (Coursolve.com). In other cases, students were directed and introduced to the industrial perception of the learnings by live webinars with guest panelists who are key relevant people from industry. It is not common that these effective practices are followed in MOOC platforms; we in this research found that students highly valued such activities and it is a very important dimension for a learning to be effective.

"… I was overwhelmed for the chance I got to execute what I learnt it the 15.390 MIT Entrepreneurship course via edX. In the class we learnt how to identify your customer and in the class offered me a link where I can find industry who is seeking collaborations to similar need .."

Another dimension, usability of the platform plays a valuable role in effective learning. As the participants point out some of the platforms navigations are difficult to trace and often lacked in usability heuristics. Many of the participants regarded the easy and simple style of web interfaces and the similar functions to be attractive and made it easy to navigate through the site. Among the much functionality in the system, assignment uploading, forum postings, watching video clips, submitting quiz answers were identified as very important to provide a usable framework. At the same time this research found providing help to the students with regard to platform problems were very important and contribute to an effective learning. In particular to MOOC the students feel they must have a contact point in the internet where they can request help for platform matters.

"…it's important that I have a contact point to request help as I recall I was unable to submit my assignment due to the network problem where the course platform supported me with the matter after I contacted through the link provided by the platform…"

Another important dimension "Interactivity" found in the research plays a major role. We found that initially students valued level of engagement with course and participants were important to a successful learning outcome. We further analyzed and found the engagement varied with different levels. Mainly the students seek interactions between other students, content and also the instructor. These interactions triggered collaboration and motivation to study which was then found as being effective in learning from MOOC. Students stated that many MOOC providers do not pay attention to the level of collaboration, whereas most of them tried to cover the interactivity part. In the revolutionizing of education it is very essential that participants learn from each other rather than just learning from a guided curricular (Sadler & Good, 2006). In our research, we discovered the fact that students presented much interest in learning from each other. Participants found that careful attention to pedagogy and the assessment as effective to their learning in MOOC. They often claimed some of the courses had only quizzes to assess and they found it as less encouraging to an active learner. They preferred to learn by doing, where the best way to assess is the overall view in the course. It is often an aggregate of participation in group work, Apart from material assessment, helpful peer grading and students also valued the assessments of their motivation to the course as well. At the same time the pedagogical changes that took place in the MOOC era have many values that students grasped as being effective for their learning. Much of the practice is in the way in which the course is conducted; having small chunks of videos, engaging in questions at the end or in the middle and students often claimed the video presentation style was important as well.

Conclusions

We tried to elaborate a detailed analysis of an emerging phenomenon, MOOC which is wide spreading in educational reformations. The number of MOOCs and platform providers keeps on rising with the demand for electronic learning. With this development, the user's perspective of the effectiveness of eLearning has been affected. It was important to identify the factors affecting to an effective eLearning in MOOC platform.

In this research we explored answers using the methodology introduced by (Glaser & Strauss, 1967), the Grounded Theory. We found that there are 10 dimensions which a participant values as effective in eLearning. Those are namely interaction, collaboration, motivation, network of opportunity, pedagogy, assessment, content/material, technology, support for learners and finally usability. Our research uniquely identified the network of opportunities as a dimension which any eLearning course should consider implementing and adapting. It is crucial that the participants should establish some connections in the network to share experiences and learn from them and at the same time it is very important for any student to connect, collaborate with peers, students from other networks and industry.

The 10 dimensions found in this research will be a guide and should be emphasized by any platform in order to provide an effective learning experience. At the same time it is important to keep identifying the changing patterns of behaviours in students while taking the MOOC courses, whereby e more affecting dimensions can be identified which will contribute to produce an effective eLearning experience.

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The ELECTRONIC ENVIRONMENT of MODERN HIGHER EDUCATION - M-learning BASIS

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The paper presents data and models of electronic learning environment in an agricultural university. We discussed what the environment can offer for f teachers and students. We suggest using the electronic learning environment and automated management to manage educational process. We also suggest mobile device learning should be included in e-learning.

Keywords: electronic learning environment, module, mobility, educational process.

Introduction

Globalization and economic reform lead to the change in higher education. The change includes educational standards, methodical aids, academic curriculum, technical and software products, students learning process and technical professional. The technical professionals are one of the most important change agents. Training the professionals requires adaption of the changing conditions of global market, which demands using more advanced e-learning system. This is ine line with the priority directions of a state policy in «The national doctrine of education development in the Russian Federation» is the following [1]:

- providing an individualization of educational process and programs considering interests and abilities of the personality;
- providing a competitive education level;
- teaching basic principles of professional career creation and skills of behaviour in a labour market;
- Taking modern achievements into account when considering educational process in organisaiton;
- creating programs with using information technologies and open education;
- allowing academic mobility of the being trained;
- training professionals to become a highly-skilled person who is capable of personal growth and professional mobility in the conditions of society information and development of new high technologies.

The directions in higher education proposed by the Russian Federation suggested taking the model "bachelor" and "master" when developing technological educational programs (innovation). Further development of the innovation in the educational environment was supported by Federal Law «About education in the Russian Federation». The law defines that possibility of educational programs with application of electronic learning and distance educational technologies as [2]:

- provision of students and teachers technologies, and means of communications;
- organization of access to electronic educational resources;
- individual educational and methodical help, including distantly.

The most effective approach to e-learning in higher education institution should include technological teaching environment and mobile technologies (devices and gadgets) when developing learning design [3].

M-learning basis

Many studies suggested how to implement e-learning and m-learning. They discussed the theoretical-methodological questions of the mobile educational environment, the perspective of use of mobile technologies, practical aspects of application of mobile technologies in educational process, etc. [3, 9, 10]. The content of concept «mobile learning» (M-learning) assumes that electronic learning environments should support information and communication technologies, which is supported by about 80 % of the world population have mobile means (laptops, tablets, smartphones, etc.) and Internet access [4]. Research on adoption of mobile technologies in higher education showed : 1) percentage of using mobile devices in learning environments of students and teachers were 99 % and 95, respectively; 2) that of laptop in learning environments of students and teachers were 83 % and 76 % respectively; 3) both 86% students and 83% teachers in higher education used technical devices for search system [5, 6]. In our study, we will apply the term «a digital inequality» in information learning and the information possibilities. This term refer to the individuals are not part of information community. It is necessary to train them to have of basic skills of electronic communications [7, 8].

Moreover, technical equipment for both students and teachers in higher education institutions is sufficient. However some universities do not have the appropriate electronic learning environments that allow active and effective learning, which make the integration less effective.

The main purpose of this paper is to consider structure of electronic learning environments for higher education and to use mobile resources to create common information learning space.

Main material of researches.

The following shows an example of creating an electronic learning environment in an agricultural university.

The basis of the electronic learning environment of university is made by the automated control system for educational process which consists of the following modules: timetable, working schedule, presence/absence, control of progress, teaching load, admissions department, lists of students, electronic documentation and employment (figure 1).

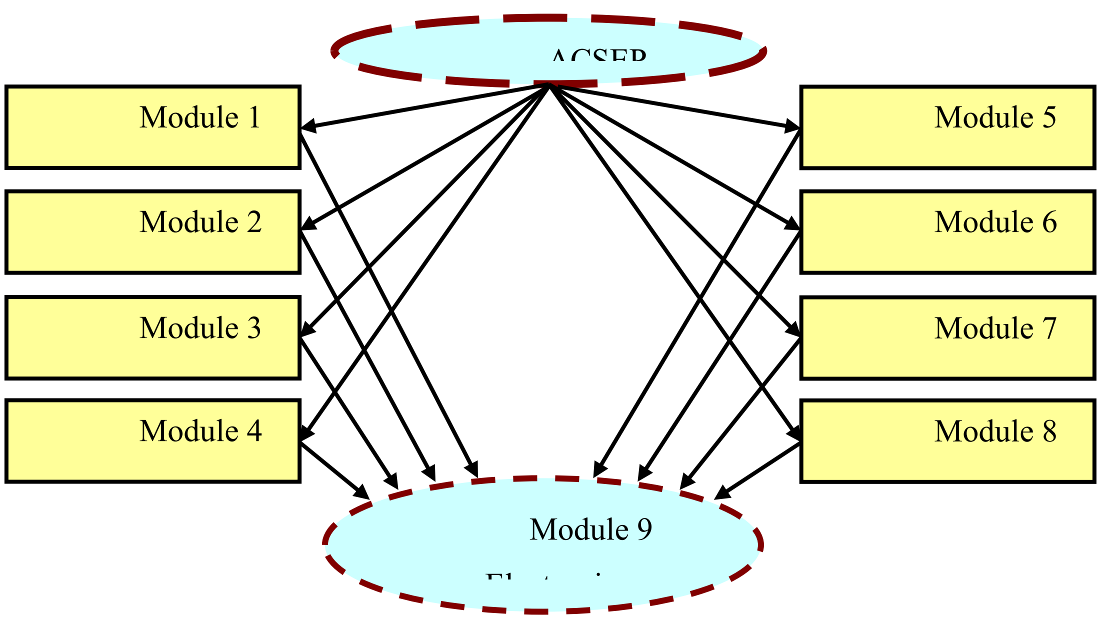

Figure 1 – The organization scheme of an internal university portal

The module 1 «Timetable» allows users to look through lesson timetable of academic groups, teachers, students, scientists and department offers, to find availability and information of educational faculties, to observe free audiences, to find the schedule of university actions, and to provide mobile version (e.g. one-day teacher timetable or the one-day student timetable).

The module 2 «Working schedule» provides information on the working degree curriculum, for example, students and their other information including studying discipline and main department lists, and class hour distributions.

The module 3 «Presence/Absence» shows statistics of student attendance including studying hour. The statistics presented the data in percentage and month format in the current semester. The data also shows the student who were absent without valid reasons.

The module 4 «Control of Progress» presents statistics of learning progress from previous session.

The module 5 «Teaching Load» shows teaching load of teachers every semester. The information includes discipline names, type of classes, teaching hour and student list. The statistics also present a summary of teaching in table form. This allows administrative persons to have an overview of the current staff.

The module 6 «Admissions Department» provides applicant information. The information included qualifying level (e.g the bachelor, the expert, the master) smf form of education. The module also provides a registration questionnaire to collect the data including personal data, Unified State Examination results, referee letters, residential addresses and other educational documents for registration. The module shows the status of the application.

The module 7 «Lists of students» shows lists of the academic groups in faculty. The lists include direction, specialty, course and group. The module also shows student funding, name, studying language, number of the record-book and the note, which is helpful to design studying group. For example, it allows teachers to use students language create of virtual groups for studying

The module 8 «Employment» records data of faculties and graduates including employment history and skills. The data can be shown in a tabular form.

The module 9 «Electronic documentation» provides users with services that they can receive electronic form of previous module information.

Every department widely apply «The educational module» for the organization of educational process and for the automated control educational system. The head of the department use this module with the purpose of realization of organization functions, providing and control of educational process on all disciplines.

«The educational module» contains the following sections (figure 2):

1) directories provide editing and control of these courses, the list of groups, structures of educational semester, audiences and teachers;
2) the curriculum allows making, editing and adjusting procedures, for example, making of working schedules of a semester, planning the different type of classes, degree work and carrying out graduation examinations;
3) university loading provides information include working curriculum in each semester and academic year, the study volume in each department;
4) loading distribution provides information about and teachers and their disciplines, which allows department planning.

Other sections of the module (the schedule of day educational form, the schedule of part-time educational form, the control module) are used by special service of educational and methodical management for the organization of educational lesson schedule separately on day and part-time educational forms of students.

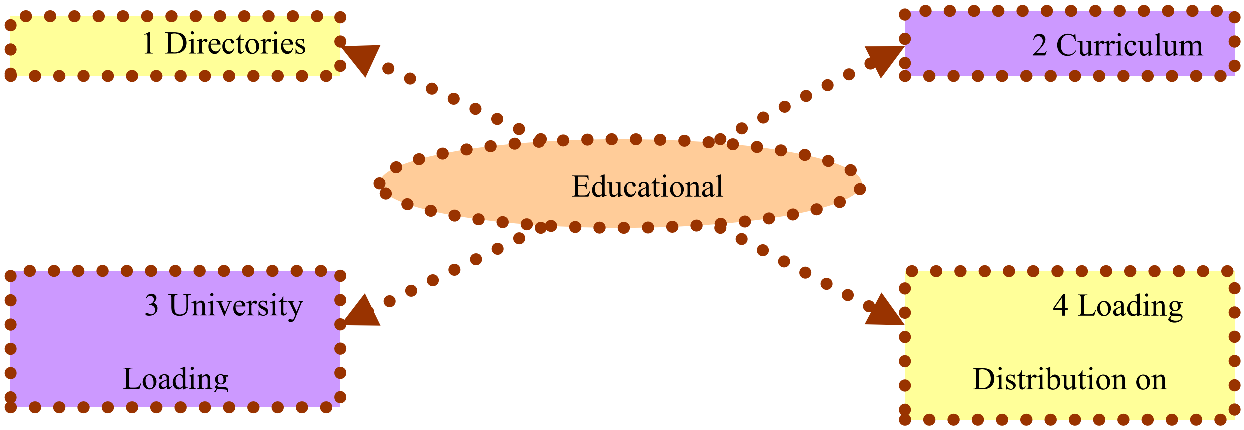

Figure 2 - The organization scheme «Educational module»

The core component of distance learning in the university is the electronic learning environment. Each member has a login and password to access the environment according to pre-examination and previous discipline testis results.

Finally set of the described means of the electronic learning environment of university allow to create continuous educational field providing access, first of all, to students to educational knowledge bases (figure 3).

Using of an automated control system by educational process with the distance electronic environment is prepared for development of mobile learning. The mobile learning increase motivation level of students. The students are likely to receive high quality education in comfortable conditions that allow flexibility.

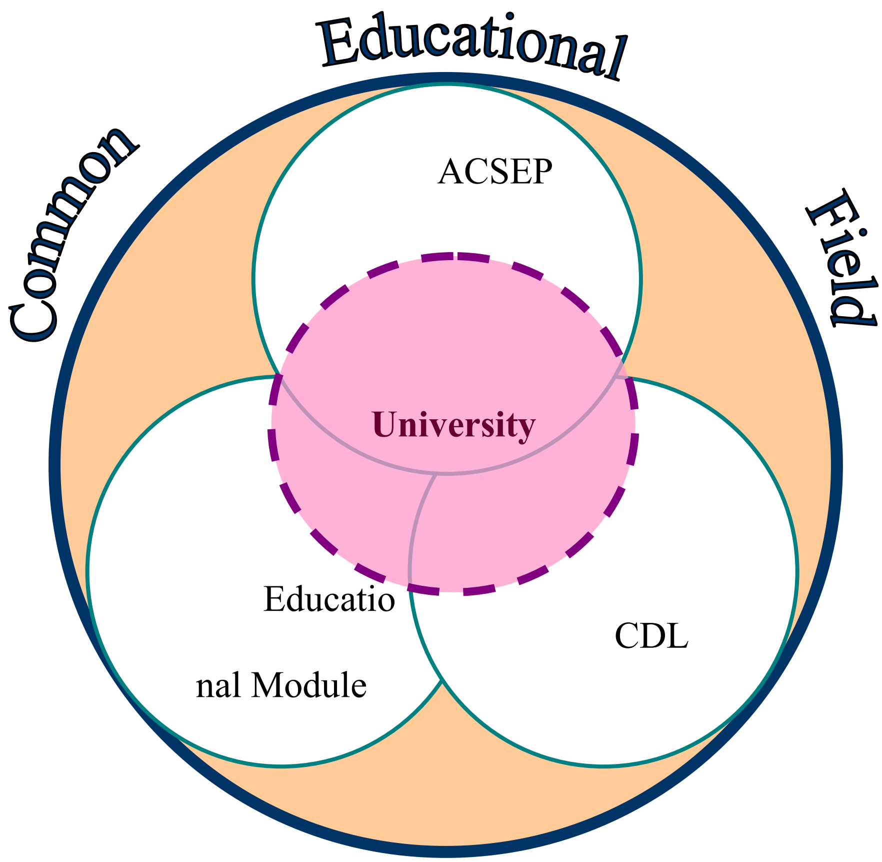

Figure 3 - The organization scheme of an educational field of university

Conclusions and future studies

In this study, we have four conclusions.

1. The analysis of use of mobile learning in students in the university provides learning flexibility. The flexibility provides student great opportunities with receiving electronic pedagogical materials to have high quality higher education.
2. The ACSEP allows us to understand individual learning results and the organizational and educational process in different courses. The use of mobile devise is necessary.

3. The common educational field of higher education should be constantly improved by considering development of a pedagogical science, information technologies and achievements in the field of a science and equipment.
4. Future development of distance, mobile and virtual learning are connected with realization of models using competency and practice-focused approach. This allows learning adapts to real conditions of production.

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