MOBILE LEARNING IN HIGHER EDUCATION: MOVING TOWARDS A FRAMEWORK FOR EFFICACY AND SUSTAINABILITY (TRANSLATED VERSION, POSTPRINT)

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ABSTRACT

The role of mobile technologies in higher education is becoming increasingly important, resulting in a need for theoretical frameworks that provide a sound foundation to support the use of these technologies for effective teaching and learning in a sustainable manner. This review summarises the characteristics of three influential but contrasting theories of mobile learning that have been developed since 2005. These three theories are compared and contrasted according to two categories; namely, the nature of the definition used for the theory and the relationship with existing theories of learning and pedagogical considerations that form the foundation of the theoretical framework. Using the lessons learned from this examination, the authors propose a methodology for creating a pragmatic Mobile Learning Evaluation Framework (MLEF) that is applicable to a variety of contexts and is flexible enough to accommodate the adoption of emerging mobile technologies. This work is already underway and is expected to be completed in 2015.

INTRODUCTION

Higher education stands on the edge of a great precipice of change – change brought about by mobile technology (Engel, Palloff & Pratt, 2011)

In the dozen or so years since the beginning of the new millennium, mobile computing technologies have evolved rapidly, enabling increasingly sophisticated methods of communication and interaction. As a result of the incremental improvements in design, tendency towards reduced size, increased functionality, improvements in data storage capability, and the reliability and ubiquity of the networks that support them, mobile technologies are increasingly perceived as essential to the conduct of people's everyday lives (Evans-Cowley, 2010). In the educational context, ubiquitous connectivity and the portable nature of these devices facilitates access to collaborative and contextualised learning experiences which translate into greater ownership of learning processes (Wong, 2012a). Furthermore, these technologies are becoming ever more affordable, presenting unique opportunities for facilitating the flexible delivery of contextualised learning experiences for diverse student cohorts. However, despite the enhanced capabilities of mobile technologies, the field of mobile learning (or m-learning) is failing to keep pace in terms of pedagogical considerations (Traxler, 2007). This is evidenced by the relative paucity of theoretical frameworks that focus on the impact of mobile technologies on learners and their experiences of mobile learning (Kearney, Schuck, Burden & Aubusson, 2012). Consequently, most mobile learning initiatives are piecemeal, are poorly supported by the institution, and are not sustained beyond the original project funding or continue once the project leader leaves the institution (Mueller, Wood, De Pasquale, & Cruikshank, 2012).

A significant challenge facing most educational institutions is identifying strategic and operational priorities for investment in mobile learning capabilities within a rapidly changing field, while maximising the educational outcomes for students and minimising institutional costs. This paper provides a comparison of three recent theories of mobile learning by contrasting and comparing each to the other. It will then describe a project that is underway to develop a framework for mobile learning that is more pragmatic and applied in its approach. It will enable higher education institutions, learning designers and educators to evaluate the impact and sustainability of mobile learning initiatives within a range of learning contexts. The Mobile Learning Evaluation Framework (MLEF) will be developed to facilitate and support higher education institutions in the assessment, development and embedding of mobile learning policies and practices to enhance the learning experiences of students and support long-term planning for improved learner and institutional outcomes. The framework will be independent of specific technologies and therefore will remain relevant despite the emergence of new devices. With the field of mobile learning field is still in its infancy, there are few guidelines available to ensure the sustainability and transferability of mobile learning initiatives.

EXISTING THEORIES OF MOBILE LEARNING

Rather than visiting territory that has already been explored, this paper builds on detailed reviews of the mobile learning literature conducted by Trifonova (2003) and Cobcroft (2006), therefore focusing only on those theories of mobile learning described in peer-reviewed journal articles or conference proceedings since 2005. This allows for any lag been the writing of Rachel Cobcroft's review and its publication, capturing those publications since 2005 that were not captured in her review. Because of the plethora of research publications available about mobile learning, the review was limited to include only those theories described in papers that received more than 100 citations in Google Scholar. This of course does not allow for more recent frameworks or theories of mobile learning that are yet to collect 100 citations but a search of the literature failed to reveal any papers that are close to being incorporated into this category. Though Google Scholar does not capture everything that has been published on a particular topic, it does capture those papers that are highly cited but also in many cases, those papers reporting on projects that are in progress (Aguillo, 2012). A search of Google Scholar using the search term 'frameworks of mobile learning' (without the parentheses) revealed only three publications which met these criteria. The names and authors of these publications are as follows:

1. Sharples, Taylor and Vavoula, (2005): *Towards a theory of mobile learning* (337 citations);
2. Motiwalla (2007): *Mobile Learning: A framework and evaluation* (262 citations); and
3. Park (2011): *A pedagogical framework for mobile learning: Categorizing Educational Applications of Mobile Technologies into Four Types* (144 citations).

In this section, each of the three theories is compared using two criteria that have been identified as crucial components uniquely distinguishing theoretical perspectives of mobile learning. These categories are:

1. The nature of the definition of mobile learning employed for the theory and the relationship with existing theories of learning; and
2. Pedagogical considerations forming the foundation of the framework.

The literature review concludes with a summary of the limitations of these theoretical frameworks and identifies a need for further research.

APPROACHES TO DEFINING MOBILE LEARNING

Researchers and educators are struggling to develop a consensual definition of mobile learning in terms that are educationally relevant (Guy, 2010). John Traxler (2010), Professor of Mobile Learning at Wolverhampton University, undertook a review of the definitions of mobile learning from which three categories of definitions emerged. He identified that early approaches to defining mobile learning tended to focus on the nature of mobile devices, referring particularly to handheld or palmtop electronic devices. The next generation of definitions exhibited a greater focus on mobility, but was largely still directed towards the mobility of the technology. The third category moved away from considerations of the technology to emphasize the mobility of the learner and the learning process.

The definition of mobile learning proposed by Mike Sharples and colleagues in 2005 falls into that third category, focusing on the mobility of the learner as opposed to the mobility of the technology. They conceptualised mobile learning as a "conversation in context, enabled by continual interaction through and with personal and mobile technology" (p. 6). According to this definition, technologies are considered to be interactive agents or tools in the process of coming to know, and the emphasis is shifted to the characteristics of the learner and his or her particular context. The framework proposed by Luvai Motiwalla (2007), however, places greater emphasis on the nature of the device rather than the learner. Although Motiwalla does not offer a definition of mobile learning, the proposed framework is founded on two levels: 1) the connectivity capability of mobile technologies and 2) e-learning, which he describes as education using the internet and other ICTs. This most likely reflects Professor Motiwalla's background in operations and information systems. Yeonjeong Park's (2011) definition of mobile learning is more similar to that proposed by Sharples and his colleagues (2005) but is less descriptive. She defines mobile learning as "the use of mobile or wireless devices for the purpose of learning while on the move" (p. 1). Though Park's definition emphasises the mobility of the learner, it does not take into account the context or interactions of the learner as with the Sharples definition.

In order to identify appropriate pedagogies for mobile learning, it is essential to understand how learning using mobile technologies differs from learning using other electronic technologies. Some researchers view mobile learning as a subset of e-learning due to the electronic nature of the devices (for example, see Peters, 2007; Brown, 2003). Kristine Peters (2007, p. 15) stated that the distinction results from the potential for mobile learning to make learning available "just in time, just enough and just for me." Theorists such as Leonard Low and Margaret O'Connell (2006) accentuate that it should be factors relating to learning, rather than technology, which allow for differentiation between existing theories of learning.

Sharples and colleagues (2005) emphasised that most theories of learning are based on the assumption that learning occurs in a fixed environment, paying scant attention to the mobility of learners. They claim their theory is distinct from learning theories such as those describing informal learning because they focus on the

continuous movement of the learner. Instead of learning being placed linearly along a set curriculum, they consider it to occur across five moving facets of the learner's environment:

1. Learning between various locations, though not necessarily while moving or on transport;
2. Learning across space as ideas and resources are moved between and across contexts;
3. Learning across time by revisiting knowledge obtained from previous learning;
4. Learning between topics as learners move continuously between competing priorities and topics of interest; and
5. With or without engagement with technology for example moving in and out of network coverage.

Park (2011) assessed the relationship between mobile learning, e-learning and ubiquitous learning (u-learning) during theory development. According to Park, ubiquitous learning involves access to a variety of technologies and digital services to facilitate the learning experience, with the focus firmly remaining on didactic or teacher-centric learning. Scant attention is paid to more learner centric modes of learning in this model. In a ubiquitous learning environment, the technology or device is secondary to the learning experience. Technology therefore disappears into the background of the learning environment. According to Park, the unique affordances of mobile devices serve to enable ubiquitous learning as they reduce dependency on wired (tethered) or fixed learning locations. The relationship between mobile learning, e-learning and u-learning is therefore envisioned in terms of a continuum with e-learning represented as being confined, distinctive and tethered, mobile learning as wireless, and u-learning as being invisible and flexible. This focus for mobile learning differs significantly to that proposed by Sharples et al. (2005) which considers mobility to encompass more than just the physical mobility of the learner but also between new and previous learning, different types of learning materials, across topics and with or without connectivity to the Internet. By way of contrast, Motiwalla (2007) maintains that "mlearning intersects mobile computing with e-learning" (p. 582). Motiwalla's framework relies extensively on factors relating to the technologies and their ability to connect to the Internet. He considers learning to be facilitated by a convergence of the Internet, wireless networks, wireless phones, handheld devices and e-learning. Similar to Park (2011), Motiwalla considers learning while physically moving to be a distinctive characteristic of mobile learning.

PEDAGOGICAL CONSIDERATIONS

Proponents of social constructivism maintain that students learn best when undertaking authentic tasks within relevant and meaningful contexts (Loyens & Gijbels, 2008) and emphasise the importance of communication and collaboration in the construction of knowledge (Wu, 2003). Social constructivism also emphasises the importance of enabling personalised learning experiences, encouraging students to take ownership of the learning process (Wilson, 1996). The portability of mobile devices as well as the sophisticated multimedia, communication and geo-location capabilities (GPS) of mobile devices enable educators to provide students with opportunities to engage in contextualised and interactive learning experiences (Kearney et al., 2012). Mobile technologies can bridge informal and formal learning contexts, enabling learners to engage in high quality learning experiences at any time and in any location (Beddall-Hill & Raper, 2010).

An extensive literature review of some 400 publications relating to mobile learning developed by Rachel Cobcroft in 2006 identified that few studies have focused on the development of specific frameworks to support the design of mobile learning. Critical discussions about the use of technology in online learning have previously identified the tendency of technology to drive pedagogy rather than as a means to support sound pedagogy (Postle, Sturman, Cronk, Mangubhai, Carmichael, McDonald, Reushle, Richardson, & Vickery, 2003). Without an understanding of the best practice pedagogical principles for mobile learning, educators run the risk of repeating these same mistakes. According to Cobcroft, Towers, Smith, and Bruns (2006), best practice in mobile learning requires educators to use mobile technologies to encourage engagement and communication in environments where students can participate flexibly.

The theory of mobile learning developed by Sharples and colleagues (2005) is informed by two theories of learning, namely activity theory and social-constructivism. The theory they developed also overlaps to a large extent with existing theories of informal learning with their emphasis on learning occurring despite formal environments or learning contexts. They consider learning to be a function of a cultural-historical activity system that is mediated by tools and technologies. Two components of this system are identified: a semiotic framework consisting of the social and cultural contexts that mediate learning processes, and a technological framework which consists of learning mediated by engagement with mobile technologies. The theory of mobile learning proposed by Sharples et al. (2005) consists of three characteristics that form the foundation of the framework:

1. The control of learning is distributed among a system of people and technologies rather than localised with one person, namely the educator;
2. The context of learning emerges as a function of interaction and is not fixed; and
3. Communication styles and learning activities emerge as a result of the capabilities afforded by mobile technologies.

Park's (2011) theory of mobile learning emerged from a desire to develop a theory that could be linked effectively to those established pedagogies already employed in distance education. Her theory is based on a modified version of the Theory of Transactional Distance formulated by Michael Moore in the early 1980s (Moore, 1993). The Theory of Transactional Distance holds that in distance education, educators and students are separated by more than just a geographical space; they are also separated by a psychological and communications space (Moore, 1993). Park recognises the ability of mobile technologies to engender social and collaborative activities by developing an additional dimension to be added to this theory which acknowledges the importance of the social aspects of learning and social technologies. Park therefore categorised mobile learning activities into four categories within the modified framework:

1. *High transactional distance and socialised mobile learning activity* where highly interactive and highly structured learning activities using mobile devices are undertaken with minimum support from the educator. These activities are undertaken as part of a group activity or are highly collaborative in nature;
2. *High transactional distance and individualised mobile learning activity* where individuals engage in highly structured activities using mobile devices with the primary contact between the individual learner and the content, rather than with the educator or other learners;
3. *Low transactional distance and socialised mobile learning activity* where leaners engage with loosely structured activities and interact with the instructor and other learners using mobile devices; and
4. *Low transactional distance and individualised mobile learning activity* where individuals undertake independent yet loosely structured and undefined learning activities using mobile devices.

The theory developed by Motiwalla (2009) focuses more on the technical functionality and application requirements of mobile devices for mobile learning rather than on pedagogical criteria. The first dimension of his theory, mobile connectivity, emphasises the importance of developing mobile devices that enable access to learning content at anytime and anywhere. According to Motiwalla, by combining *push* and *pull mechanisms* to deliver content to users results in increased personalisation of the messages delivered as students are able to control or filter the content. The second dimension of the framework, e-learning, attempts to build on the learner-centred and collaborative principles of social constructivist theory. Motiwalla maintains that by using push and pull mechanisms, students are able to reflect and react to the information they receive and therefore content is more collaborative. There is a certain lack of clarity about what is meant by "push and pull" mechanisms in the context of this theory.

Towards a New Theory of Mobile Learning: Developing the Mobile Learning Evaluation Framework

Over the past ten years, a number of pilot or experimental research studies have been conducted across sectors to investigate the impact of mobile technologies on learning and teaching (e.g. Elias, 2011; Biggs & Justice, 2011; Wong, 2012b). One of the most consistent conclusions of these studies is that there are still a number of barriers that influence the adoption of mobile learning initiatives in education, both at an institutional and at a user level. Higher education institutions are cautious about investing extensively in mobile technologies because of the rate of emergence of new models and the speed with which devices become obsolete. Few higher education institutions have therefore implemented well-financed and highly visible mobile learning initiatives that are operationalized within policy and practice.

A report conducted for the Joint Information Systems Committee (JISC) e-Learning program in late 2010 indicated that the most prominent issue in the field of mobile learning is the lack of full scale evaluations of mobile technology in higher education (Wishart & Green, 2010) and the absence of a stable platform from which to effectively research the role, drivers and impact of mobility on learning (Park, 2011). Several attempts to conceptualize mobile learning have been made (e.g., Traxler, 2007; JISC InfoNet, 2011; Pachman, Logunov, & Quinton, 2011; Vavoula & Sharples, 2009), yet none have been sufficiently targeted to ensure comprehensive and rigorous coverage of the rapidly developing and changing landscape of contemporary mobile learning networks and technologies. A project underway at the University of Southern Queensland will address this gap by developing an effective assessment mechanism that can be used to evaluate whether mobile learning initiatives are successful, scalable and replicable.

This project will result in three significant outcomes:

1. A standardised model to explore how mobile learning initiatives impact on learning and teaching in higher education;
2. A review and analysis of the broad spectrum of pilot studies and initiatives that have been implemented in Australia and elsewhere, and the kinds of approaches used to evaluate them; and
3. A Mobile Learning Evaluation toolkit: a set of principles, procedures and methods that can be used to promote the collection and review of information related to new mobile technologies, the objective evaluation of mobile learning initiatives, and prioritisation of proposed investments in mobile learning within various learning contexts.

This project is funded by a Collaborative Research Networks (CRN) project led by the Australian Digital Futures Institute at the University of Southern Queensland (USQ) in conjunction with the Australian National University (ANU) and the University of South Australia (UniSA).

Project approach

The aim of this project is to build an evaluation model that is sufficiently flexible to accommodate the current and future needs of students and educators for mobile learning initiatives. For this reason an iterative approach will be used to ensure that each commencing stage is built from the insights obtained in the previous stage and allow the inclusion of new insights and innovations in the field as the research project matures. Participatory monitoring and evaluation (PM&E) methods will be used as the project involves the development of artifacts, such as a Mobile Learning Evaluation toolkit, which are aimed at being responsive and relevant to the needs of the higher education community. PM&E has emerged from the extension of participatory action research (PAR) into evaluation (Lennie, 2006) and is a holistic approach that accounts for the diverse perceptions and interpretations of participants as well as actively and collaboratively engages participants across all levels of the project (Estrella, 2000). The method is based on the principles of PAR which allows for context-specific cycles of action, data collection and analysis, reflection and re-integration of findings and ideas

(Walter, 2009). The use of these methods will ensure that the outcomes of the project are relevant within real-world contexts.

A systematic review will be conducted which will identify and appraise all high quality research evidence related to cross-disciplinary mobile learning initiatives in higher education. An additional review of the methods developed and used so far to evaluate the impact of mobile learning as well as broader ICTs on teaching and learning will be conducted, with an emphasis on the strengths and inefficiencies of each of the different approaches and the gathering of resources to be included within the toolkit. During this stage a comprehensive definition of mobile learning will be developed and potential mobile learning pilot studies or exemplars will be identified for further examination.

The project will be undertaken over a period of two years and consists of the following three stages:

STAGE 1: DEVELOPMENT OF THE MOBILE LEARNING EVALUATION CRITERIA
The focus of the first stage of the project will be on developing the preliminary evaluation criteria and framework. Quinton, Pachman and He (2010) recommend that a three layered approach – pedagogical, technical and organisational – needs to be adopted when evaluating the impact of ICT initiatives on teaching and learning to ensure the sustainability of any learning technology. This approach will be adapted for the first stage of the project. The following groups that represent each layer will be consulted during this stage to identify the needs, expectations and challenges of each level when considering the implementation of mobile learning initiatives:

Level	Description	Method	Sample size
Organisational	Senior level management at the partner institutions and higher education institutions globally who have conducted pilot studies or implemented institution wide mobile learning initiatives.	Recorded online or telephonic interviews	5-10
Technical	ICT or learning systems support representatives responsible for technical infrastructure, standards and protocols at each of these institutions.	Recorded online or telephonic interviews	5-10
Pedagogical – Teaching	Educators from different higher education institutions and disciplines globally who have attempted to pilot mobile learning initiatives.	Online discussion boards or interviews	20-25
Pedagogical – Learning	Students at each of the three partner institutions who are interested in mobile learning who will be able to contribute input on needs and preferences.	Focus groups and social media surveys	60-75 (20-25 at each institution)

This stage of the study is exploratory and will focus on the following objective at each level:

- **Organisational:** Clarification of the institutional policies and practices that currently support or hinder the implementation of mobile learning initiatives and the criteria required by each institution for the functionality and features of the ideal initiatives.
- **Technical:** Identification of the current infrastructure assets and challenges as well as standards and protocols that will impact on the success of mobile learning initiatives.

- **Pedagogical (teaching):** Reflection on the strengths and inefficiencies of current mobile learning practices as well as the barriers and critical success factors that impact on the adoption of mobile learning initiatives.
- **Pedagogical (learning):** Exploration of the current definition and expectations of mobile learning and insight into current formal or informal mobile learning practices to identify gaps in current services and student learning needs.

Potential participants will be identified and approached during the review stage that forms part of the project. As the principles of participatory action research form an integral part of the project, participants at all levels will be requested to continue participating in the project as a review panel to comment on research findings and deliverables. Established social media channels and project blog will be the channels that are used to facilitate this interaction. The majority of interviews will be conducted using online collaboration software such as Blackboard Collaborate. Interested members of the mobile learning community will be invited to attend the interview and ask questions. The interviews will be recorded edited into mini-webinars and made available on the project website. NVivo will be used to support analysis of the data collected from these interviews.

The first iteration of the online Mobile Learning Evaluation toolkit will be developed during this stage which will include mobile learning exemplars and best practice resources collected during the review. These resources will be presented in the form of case studies as well as examples of evaluation methods. The online toolkit will be the central point from which the dissemination of project activities will occur. The project team will adopt some of the creative and highly effective online and social media dissemination strategies developed by the "Learning to Teach Online" project (McIntyre & Watson, 2011) such as the consistent use of dedicated social media channels to engage the education community around the world. The website used to host the toolkit as well as the project blog, dedicated social media sites and RSS technology will be used to communicate the concept, relevance and need for the project as well as solicit information and encourage the development of a mobile learning online community.

STAGE 2: VALIDATION OF EVALUATION CRITERIA AND DEVELOPMENT OF MODELS AND FRAMEWORKS

The second stage of the project involves the confirmation of the evaluation criteria and development of the models and frameworks. In order to ensure that the evaluation criteria, mobile learning maturity model and user models are reliable and representative of the Australian higher education population, a large scale survey research study will be conducted. The following sample sizes and populations will be targeted:

Level	Description	Method	Sample size
Organisational	Senior level management at regional or metropolitan Australian higher education institutions.	Online survey	20-25
Technical	ICT or learning systems support representatives at regional or metropolitan Australian higher education institutions.	Online survey	20-25
Pedagogical – Teaching	Educators at regional or metropolitan Australian higher education institutions, across various disciplines, who are interested in mobile learning.	Online survey, discussion forums, polls	100-150
Pedagogical – Learning	Students from regional or metropolitan Australian higher education institutions.	Online survey, discussion forums	1000-2000

Four survey instruments will be developed that are customised for each of the levels. The item pool for the surveys will be drawn from the data collected during the first stage of the study and will measure several components such as institutional context, adoption drivers and barriers, user expectations and needs, pedagogical criteria and learning styles, and impact of mobile learning initiatives. The draft instruments will be sent to the initial participants as well as a panel of experts including the reference group for formal review. The initial form of the instrument will be piloted on a sample of students and educators at one of the partner universities. The pilot survey data will be analysed using SPSS and the results will be used to refine the instruments and develop the preliminary maturity and user models. The data obtained from participants completing the final surveys will be used to calculate reliability and validity of the instruments, validate the models using techniques such as structural equation modelling (SEM), and obtain the normative data. The data will also be analysed in order to segment and profile the differences in mobile learning by students and educators across various regions, demographics, age-groups, and study fields.

STAGE 3: FINALISATION OF THE MOBILE LEARNING EVALUATION TOOLKIT

During the third stage of the study the finalised Mobile Learning Evaluation toolkit and resources will be made available on the online website to be accessed freely by the education community. Responses and critical feedback to the final deliverables will be actively sourced during this stage. The toolkit will also act as a resource for the community that will enable the identification of mobile learning initiatives that have been demonstrated in pilot and experimental studies to contribute to high quality learning experiences and which can be re-used and adapted across learning contexts.

CURRENT PROGRESS OF THE PROJECT

The project is currently in the first stage: development of the mobile learning evaluation criteria. This component of the research has included an extensive project management phase which involved developing the preliminary project website and blog and development of the project plan. During the initial stages of planning the research activities and conducing a literature review, it was identified that few researchers are in agreement about the definition, attributes and affordances of mobile learning. This was a gap in the research identified by the project team that requires redress in order to develop a theoretically sound evaluation framework. Consequently an online Delphi survey was developed to reach out to experts in the mobile learning research community in order to develop a consensus definition of mobile learning. This survey consists of three phases;

1) Phase 1 is currently underway and consists primarily of an unprompted question that requests participants to provide a list of characteristics that they feel should be included in a definition of mobile learning as well as an operational definition for each of the characteristics.

2) Phase 2 will commence in June 2013 and participants will be provided with a consolidated list of attributes from phase 1 of the research combined with findings from the literature and attributes identified by the project team during an internal workshop. Participants will be requested to indicate the extent to which they feel these attributes should be included in the final definition and assist with categorization of the attributes.

3) Phase 3 will commence in August 2013 and will include the final list of characteristics as well as taxonomic definition of mobile learning. Participants will be provided with the opportunity to comment on the suitability and face validity of the final definition.

The findings from the final phase of the Delphi technique will contribute to the foundation of the Mobile Learning Evaluation Framework.

The project team is also currently recruiting and conducting focus groups and interviews with educators and students at the three universities (USQ, UniSA and ANU). These research activities will be completed by the

end of July 2013. The interviews with mobile learning pioneers will be held in the form of webinars that will be available for participants of the mobile learning research community to attend. These webinars will also be made available as open educational resources on the project website to be used and accessed freely, accompanied by a case study about the project. One webinar has been scheduled to date to be conducted in July 2013.

Key learning's that have been identified during this phase is that educators and researchers have multiple different ideas about what mobile learning means and that this disparity in understanding often hinders adoption of mobile technologies for learning and teaching amongst educators. An additional key learning is that sufficient time for effective project management and planning is a key consideration when developing large scale research studies and the amount of time required for these activities can be easily underestimated.

CONCLUSION

As mobile technologies have evolved and become more capable of supporting learning experiences in both blended and mobile-only contexts, the field of mobile learning has emerged as a new learning paradigm and become a focus of research and development activities (Kukulska-Hulme et al., 2011; Engel et al., 2011). The near ubiquitous access enabled by the connectivity of mobile technologies has attracted the attention of educators because of the potential to open new avenues of communication, disrupt traditional classroom boundaries and "create and sustain communities of learners" (Garrison, 2011, p.1). Mobile technologies allow a user to learn anywhere, anytime and are therefore a tool which may bridge life-wide and lifelong learning (Beddall-Hill & Raper, 2010). As high speed broadband, supported by the development of the National Broadband Network (NBN) becomes more widely available in Australia, training and educational services will migrate from face-to-face and traditional distance education models to mobile paradigms. This will improve the capacity of educators to reach remote learners and workers in the field.

The three theories discussed at the beginning of this article are very distinct in terms of their focus with Sharples and colleagues (2005) emphasising the changing contexts of the learner above the nature of the technology, Park (2011) focusing on the mobility of the learner and Motiwalla (2007) targeting the nature and connectivity of mobile devices. All three theories have been highly influential in the mobile learning literature as evident by the large number of citations each has accrued, yet these three theories each contribute very differently to the mobile learning literature. This emphasises the need to consider both the technologies used and the various contexts of the learner aspects in any mobile learning theory.

Both Motiwalla (2009) and Park (2011) emphasise the mobility of the learner and the potential to take advantage of his or her time while travelling as a major benefit of mobile learning. Interestingly, no evidence was provided by these authors to demonstrate that students are actually able to engage in meaningful learning experiences during transit. There is also no indication that students want to engage in learning during these times. Sharples and his colleagues (2005) assert that mobility of the learner rarely refers to actual movement, but rather the ability to learn across and between contexts.

Park (2011) identified that although many educators in distance education environments have incorporated mobile technologies into their teaching and learning, there is a need for guidance on the effective use and integration of these devices into existing practices. Of the three theories, Park's relates most to the distance education environment and provides the most practical classifications of potential mobile learning scenarios in this context. Additional consideration of the impact of these scenarios on student learning outcomes and learning experiences is still required. Further research is also required into the development of best practice guidelines on how to leverage pedagogical frameworks to take full advantage of the capabilities of mobile learning to provide students with more contextualised, collaborative and personalized learning experiences.

A search of the literature revealed few studies that have examined the foundations of these three theories either quantitatively or qualitatively. For any of these three theories to be considered as valid frameworks for mobile learning, additional investigation into the validity and reliability of the underlying dimensions of the theories is required. Due to the diverse nature of the three theories there appears to be a requirement for a single theory which focuses more on all aspects of mobile technologies, mobility in learning and mobility of devices to provide a more holistic representation of the construct.

Though these three theories have been highly influential in the academic discourse surrounding mobile learning, they are largely theoretical and present little concrete advice as to how to design, implement and evaluate mobile learning initiatives. The latter part of this paper describes a project underway at the University of Southern Queensland, the Australian National University and the University of South Australia that is more pragmatic in its approach. The project will develop a Mobile Learning Evaluation Framework that will aid in the selection and justification of mobile learning initiatives. The framework will be encapsulated in an easy to use online Mobile Learning Evaluation toolkit which will consist of: a standardised evaluation framework, resources and guidelines; a mobile learning maturity model; a database of mobile learning exemplars; and an interactive mobile user model. Participatory monitoring and evaluation (PM&E) methods will be used to develop outcomes and deliverables.

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