Mobile Computing Devices in a Secondary School in New Zealand – Charting Paths for the Future in Mobile Learning

Kumar Laxman[1] & Louise Sheryn[2]

[1,2] University of Auckland, Faculty of Education, New Zealand
Correspondence: Kumar Laxman, Faculty of Education, New Zealand.
Email: haribol.kumar@gmail.com

Received: August 28, 2017 Accepted: January 23, 2018 Online Published: March 1, 2018

doi: 10.23918/ijsses.v4i4p1

Abstract: The chief aim of this study was to investigate the different strategies that can be adopted in exploring how mobile computing devices can be used in curricular delivery. The research site of our study i.e a college in Auckland, adopted a Bring Your Own Device (BYOD) plan for mobile devices acquisition. Our research study focused on the mobile learning culture that has emerged in this school brought about by this BYOD policy and its impact on learning and teaching. A case study research methodology was adopted for this study. It was observed from the cases that students generally seemed more motivated in and excited about their learning when mobile devices were used during classroom curricular hours. However, the findings of this study also clearly attest to the fact that merely embedding technological tools within curricular design doesn't necessarily transform teaching and learning to higher levels of pedagogical effectiveness. The teaching that was happening in the classrooms operated often at the elementary substitution level of SAMR model. It was obvious that technology needs to be wrapped around the critical core of effective learning design to match the affordances of the technology involved with the optimal learning pathways of students.

Keywords: Mobile Learning, Technology, Education

1. Introduction

The chief aim of this study is to investigate the different strategies that can be adopted in exploring how mobile computing devices, particularly iPADs can be integrated within curricular design and developmental processes. In an attempt to move beyond the limiting boundaries of fixed classroom locations and curricular classroom hours, handheld computing devices such as iPADs are seen as tools that could empower students to optimize student learning in more engaged ways. The findings of this study will inform New Zealand educational institutions and schools on the different ways in which they can successfully incorporate mobile computing devices in their curricular design to foster more interactive, individualised and flexible learning experiences for their students.

2. Literature Review

According to Traxler (2005) "mobile learning can perhaps be defined as 'any educational provision where the sole or dominant technologies are handheld or palmtop devices" (p. 262). This definition may

mean that mobile learning could include mobile phones, smartphones, personal digital assistants (PDAs) and their peripherals, perhaps tablet PCs and perhaps laptop PCs, but not desktops in carts and other similar solutions. Perhaps the definition should address also the growing number of experiments with dedicated mobile devices such as games consoles and iPODs.

Corbeil & Valdes-Corbeil (2007) argue that mobile learning can increase learner motivation, engagement and personalize learning by differentiating lessons to suit individual learners' needs. Pegrum, Oakley and Faulkner (2013) conducted a study in Australian schools where they found the use of devices such as IPads increased student motivation and enjoyment levels. Mobile learning also offers opportunities to enable learning to be more collaboration and reflection oriented (Aubusson, Schuck & Burden, 2009). Research undertaken by Murray (2010) and Munawar (2011) found that students were more active in their collaborations and were developing higher order thinking skills when using mobile devices, particularly in one to one situations. Mobile learning allows for flexibility in learning, the creation of a learning community through enhanced interactions and the provision of access to a variety of online resources in real time (Tyagi, 2013). It is a means to enhance the broader learning experiences of students and engage them on their own terms. The information present in the mobile devices is readily and always available whenever the learners need to use it to enable learning to occur anytime, anywhere (Behera, 2013).

Though mobile learning offers a raft of potential benefits in enhancing educational design and delivery, it also comes with its own share of challenges that educators need to be aware of in considering its implementation. One entrenched challenge for schools is the digital-divide; there is a huge difference between what devices parents from high and low socio-economic areas can afford to buy their children. Shadwell (2013) argues that while it is a good thing to advance technology in schools, it is prudent to be aware that not all parents can afford devices, and this could create a culture of have and have not's in schools. The pervasive use of mobile devices, particularly mobile phones seem to have unintentionally contributed towards problems in literacy learning. When students use mobile phones they often use text language and abbreviations, that can affect the students ability to write essays and long answer questions. Lytle (2011) asserts that teachers in America have seen a dramatic decline in writing abilities and attribute that to "tweeting, Facebook and texting". Another major challenge rests in changing teachers' conceptualizations of mobile learning - implementing mobile learning is not simply replicating old pedagogy on a new device (Swartz, 2014). It is important that teacher knowledge of mobile learning pedagogies be developed and enhanced through regular on-going professional development opportunities. Mehdipour and Zerihkafi (2013) identify a number of technical limitations, including multiple screen sizes and operating systems, connectivity and battery life, and reworking existing e-Learning materials for mobile platforms. They also go on to identify challenges from social and educational perspectives such as how to assess mobile learning, device variation, content security and piracy issues, protection of personal and private information, tracking of results and risk of distraction.

A growing corpus of research literature from studies conducted worldwide attests to the increasing strategic interest in and relevance of mobile learning within educational contexts. For example, a case study conducted by Lui and Tsai (2013), using augmented-reality-based mobile learning materials in EFL English composition found that participants were engaged in the learning scenario, constructed linguistic and content knowledge, and produced meaningful essays. The important aspect of their study

is that the learning using AR-based mLearning can only be accessible using technology and through the mLearning design activities. According to Lui and Tsai (2013), when a learning activity is supported by mLearning, learners have several opportunities to actively construct their knowledge and learning. Essentially, learners can easily access their learning activities on their device and the portability can allow them to learn whenever and wherever.

Specifically, within a New Zealand context, the government has developed key documents and strategies related to learning using digital tools and devices. Some of the key documents include "The Digital Strategy 2.0" (2008), (designed to develop a cutting edge infrastructure in New Zealand education) "ICT Strategic Framework for Education 2007-2007: Supporting learning in a connected sector through the smart use of ICT" (2006), (designed to integrate the use of technology into our education system), and "Enabling the 21st Century Learner" (2009). Recently, the eLPF, (E-learning Planning Framework), has been instrumental in supporting successful development of e-learning and m-learning environments in New Zealand. In terms of strategies implemented, they include the establishment of ICT learning clusters, development of the Virtual Learning Network, nationwide infrastructure development in schools, and support for large community initiatives, such as the Manaiakalani project.

3. Theoretical Framing

The SAMR Model

Integrating mobile technologies in the classroom requires complex procedures that include: (a) learning the technology, (b) using technology in teaching and the learning process and (c) integrating technology to enhance student learning (Dockstader, 1999). The challenge in adopting mobile learning (mLearning) is that teachers need to have an overall understanding and purpose for using educational technologies in a meaningful way. Simply knowing *how* to use technology is not enough. In Romrell, Kidder and Wood's (2014) evaluation of mobile learning (mLearning), stated that it is more important for educators and instructional designers to focus on how mobile devices can be used to improve learning and not just simply operating the device. Puentedura's (2006) SAMR model provides a classification and a framework of how to evaluate educational technologies design activities for the purpose of transformative learning. The SAMR model was used as the theoretical basis to understand and analyse the pedagogical rationale and dynamics of the mobile learning activities implemented by teachers in the cases observed in this study.

The use of the SAMR model evaluates the use of technology and goes beyond than simply using technology in education. The SAMR, an acronym of *substitution*, *augmentation*, *modification* and *redefinition*, evaluates technology use to a more transformative learning and can only be achieved through the use of technology (Romrell, Kidder & Wood, 2014). Developed by Ruben R. Puentedura and part of his work with the Maine Learning Technologies Initiative (Puentedura, 2006), the SAMR classification framework provides a distinction of how teachers and students are utilising educational technologies.

Lui and Tsai (2013) posited that the SAMR framework classification, if structured correctly, allows learners to reconstruct there learning to a more engaging and effective way. A well designed and structured mLearning activity will be personal, situated and connected through a mobile device to

modify or redefine how concepts are taught (Romrell, Kidder & Wood, 2014). However, if the mLearning activities were ill fitted and poorly designed or were integrated without a purpose then, it will only introduce a new set of potential problems (Romrell, Kidder & Wood, 2014; Evan, 2008).

SAMR provides a categorical framework of how educational technology is integrated and how it progresses from *substitution*, *augmentation*, *modification* and *redefinition*. The key purpose of the SAMR model is to examine teacher and students' usage of educational technologies and characterise the benefits in restructuring and transforming user's learning experiences through the use of technology.

- *Substitution.* Substitution is described as how technology replaces a particular tool in the curriculum with no functional change (Romrell, Kidder & Wood, 2014). This is the most basic and simplest form of usage of educational technology. Gromik's (2012) study which utilised video camera capabilities of mobile phones were used to practice English in an English language course. The study found that the videos helped increase student's confidence and their English progression. However, this study is an example in which mobile phones were used as a substitute for other traditional methods such as a video recorder (Romrell, Kidder, & Wood, 2014). Therefore, the study merely replaced one tool for another and the use of the mobile video camera was simply a substitute for the traditional video recorder.
- *Augmentation.* The augmentation process goes a little further than substitution, where the technology replaces an educational tool but with functional improvements (Romrell, Kiddler & Wood, 2014). An example of this is when a teacher uses an application called Google Maps and the function called Google Earth rulers, instead of an Atlas, to locate and measure the distance between two places. In Chuang and Tsao (2013) study of the use of short-messaging-service (SMS) text messages to help nursing students memorize information about medications, it was found that the use of mobile technology's SMS text messages assisted them in memorizing vital information about medications. According to Chuang and Tsao (2013) students who received daily text messages showed significantly higher learning gains throughout the study. The use of mobile technology could be classified as augmentation because it added a practical and useful component to the previous model such as a flash card or just simply the daily lectures.
- *Modification*. Modification changes and redesigns the learning activity based on the utilisation of technology (Romrell, Kiddler & Wood, 2014). In this technology integration classification, the overall learning activity is transformed. Wang, Yu and Wu (2013) designed a module where students were required to work in groups but it was set up as they can either work face-to-face or through the use of a mobile social media application for meetings. In this study, the use of the mobile application was optional but the support and training of the use of these applications prompted students to think about using their mobile social media applications and how to use them to increase accessibility from each other. Students where able to modify and restructured how they could meet on a daily bases and work on their assignments. According to Wang et al. (2013) students reported that they felt the mobile applications improved their learning and the mobile social media applications where a useful tool in creating an environment online in order to fulfil their class work.
- *Redefinition.* Redefinition, according to Lui and Tsai (2013), is the stage where technology allows for the creation of task or learning that could only be achieved through the use of technology. In Lui and Tsai's (2013) study, the development and usage of AR-based mLearning

application on mobile phones for the purpose of assisting Chinese students learn English, the application would have an English language description of the things around what student would display over the image, as seen through the phone's camera. According to Lui and Tsai (2013), the functionality and usability of the mLearning application resulted in increasing the effectiveness of their language learning. In this example, the English language acquisition can only be achieved through the use of the mLearning application and activity – the traditional approaches of pedagogy are unable to accomplish this goal.

4. Research Methodology

Rather than schools providing the mobile devices for its students and teachers as is usually the case (one to one model) with the provision of follow-up technical assistance services, the research site of our study i.e a college in Auckland, instead adopted a unique Bring Your Own Device (BYOD) plan for mobile devices acquisition. Parents were required to buy a portable device for their child at the College and teachers purchased portable devices at a subsidised rate. Our research study will focus on the mobile learning culture that has emerged in this school brought about by this BYOD policy and its impact on enhancing and advancing learning and teaching.

Case methods were adopted as the research methodological approach to framing and implementing the study described in this paper. Robert K. Yin defines the case study research method as an empirical inquiry that investigates a contemporary phenomenon within its real-life context; when the boundaries between phenomenon and context are not clearly evident; and in which multiple sources of evidence are used (Yin, 1984). Case study serves the purpose of discovering, probing deeply, gaining a rigorous insight and understanding of a particularly chosen phenomenon (Burns, 2000). The cases selected are generally purposive and used to optimize the learning of complex meanings and interpretations encapsulated in the cases within the amount of time that was allocated to the study (Bogdan & Biklen, 1998; Stake, 1995). The classes selected for our study would serve as context-specific exemplars where the impact of embedding iPADs in curricular delivery can be examined from multiple angles of analysis. The descriptive narratives of the observed cases convey to readers the dynamics of the pedagogical processes embedded in implementing mobile learning in the classrooms. The situated nature of these elucidations would then allow readers to draw their own interpretations and understandings in applying these findings to other relevant educational contexts.

5. Results

Case 1 – female teacher - Year 9 Science lesson on Chemical Change (Rusting)

For the first ten minutes the teacher explicitly taught the students on coming up with a plan on doing an experiment on rusting. She discussed the aims, hypotheses, methods etc of the experiment to be conducted and took questions from students on what needs to be done. During the first ten minutes no iPads were used – in fact, the teacher instructed the students to put away the iPads. Students were generally on task. For the next ten minutes, students broke off into groups to discuss plans. Students used the lab book app in iPad to record their discussions. I-lab book app is a replication of the physical paper-based lab book. Teacher walks around and answers questions of students as they continue to work

on their plans. For the next thirty minutes students then go about actually setting up their plans in the lab using test tubes, nails etc. In the last ten minutes students were told to get back to their seats and put away their iPads. The teacher then showed a video to the whole class on the process of rusting and concluded the class.

Case 2 – Male teacher – Year 10 Science lesson on Electricity

For the first twenty minutes the teacher got the students to doing the interactive online quiz in groups. Socrates is the name of the online quiz and it automatically gives feedback on whether the answers are right or wrong. For the next twenty minutes teacher then proceeds to ask students to go to the school intranet website for the task to be done for the day. The task requires the students to define scientific concepts such as current, voltage, how ammeters are connected to measure current etc which they have already previously been taught. He instructs the students to post in their blogs or write in page in their iPads or email directly their responses. This task was done individually. Finally in the last twenty minutes the teacher goes through some of the questions from the task in a predominantly didactic manner and usually told the answers to the class.

Case 3 – Male Teacher – Year 8 Statistics

As a starting activity students were asked to complete a report based on the data being shown on the screen by the teacher. Students used a variety of approaches for this – some used the Notability App on iPads to complete the report, while others opted to use a paper-based approach. During this activity the teacher circulated through the class discussing approaches and responses by the students. This activity concluded with the teacher asking questions to the whole class about the conclusions they drew. The teacher then directed the students to complete a worksheet from the intranet. During both of these activities the students were highly motivated – working individually but helping each other as necessary. The concluding activity was Strike. The teacher rolled 4 dice and noted the numbers on each for the students to use. The students then had to make each number from 1 to 10 using maths operations on these four numbers. The students used MyScript Calc app on the iPad to complete this activity. They used a stylus or their finger to write sums and the app calculated the total. The students then took a screen shot of their calculation. When they had a complete set of 10 they asked the teacher to check their work.

Case 4 – Male Teacher – Maths - Stained Glass Window (Activity with area)

The teacher started with “Screens Up” asking students to follow him as he projected onto the screen the route to the activity on the intranet. After the initial instruction the students were very noisy and quite unmotivated. The activity was based around using Notability to draw a rectangle and within this create a stained glass window with different shapes with the students to calculate the different areas and the cost of each panel of coloured glass. The students grew slightly more motivated as the lesson moved on. The teacher responded to student questions individually, then realised that similar questions were being asked so brought the class together to give further instruction. The majority of the lesson was spent with students working on their individual design. The final few minutes of the session was a recap of the activity and sharing ideas for their designs.

6. Discussions

Substitution is the simplest method of integrating a mobile technology in the SAMR model (Romrell, Kidder, & Wood, 2014). All four of the Case studies found that using mLearning, iPads, were beneficial to the learning experiences of the students in the class. Consequently, the teacher's integration of iPads in each cases, beneficial it may be, simply substituted or replaced an activity that are more traditionally conducted with a basic learning material such as a paper, notepad or a calculator. In Case 1, students used their iPads to record their discussion answers. Case 2, students where requested to use their iPads to post blogs or use pages or email their discussion items from their lesson. Case 1 and Case 2 were similar in terms of their use of iPads and was set up to record and keep track of discussion answers. In Case 3, iPads were used as a substitute for calculators and lastly, Case 4 Math activity and learning about rectangles and designing stained glass window. For Case 3 and Case 4, iPads were used sparingly.

In each of the Case study, iPads were used to substitute other forms of learning activities and materials. There were forms of beneficial learning from students and increased motivation due to the novelty of using their iPads within the lesson plan however; the use of the iPads could have been more integrated in terms of transforming and redefining the student learning. According to Romrell, Kidder and Wood (2014), a well-designed mLearning activity will be personal, situated and connected through a mobile device to modify how concepts are taught.

In Redondo, Fonseca, Sanchez, and Navarro's (2013), analysis of mLearning, the technology device was the primary method of learning for students. Students were required to create and worked on three-dimensional models for their project. As for the Cases, the use of iPads could have been more beneficial, if some form of iPad application were downloaded and utilised to unpack the processes behind chemical reactions or the importance of learning Math. One potential iPad learning activity could have been in a form of video capturing and students can describe and narrate the chemical reaction of rusting or the cost-benefit of stained glass windows.

Nonetheless, using mLearning devices as a substitute and as a useful tool has its potential in increasing learning due to the newness and novelty. Romrell, Kidder and Wood (2014) stated that students generally enjoy using their mobile devices and are a positive alternative to other methods of learning. This may be the case with the current study. Students in the Case 4 study seemed to increase their motivation during the latter parts of the lesson plan when iPads where integrated. Even though the use of iPads were only in the classification of substitution, students were slightly more motivated and this is possibly due to the change of learning method from paper or calculator to their personal iPads.

7. Recommendations and Conclusions

It was observed from the cases that students generally seemed more motivated in and excited about their learning when iPads were used during classroom curricular hours. This indicates that iPads as pedagogical aids do offer immense potential in engaging students in their learning and positively impacting on educational transactions. However, the findings of this study also clearly attest to the fact that merely embedding contemporary technological tools within curricular design doesn't necessarily transform teaching and learning processes to higher levels of pedagogical effectiveness and fluency. In the cases described above, all teachers and students were equipped with iPads uploaded with the latest

apps. But the teaching that was happening in the classrooms operated often at the elementary substitution level of SAMR model when so much more could have been done with the iPads to increase pedagogical sophistication and innovate instructional delivery. It becomes obvious from the findings of this study that technology, no matter how cutting-edge and emergent as it might be, on its own alone cannot do much to power pedadogy to achieving enhanced learning outcomes. Technology needs to be wrapped around the critical core of effective learning design to match the affordances of the technology involved with the optimal learning pathways of students. Hence, teachers play a pivotal role in deftly combining the right fit between technology and pedadogy to bring out the optimal best in their students – they need to have a comprehensive understanding of the learning needs, abilities and preferences of their students as well as the instructional affordances embedded in the technological tools to be able to match them accordingly and create opportunities for individualized, engaged, active learning to occur.

References

Aubusson, P., Schuck, S., & Burden, K. (2009). Mobile learning for teacher professional learning: benefits, obstacles and issues. *Research in Learning Technology*, 17(3), 233-247.

Behera, S. K. (2013). E- and M-learning: A Comparative Study. *International Journal on New Trends in Education and their Implications*, 4(3), 65-78. doi: 1309-6249. Retrieved from http://www.ijonte.org/FileUpload/ks63207/File/08.behera.pdf

Chuang, Y.H., & Tsao, C.W. (2013). Enhancing nursing students' medication knowledge:

The effect of learning materials delivered by short message service. *Computers & Education*, 61, 168-175. Retrieved from http://dx.doi.org/10.1016/j.compedu.2012.09.013

Corbeil, J. R., & Valdes-Corbeil, M. E. (2007). Are you ready for mobile learning? *Educause Quarterly*, 30(2), 51.

Dockstader, J. (1999). Teachers of the 21st century know the what, why, and how of technology integration. *THE Journal, 26*(6), 73-75. Retrieved from http://search.epnet.com/direct.asp?an=1464352&db=aph

Evans, C. (2008). The effectiveness of m-learning in the form of podcast revision lectures in higher education. *Computers & Education 50*, 491-498. doi:10.1016/j.compedu.2007.09.016

Lui, P. H. E., & Tsai, M.K. (2013). Using augmented-reality-based mobile learning material in EFL English composition: An exploratory case study. *British of Journal of Educational Technology, 44*, E1-E4. doi:10.1111/j.1467-8535.2012.01302.x

Lytle, R. (2011). *How Slang Affects Students in the Classroom: Are social media and text messaging negatively impacting high school students?* Retrieved from:http://www.usnews.com/education/high-schools/articles/2011/06/13/how-slang-affects-students-in-the-classroom

Mehdipour, Y., & Zerihkafi, H. (2013). Mobile learning for education: Benefits and challenges. *International Journal of Engineering Computation 3*(6), 93-101. Retrieved from: http://www.ijceronline.com/papers/Vol3_issue6/part%203/P03630930100.pdf

Ministry of Education. (2006) ICT Strategic Framework for Education 2007-2007: Supporting learning in a connected sector through the smart use of ICT.

Ministry of Education. n.d. E-learning Planning Framework. Retrieved from http://elearning.tki.org.nz/Professional-learning/e-Learning-Planning-Framework

Ministry of Social Development. (2008). The Digital Strategy 2.0.

Munawar, M. (2011). *Assessing the m-learning hype: Do mobile technologies enhance the overall learning experience?* In Proceedings of World Conference on E-Learning in Corporate, Government, Healthcare, and Higher Education 2011(pp. 792-807).

Murray, C. (2010). Mobile Learning in the classroom. *Agora*, 45(1), 48-54, 2010.

Pegrum, M., Oakley, G., & Faulkner, R. (2013). Schools going mobile: A study of the adoption of mobile handheld technologies in Western Australian independent schools. *Australasian Journal of Educational Technology*, 29(1).

Puentedura, R. (2006). "Transformation, technology, and education", available at: www.hippasus.com/resources/tte/ (accessed November 14, 2014).

Romrell, D., Kidder, L. C., & Wood, E. (2014). The SAMR Model as a framework for evaluating mLearning. *Online Learning: Official Journal of the Online Learning Consortium*, 18(2), 1-12.

Shadwell, T. (2013). *Tech divide in schools feared.* Retrieved from: http://www.stuff.co.nz/technology/digital-living/8652544/Tech-divide-in-schools-feared.

Schwartz, K. (2014). *5 essential insights about mobile learning.* Retrieved from http://blogs.kqed.org/mindshift/2014/07/5-essential-insights-about-mobile-learning/

Traxler, J. (2005) *Defining Mobile Learning*. IADIS International Conference Mobile Learning 2005. Retrieved from https://www.academia.edu/2810810/Defining_mobile_learning

Tyagi, S. (2013, August 28). How Mobile Learning Works [Blog]. Retrieved from http://www.edudemic.com/how-mobile-learning-works/

Wang, J., Yu, W. C. W., & Wu, E. (2013). Empowering mobile assisted social e-learning: Students' expectations and perceptions. *World Journal of Education, 3*(2), 59-70. Retrieved from http://dx.doi.org/10.5430/wje.v3n2p59

Yin, R. K. (1984). *Case Study Research: Design and Methods.* Newbury Park, CA: Sage.