An mlearning Journey: Mobile Web 2.0 Critical Success Factors.

Thomas Cochrane
Unitec
New Zealand
tcochrane@unitec.ac.nz

Abstract

This paper discusses six critical success factors for mobile web 2.0 implementation identified throughout fifteen mlearning action research projects carried out and evaluated between 2006 and 2009. The paper briefly outlines the implications of each of the five learning contexts involved in the projects in light of these critical success factors. The resultant development of strategies for future mlearning projects in 2010 and beyond are also briefly discussed.

Keywords

Mlearning, Web 2.0, Social Constructivism.

1. INTRODUCTION

Fifteen mlearning projects (Cochrane, 2009b; Cochrane & Bateman, 2010a) from 2006 to 2009 informed the identification of critical pedagogical success factors for implementing mobile web 2.0 within tertiary education, and were used to inform the planning of twelve subsequent mlearning projects in 2010.

1.1 Pedagogical Context

The mlearning projects encompassed five different tertiary courses, forming five core case studies spanning from one to three years of implementation and refinement, and involved a total of 280 participants. The learning contexts included: Bachelor of Product Design (2006 using Palm Lifedrive, 2008 using Nokia N80, N95, 2009 using Nokia XM5800, N95, N97), Diploma of Landscape Design (2006 Using Palm TX, 2007 using Nokia N80, 2008 using Sonyericsson P1i, 2009 using Dell mini9 netbook), Diploma of Contemporary Music (2008, 2009 using iPod Touch, iPhone 3G), Bachelor of Architecture (2009, using Nokia XM5800 and Dell Mini9 netbook), and the Bachelor of Performing and Screen Arts (2009 using Dell Mini9 netbook and Nokia XM5800). The research used a participatory action research methodology, and based its pedagogical decisions upon the foundation of social constructivist learning theories, with a focus upon facilitating student-generated content and student-generated learning contexts. See Cochrane and Bateman (2010a), and Cochrane (2009b) for summaries of the research methodology and project outlines.

1.2 Mobile Web 2.0

An explicit social constructivist pedagogy underpins each of the mlearning projects, forming the basis for the selection of tools to support this pedagogical approach. Mobile web 2.0 tools are web 2.0 services that are formatted for use with mobile devices including: blogs, Google mobile tools, YouTube, Flickr, Twitter, QR Codes etc… (Cochrane & Bateman, 2010b). These web 2.0 (O'Reilly, 2005), or 'social software' tools (Alexander, 2006; Mejias, 2006), share many synergies with social constructivist learning pedagogies. Web 2.0 supports collaborative group work, peer critique, formative feedback, user generated content, user tagging (categorizing and collating), and other processes similar to those used in social constructivist learning environments where the focus is on what the students do and discover.

> The application of social software in this manner supports a constructivist pedagogy where students feel empowered to take charge of their own learning (Mejias, 2006, p. 5).

Increasingly educators are harnessing web 2.0 tools for creating engaging student-centred learning environments. This appropriation of web 2.0 tools within a social constructivist pedagogy has been termed "pedagogy 2.0" (McLoughlin & Lee, 2008). This research was interested in appropriating the benefits of web 2.0 and pedagogy 2.0 anywhere anytime using mobile web 2.0 and wireless mobile devices (or WMDs), in particular WiFi (wireless ethernet) and 3G (third generation mobile 'broadband') enabled smartphones, and 3G enabled netbooks.

1.3 Identified Critical Success Factors

Based on the experiences gathered from the fifteen mobile learning projects between 2006 and 2009 the researcher has identified several pedagogical critical success factors as emergent themes for mobile web 2.0 integration (Cochrane, 2010a). These success factors were identified across the mobile web 2.0 projects by evaluating the following:

- The level of student engagement and satisfaction achieved – as evidenced in evaluative surveys and focus group feedback.
- The level of moblogging (mobile blogging) achieved by students in the courses.
- Lecturer reflective feedback.

The case studies identified the following critical success factors:

- The level of pedagogical integration of the technology into the course criteria and assessment.
- The level of lecturer modeling of the pedagogical use of the tools.
- Creating a supportive learning community
- Appropriate choice of mobile devices and web 2.0 social software.

- Technological and pedagogical support.
- Allowing time for developing an ontological shift, both for the lecturers and the students.

These identified critical success factors can be compared and validated against similar success factors and principles identified by other research projects (Barker, Krull, & Mallinson, 2005; A. Herrington & Herrington, 2007; JISC, 2009a). While each of these studies and reports emphasize different critical success factors for mlearning, in general they align with the factors identified by the research herein, adding validity and rigour to these findings. Table 1 compares these critical success factors with the researcher's.

Table 1. Comparison of mlearning critical success factors

The author's 2010	Herrington & Herrington 2007	JISC 2009	Barker et al 2005
1. The level of pedagogical integration	1. Authentic contexts 2. Authentic activities 4. Multiple roles and perspectives 6. Opportunities for reflection 9. Authentic assessment	1. Active participative learning 6. Learning tasks and outcomes 7. Extends the potential for learning	1. Interactivity 2. Coordination 4. Organisation of material
2. The level of lecturer modeling	3. Access to expert performances	4. Look to their tutors for guidance	6. Motivation
3. Creating a supportive learning community	5. Collaboration 8. Coaching and scaffolding		3.Negotiation and Communication 7. Collaboration
4. Appropriate choice of WMD and web 2.0	7. Opportunities for articulation	2. Selecting the most appropriate tools for the purpose	5. Mobility
5. Technological and Pedagogical Support		5. Benefits need to be clearly communicated to learners	
6. Time for ontological shifts			

The comparison of the four lists of critical success factors indicates that most research has been put into the area of pedagogical integration, with relatively little focus on the aspects of technological and pedagogical support, and nothing on the significant time frames required for learning reconceptualisations. The researcher would suggest that this lack of emphasis upon the time required for the ontological shifts that these disruptive technologies (Sharples, 2001) facilitate is because typically mlearning projects are short-term projects and do not look at the longitudinal impact of mlearning. A noteable exception is the MoleNet study (Attewell, Savill-Smith, & Douch, 2009) whose findings are in the process of evaluation at the time of writing.

Therefore the unique findings of this research include:

1. The matching of the unique affordances of mobile web 2.0 with social constructivist learning paradigms.
2. The explicit scaffolding of the required ontological shifts in pedagogical transformation via a structured and sustained intentional community of practice model over a significant period of time.

2. EXPLORING IDENTIFIED CRITICAL SUCCESS FACTORS

2.1 The Level of Pedagogical Integration

The WMD case studies indicated the critical role of the level of pedagogical integration of the technology into the course criteria and assessment. This involves scoping and planning appropriate course activities and assessments based upon the chosen pedagogical model (social constructivism), creating pedagogical alignment (Biggs, 2003). The point of acceptance into course integration of the mobile web 2.0 tools is typically reached as lecturers realize the flexibility of learning context and feedback that these tools facilitate. Learning activities typically begin as translations of more traditional paper based activities into a mobile web 2.0 alternative (A. Herrington & Herrington, 2007). As lecturers become more acquainted with the possibilities afforded by mobile web 2.0 tools more creative learning activities are developed and integrated into the courses. A key tool used to facilitate redeveloping course outlines has been Google Docs (http://docs.google.com) for collaborative course and assessment planning between the course lecturers and the technology steward (researcher).

As a result, a design framework was developed to guide the integration of mobile web 2.0 tools into the courses. This framework was developed iteratively over the life of the research, which began in 2006 with two test projects that informed the practical implementation of the subsequent projects in 2007 to 2009. The framework table format is based loosely on that suggested by Sharples et al (2009), emphasizing that the starting point of the design process is the learning practice and chosen pedagogical framework, which then informs the appropriate choice of mediating technologies. The case studies illustrate that curriculum integration must focus on the unique affordances of mobile web 2.0 in order to create authentic learning environments (A. Herrington & Herrington, 2007). To achieve this, curriculum integration must start with the learning practice that is to be achieved (As illustrated in

Table 2), aligning and choosing appropriate mobile web 2.0 affordances with this goal. Following such a design framework will ensure that the technology is not the primary focus, or that good pedagogy is retrofitted to technology.

Table 2. MLearning project design framework

Learning Practice	**Mediating Circumstances**		
Social Constructivism	**Context**	**Technology**	**Agent**
Lecturer Community of Practice	Lecturer professional development, pedagogical brainstorming	Face to face Scaffolded using LMS Smartphone Web 2.0 services	Lecturers as peers, with researcher as technology steward
Student and lecturer Community of Practice	Pedagogical integration and technical support	Face to face Scaffolded using LMS Smartphone Web 2.0 services	Students as peers, Lecturer as guide and pedagogical modeler, with the researcher as technology steward
Collaboration	Group projects	Social networking, Collaborative documents	Google Docs, student peers
Sharing	Peer commenting and critique	Web 2.0 media sites, eportfolio creation	RSS, student peers, lecturer
Student content creation	Student individual and group projects	Smartphone with camera and microphone, content uploaded to web 2.0 sites	Student and peers
Reflective	Journal of learning and processes, recording critical incidents	Web 2.0 hosted Blog	Personal appropriation, formative feedback from lecturer
Learning Context Bridging	Linking formal and informal learning	Smartphone used as communications tool and content capturing	Student interacting with context, peers, and lecturers

2.2 The Level of Lecturer Modeling of the Pedagogical Use of the Tools

Modeling the pedagogical use of technology involves creating a Zone of Proximal Development (Attwell, 2006; Vygotsky, 1978).

> This theoretical construct states that learning occurs best when an expert guides a novice from the novice's current level of knowledge to the expert's level of knowledge. Bridging the zone of proximal development construct with legitimate peripheral participation construct may be accomplished if one thinks of a zone in which the expert or mentor takes the learner from the peripheral status of knowing to a deeper status… the expert scaffolds the environment to the extent in which the learner is engaged with the discourse and participants within the zone and is drawn from a peripheral status to a more engaged status (Attwell, 2006, p. 6).

A second aspect of modeling is socialising the everyday use of the technology, creating socially-defined ways of appropriating the technology within each unique group of learners.

The researcher sees similarities and useful alignment of our pedagogical approaches with 'pedagogy2.0', 'authentic learning' and some of the Pedagogy-Andragogy-Heutagogy (PAH) continuum principles (Luckin, et al., 2010). The key point of difference is in the role that the authors assign to the lecturer within the formal and informal learning environments. We see the input and facilitation of the lecturer as a critical success factor in implementing mobile web 2.0 technologies, and would agree with Laurillard's position that states "M-learning, being the digital support of adaptive, investigative, communicative, collaborative, and productive learning activities in remote locations, proposes a wide variety of environments in which the teacher can operate" (Laurillard, 2007, p. 172). Therefore the staged integration of mobile web 2.0 within the course closely follows the staged and scaffolded implementation of a learning paradigm that moves the students from highly teacher-directed (pedagogy) in first year to highly self-directed (heutagogy) in the third year. Therefore strategies for the integration of the mobile web 2.0 technologies into lecturers' daily workflow were developed. Taking some broad framework ideas from the Wollongong mlearning projects (J. Herrington, Mantei, Herrington, Olney, & Ferry, 2008), lecturers participating in the projects were required to fulfill several commitments (as below), and the projects were rolled out over two semesters: beginning with the continuation and expansion of established projects in semester one, (which were used as example champions) with new projects focusing initially on lecturer professional development during semester one, followed by student implementation in semester two of each academic year.

Participant (Lecturers) requirements for mlearning:

- Participation in a weekly Community Of Practice.
- Personalised integration of mobile web 2.0 technologies.
- Development of mlearning activities based on social constructivist pedagogy for implementation with students.
- Implement a semester-long mlearning project with students.

- Publish a research output based on the project, e.g. as a study paper at a conference, or in a journal, or presentation at a symposium to other staff.
- Ethics consent for the researcher's anonymous use of data.

2.3 Creating a Supportive Learning Community

Each mlearning project involved the development of a unique learning community that included: the use of regular formative feedback from both lecturers and student peers, establishing and nurturing of an intentional Community Of Practice (COP) (Langelier, 2005; Wenger, White, & Smith, 2009; Wenger, White, Smith, & Rowe, 2005), and was supported by social networking and collaboration (Wenger, et al., 2009; Wenger, et al., 2005). An intentional Community Of Practice model (Langelier, 2005) was found to be effective for guiding and supporting the mlearning roll-out to achieve these goals. This comprised weekly pre-project "technology sessions" (Community of Practice) with small groups of lecturers facilitated by an appropriate 'technology steward' (Wenger, et al., 2005). The same model was then used with the students and their lecturers in courses.

A common theme in student feedback from all the projects was their desire to receive more formative feedback from their lecturers, which they saw blogs as a suitable tool for facilitating. Additionally students valued peer commenting on their blogs. This is a culture that needs to be established early in moblogging projects. When modeled by their lecturers and the technology steward, students in the projects developed a strong sense of community and integrated the technologies into multiple learning environments, while also critiquing and collaborating with their peers. The focus moves from teacher-directed to student-centred, where students create accounts on free web 2.0 sites and then invite their lecturer and peers to collaborate within these environments, turning the control of the learning environment beyond the domain of the teacher-directed learning management system (LMS). MLearning technologies provide the ability to engage in learning conversations between students and lecturers, between student peers, students and subject experts, and students and authentic environments within any context. It is the potential for mobile learning to bridge pedagogically designed learning contexts, facilitate learner generated contexts, and content (both personal and collaborative), while providing personalisation and ubiquitous social connectedness, that sets it apart from more traditional learning environments.

2.4 Appropriate Choice of Mobile Devices and Web 2.0 Social Software

To create authentic learning environments (A. Herrington & Herrington, 2007), the WMDs mlearning affordances must be mapped to the chosen pedagogy. A central focus of the mlearning projects was facilitating student-generated content and context bridging via the ubiquitous connectivity of smartphones. To reduce the cost of WMD Internet connectivity, dual wifi and 3G WMDs were specified. To make this affordable for the participants, institutionally owned WMDs were supplied to the participants. Participants were encouraged to treat the WMDs as if they owned them, fostering a sense of personal ownership leading to appropriation and integration of the technology via socially constructed choices (Bijker, 1995; Carroll, Howard, Peck, & Murphy, 2003; Davis, 1989). This requires utilising the types of WMDs that students want to use and own. In most cases students personalised and socialised the everyday use of the smartphones beyond embracing them simply as tools to aid their learning. Student feedback from the mlearning projects clearly showed that the choice of smartphone was critically important in the acceptance of its use. This is a function of both the social acceptance (social construction) of a smartphone, and the smartphones ability to enhance the specific requirements of a particular course's focus.

In response to this a smartphone evaluation rubric was developed for choosing or recommending an appropriate smartphone for each of the mlearning projects. The rubric was used for comparative rating of several current (2009) and soon to be available smartphones according to their match with sixteen chosen affordances for mlearning and mobile web 2.0 (Cochrane & Bateman, 2010b).

Student feedback indicated that too many mobile web 2.0 options and affordances were covered in the 2008 projects, and experience has shown that students prefer to use the smartphones for activities that make use of the unique affordances of the WMDs rather than replicate what can be achieved using a standard laptop or desktop computer. Therefore specific affordances of the new generation of smartphones were focused on in the 2009 projects and beyond.

2.5 Technological and Pedagogical Support

Initial pedagogical and technical support for each mlearning project began with the establishment of a lecturer COP focusing upon investigating the pedagogical use of the tools and developing lecturer competency and personal appropriation of the tools. This was then followed by the establishment of a combined lecturer and student COP for implementing the mlearning project. The projects highlighted the critical role of the 'technology steward' (Wenger, et al., 2009; Wenger, et al., 2005) within the COPs. A strategy for pedagogical and technological support for the integration and implementation of mobile web 2.0 was developed using an intentional COP model (Cochrane, 2007; Cochrane & Kligyte, 2007; Langelier, 2005). Using this model, the mlearning projects were guided and supported by regular 'technology sessions' (COPs) facilitated by an appropriate 'technology steward' (Wenger, et al., 2009; Wenger, et al., 2005) who provided guidance to the group, while also interacting as a peer group member in this learning community. These mlearning projects therefore become collaborative projects between the 'technology steward', the course lecturers (one

of whom may take on the role of technology steward), and the students on the course. The institution's LMS was then used to provide scaffolding and support for both lecturers and students. Lecturers were encouraged to model the use and integration of mobile web 2.0 in their own daily workflows and to provide regular formative feedback to students via interaction on their web 2.0 sites and eportfolios.

While very time intensive, requiring prolonged commitment from both the participants and the technology steward, the use of an intentional Communities of Practice model for creating academic peer support groups to investigate the integration of social software and elearning and mobile technologies into tertiary education has proven to be more successful and a better use of resources than general workshops for academic staff. Academics who have participated in the mlearning COPs feel better prepared for today's technology adept learners. The uptake throughout the institution of COPs for educational technology is encouraging, and leading to collaborative projects between the researcher, academics and students. Staff who previously struggled with integrating technology into their pedagogical approaches are now implementing mobile learning projects with students, and thus we are seeing the awareness and uptake of mobile technologies in tertiary learning increase at Unitec. Key to the models success is its flexibility: recognizing that every COP formed is unique, requires negotiable content, motivational goals, and appropriate access to resources. Every COP requires a different approach for nurturing and motivation. Finally, the guidance of a Technology Steward is critical in establishing and guiding each COP in their investigation and use of technology.

2.6 Allowing Time for Developing an Ontological Shift

The mlearning projects identified three key issues around reconceptualising teaching and learning (an 'ontological shift' in participants' understanding):

- Staging and scaffolding the introduction of disruptive technologies reduces students' cognitive load and maximizes the effectiveness of the zone of proximal development (Attwell, 2006; Vygotsky, 1978).
- Shifting lecturers from pedagogy to heutagogy – reconceptualising teaching (Luckin, et al., 2008; McLoughlin & Lee, 2008).
- Shifting students beyond their knowledge threshold – reconceptualising learning, and using the WMDs to engage students with "troublesome knowledge" (Land, Cousin, Meyer, & Davies, 2005).

Lecturers typically require significant time to become comfortable with using the mobile web 2.0 tools, and with the potential for enhancing their course. The various mlearning trials undertaken have illustrated that pedagogical integration of mlearning into a course/curriculum requires a paradigm shift on behalf of the lecturers involved, and this takes significant time. Hameed and Shah (2009) describe this process as a "cultural re-alignment". The research followed the learning journeys of the researcher and participants as they moved from personal appropriation of the new technologies to the ontological shifts (Chi & Hausmann, 2003) required for integrating the unique affordances of these mobile web 2.0 technologies into their pedagogical practice and courses, enabling collaborative learning environments that bridge multiple contexts. Many of the identified mlearning scenarios were serendipitous rather than planned by the lecturers during the earlier mlearning projects. It also became apparent that students also require significant time to gain the skills required to maximise the potential of new and emerging web 2.0 tools – as our pre-project surveys indicated, few students were already using these tools for their own content creation before the projects. Based upon these experiences, in order to achieve an explicit move to a social constructivist learning environment using mobile web 2.0 tools during 2009, a staged, and scaffolded approach was adopted. This staged approach allows the bridging of the PAH (Pedagogy, Andragogy, Heutagogy) continuum (Luckin, et al., 2008), and the embedding of mobile web 2.0 affordances that support each stage. A key strategy to facilitate a move along the PAH continuum (Luckin, et al., 2008) is curriculum integration of mobile web 2.0. Thus beginning the introduction of web 2.0 integration into the first year of a course (in multi-year courses) will prepare students for higher-level context bridging in subsequent years of their course.

3. IMPLICATIONS OF THE FIVE CASE STUDIES

3.1 Implications of Case Study1: Diploma of Landscape Design 2006 to 2009

Beginning in 2006 (Cochrane, 2010b), the first mlearning project paved the way for the following projects, highlighting a range of technical and implementation issues that could be improved upon. The project also emphasized the disruptive nature of mlearning (Sharples, 2001; Stead, 2006), illustrating the process of lecturer pedagogical reconceptualisation of teaching, and the process of student reconceptualisation of learning required as the course moved from teacher-centred (pedagogy) to social constructivism (andragogy to heutagogy) (Luckin, et al., 2008; McLoughlin & Lee, 2008). Thus the importance of a robust yet flexible technical and pedagogical support strategy was highlighted. The unique student profile (all the students were aged between 43 and 69) of the 2008 iteration of the Landscape Design mlearning project highlighted the importance of choosing appropriate WMDs for the needs of each unique student group. Thus the 2009 Landscape Design mlearning project used netbooks to minimize the cognitive load for the students (Kirschner, 2002; Valcke, 2001), and highlighted the importance of learning community formation to be integrated into the course.

3.2 Implications of Case Study2: Bachelor of Product Design 2008 to 2009

The Product Design mlearning projects achieved significant progress in course integration, pedagogical reconceptualisation, and development of a staged and scaffolded implementation model for developing learning communities facilitated by intentional communities of practice across each year of the course (Cochrane & Bateman, 2010a). The case study illustrated the potential to stage and scaffold mlearning integration across all three years of a Bachelor level course, starting with establishing a learning community culture involving both the students and the lecturers and facilitation of a progression of teaching paradigms from pedagogy to heutagogy (PAH) (Luckin, et al., 2008) following the first year to third year of the course. The PAH continuum maps well with the progression of mobile web 2.0 course integration from web 2.0 appropriation (JISC, 2007, 2009b) in first year to student mobile facilitated content creation (Bruns, 2007; JISC, 2009a) in second year, and finally the context independence and bridging affordances of mlearning (Luckin, et al., 2008; Vavoula, 2007) leveraged in the third year 'nomadic studio'.

3.3 Implications of Case Study3: Diploma of Contemporary Music 2008 to 2009

The Diploma of Contemporary Music mlearning project developed from an initial exploration of the potential of mlearning to engage students and enhance the course to an example of successful course integration and student adoption and appropriation of mlearning. During the first iteration of the mlearning project students and lecturers were enthusiastic and engaged by the tools, but skeptical as to the potential impact on the course and learning outcomes (Cochrane, 2009a). The second iteration of the mlearning project integrated the mlearning tools into the course assessment leading to adoption and appropriation by the students beyond personal and social use, leveraging the learning context bridging (Vavoula, 2007) affordances of mobile web 2.0 for facilitating authentic (A. Herrington & Herrington, 2007) course-related learning environments beyond the classroom. This case study also demonstrates the need for significant time for lecturer pedagogical reflection for the necessary ontological shifts (Chi & Hausmann, 2003; Hameed & Shah, 2009) in their pedagogical conceptions to be able to integrate mlearning authentically.

3.4 Implications of Case Study4: Bachelor of Architecture 2009

The Architecture mlearning project was the widest scoped in terms of student numbers, encompassing the entire second year of the Bachelor of Architecture (115 students). However the project was a first implementation within the school, and formed an exploratory initiation into the potential of mlearning for both the lecturers and the students. This illustrates a consistent theme in all of the mlearning projects, that the first implementation of an mlearning project breaks new ground, and while not necessarily producing significantly transformed pedagogy due to a lack of course integration, the first iteration creates the groundwork for the ontological shift (Chi & Hausmann, 2003) required by the course lecturers to conceptualise the potential to integrate the technologies into the course in subsequent iterations of the mlearning project. Key lecturers declined to be involved in the establishment of the initial lecturer investigative community of practice, leading to a lack of willingness to integrate the project into the course assessment. This case study therefore highlights the critical importance of lecturer professional development and subsequent course integration of the mlearning tools. This is the first significant step in the journey of ontological reconceptualisation of teaching by the lecturers, and the ontological reconception of learning by the students that the mobile web 2.0 projects have been explicitly designed to facilitate. The lecturer's input into the design of mlearning is critical (Laurillard, 2007).

3.5 Implications of Case Study5: Bachelor of Performing And Screen Arts 2009

The Performing and Screen Arts mlearning project was one of the most ambitious of the mlearning implementations with regards to the use and exploration of the mobile technologies. However, its implementation suffered from the relatively short time the lecturers had for personally appropriating the mlearning tools themselves, and timetabling limitations led to a significant change in the community of practice support model. While not personally modeling the use of the mobile web 2.0 tools to a high level, the course lecturers nevertheless created an atmosphere of high expectations of the students that created an energetic 'buzz' among them, facilitating experimentation and collaboration around the use of the tools. While there was a lack of course-focused community facilitated by the WMD implementation, there was a very high level of personal appropriation of the WMDs by the participating students. Students found the portability and ubiquitous connectivity of the smartphones empowering for both accessing course content and their social networks. This case study therefore highlights the importance of the development of a regular supportive learning community, and the positive impact of high expectations from the lecturers on the participating students.

4. DISCUSSION

While the research has sought to produce transferable principles and strategies to enhance tertiary education using mobile web 2.0, it is ultimately bound by the limits of the contexts of the learning communities that it is embedded in (the five case studies are based in the 'creative arts and industries' fields), and the current affordances of the available mobile web 2.0 technologies. The mobile web 2.0 projects have so far used a model of providing a common smartphone for the students and lecturers within a course. The students and lecturers involved have been encouraged to use the smartphones as if they owned them for the period

of the projects. This approach was used to seed the concept and provide proof of concept results. However, to create a sustainable approach, the goal going forward is to move to a student-owned model, where students purchase a smartphone that meets specifications outlined by the course requirements, much as many institutions currently require students to purchase a specified laptop computer to ease support requirements. As the cost of appropriate smartphones and 3G data costs drop, the purchase cost may be sustainably subsidized by institutions in lieu of other course related costs that the mobile web 2.0 paradigm replaces. However it is yet to be seen whether there can be transferability of the research outcomes based upon an institution supplied or specified WMD and mlearning projects based upon student chosen and owned WMDs (Traxler, 2010).

The technological goal-posts of mobile web 2.0 are rapidly changing, and new integrated smartphone affordances continue to provide new ways of communicating, collaborating and enhancing learning. An example for future research is the rise of augmented reality applications for smartphones and integration with web-based services. The challenge is to implement these new technologies from a sound pedagogical basis.

An intentional community of practice model provides a sustainable framework for pedagogical and technical support of mlearning projects. While it is time-consuming, the results are rich. "The community of practice is one way to manage knowledge. It is a powerful, but demanding tool" (Langelier, 2005, p. 8). The COP model has led to the development of mutually collaborative partnerships that have seen rewards in increased student engagement, deeper pedagogical reflection, and practice-based research outputs. The symbiotic relationship developed between the researcher (technology steward) and the lecturers involved in each of the mobile learning trials overviewed has proven to be a rich environment for harnessing mobile web 2.0 technologies to design social constructivist learning environments for different groups of tertiary students. The disruptive nature of mobile web 2.0 technologies has been presented as a catalyst to move traditional instructivist pedagogies towards social constructivist pedagogies that bridge both on and off campus learning contexts.

A limitation of the participatory action research methodology of the research is the significance of the input of the researcher as the technology steward for the projects. The partnerships developed between the researcher and the participants (particularly the lecturers) have been critical in supporting and providing direction for the projects. It is yet to be seen whether the approach can be transferred to other mlearning contexts involving a different technology steward.

5. CONCLUSION

Mobile web 2.0 is a continually evolving environment with new technologies and affordances developing at an astonishing rate. However this research has illustrated that by identifying and putting in place strategies to support mobile web 2.0 critical success factors it is possible to transform teaching and learning.

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