Exploring the Pedagogical Affordances of Mobile Web 2.0

ABSTRACT

This chapter explores the potential of Mobile Web 2.0 to enhance tertiary education today, outlining both research-informed principles, as well as providing case study examples of Mobile Web 2.0 participants' experiences of how the use of Mobile Web 2.0 within a pedagogical framework has transformed both students' and lecturers' conceptions of teaching and learning.

INTRODUCTION

This chapter is based upon the author's research that covers three years of action research mLearning (mobile learning) projects encompassing five different courses, forming five case studies spanning from one to three years of implementation and refinement, and involved thirteen mLearning projects undertaken between 2007 and 2009 with a total of 280 participants (Cochrane & Bateman, 2010a). 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 Sony Ericsson 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 aim of the research was to investigate the potential of Mobile Web 2.0 tools (with a focus upon smartphones coupled with mobile formatted Web 2.0 social software) to facilitate social constructivist learning environments across multiple learning contexts (both formal and informal).

The research used a participatory action research methodology (Swantz, 2008), and based its pedagogical decisions upon the foundation of social constructivist learning theories (Piaget, 1973; Vygotsky, 1978).

The research captured the learning journeys of the researcher and participants as they moved from initial skepticism to personal appropriation of the new technologies, to the ontological shifts 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.

The research led to the development of an intentional community of practice model (Langelier, 2005; Wenger, White, Smith, & Rowe, 2005) for lecturer professional development and scaffolding student learning, established a pedagogical design framework, identified critical success factors, and developed an implementation strategy for the integration of mLearning within tertiary education.

The research adds the insights of a longitudinal study to the relatively new body of knowledge around mLearning. What began as an investigation of the affordances of Web 2.0 in 2007 developed into a wide exploration of Mobile Web 2.0 within a variety of learning contexts. The

success of these projects led to the implementation of integrating Mobile Web 2.0 technologies (based on an explicit social constructivist pedagogy) across the institution.

This chapter summarises the potential of Mobile Web 2.0 in tertiary education from the researcher's perspective and experiences, over-viewing a range of current freely available Web 2.0 services. Two case studies are used to illustrate the integration of Mobile Web 2.0.

BACKGROUND

This section briefly outlines some of the core concepts and the author's position on mLearning and Mobile Web 2.0.

Web 2.0

While definitions of Web 2.0 are difficult to pin down, it is their similar characteristics that link these diverse web services. "Ultimately, the label "Web 2.0" is far less important than the concepts, projects, and practices included in its scope" (Alexander, 2006, p. 33). McLoughlin defines Web 2.0 as "a second generation, or more personalised, communicative form of the World Wide Web that emphasises active participation, connectivity, collaboration and sharing of knowledge and ideas among users" (McLoughlin & Lee, 2007, p. 665).

Pedagogy 2.0

Recent years have seen many attempts to reconceptualise pedagogical approaches within tertiary education (JISC, 2009b; Laurillard, 2001). These have been driven by the emergence of new learning theories based broadly upon constructivist and social constructivist foundations, and the development of new learner-centred technologies that facilitate these newer pedagogies (Alexander, et al., 2006; JISC, 2009a). For example, the appropriation of Web 2.0 tools within a social constructivist pedagogy facilitates what has been termed "Pedagogy 2.0" (Catherine McLoughlin & Mark Lee, 2008). McLoughlin advocates the exploration of the potential of the alignment of Web 2.0 tools and emerging learning paradigms based loosely upon social constructivism such as 'navigationism', and 'connectivism'.

The affordances of these technologies, coupled with a paradigm of learning focused on knowledge creation and networking, offer the potential for transformational shifts in teaching and learning practices, whereby learners can access peers, experts, the wider community and digital media in ways that enable reflective, self-directed learning (C McLoughlin & Mark Lee, 2008, p. 649).

Similarly, Herrington has proposed that mobile technologies can facilitate 'Authentic Learning' (J. Herrington, Mantei, Herrington, Olney, & Ferry, 2008).

Focusing even more explicitly on empowering independent learners, Luckin et al (2008) propose the concept of Learner Generated Contexts (LGC) as a potential framework for technology based learning based on the Vygotskian concept of 'Obuchenie'. Though not explicitly limited to mobile learning, the concept focuses upon learning within learners own environments that new technologies facilitate. 'Obuchenie' blurs the distinction between teaching and learning, creating a two-way dyadic interaction within the Zone of Proximal Development. Luckin et al see a reconceptualisation of the level of influence the teacher plays in these contexts,

and attempt to breakdown the classical PAH continuum (Pedagogy – Andragogy – Heutagogy) (see Table 1 below).

Table 1: The PAH continuum, from Luckin et al (Luckin, et al., 2008, p. 10).

	Pedagogy	**Andragogy**	**Heutagogy**
Locus of Control	Teacher	Learner	Learner
Educational sector	Schools	Adult education	Doctoral research
Cognition Level	Cognitive	Metacognitive	Epistemic
Knowledge Production Context	Subject understanding	Process negotiation	Context shaping

While the researcher is not advocating a radical reconceptualising of educational pedagogy on the scale that is proposed by Luckin et al, the researcher sees similarities and useful alignment of our pedagogical approaches with 'Pedagogy 2.0', 'Authentic Learning' and some of the PAH continuum principles. The key point of difference is in the role that the researcher assigns to the lecturer within the formal and informal learning environments. The researcher views 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 "mLearning, 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). However, the role of the lecturer is significantly changed. 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

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. Mobile learning, as defined in this research, involves the use of wireless enabled mobile digital devices (Wireless Mobile Devices or WMD's) within and between pedagogically designed learning environments or contexts. From an Activity Theory perspective, WMD's are the tools that mediate a wide range of learning activities and facilitate collaborative learning environments (Uden, 2007).

Mobile Web 2.0

The WMD's wireless connectivity and data gathering abilities (for example: photoblogging, video recording, voice recording, and text input) allow for bridging the on and off campus learning contexts – facilitating "real world learning", disrupting traditional instructivist teaching

models and facilitating a move along the PAH continuum to social constructivist learning paradigms.

PEDAGOGICAL AFFORDANCES OF MOBILE WEB 2.0

Adoption and integration of technology into educational environments need to be based upon a pedagogical design framework that aligns the affordances of the chosen technologies with the chosen pedagogical framework (Cochrane & Bateman, 2010b).

Successful technology integration is a sociological issue, intimately connected to institutional cultures and practices, to social groups (formal and informal), and to individual intention, agency and interest. Most importantly, appropriate use of technology in teaching requires the thoughtful integration of content, pedagogy, and technology. (Mishra, Koehler, & Zhao, 2007, p. 2)

The addition of a new technology reconstructs the dynamic equilibrium between all three elements forcing instructors to develop new representations of content and new pedagogical strategies that exploit the affordances (and overcome the constraints) of this new medium. Similarly, changing pedagogical strategies (say moving from a lecture to a discussion format) necessarily requires rethinking the manner in which content is represented, as well as the technologies used to support it. (Mishra, et al., 2007, p. 8)

Experience and feedback from the research participants (2007 to 2009) has shown that the focus should be on the affordances of Wireless Mobile Devices (WMDs) that are most suitable for the small screens and slower text entry, as well as those affordances that are unique to WMDs (For example: the built-in geotagging, media recording capabilities, and communication tools). In particular, it is the WMDs potential to bridge multiple learning contexts that facilitate rich interactions between formal and informal social constructivist learning environments. As Laurillard notes: "The intrinsic nature of mobile technologies is to offer digitally-facilitated site-specific learning, which is motivating because of the degree of ownership and control." (Laurillard, 2007, p. 157).

Mobile Web 2.0 Design Framework

The design framework for each of the projects is shown in Table 2. 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.

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

Evaluation of Example Mobile Web 2.0 Services

This section overviews some of the currently available Mobile Web 2.0 services that can be utilised within a social constructivist pedagogy.

Table 3: Affordances of smartphones mapped to social constructivist activities.

Activity	Overview	Examples	Pedagogy
Video Streaming	Record and share live events	Flixwagon, Qik http://www.qik.com Knocking, Livestream	Real-time Event, data and resource capturing and collaboration.
Geotagging	Geotag original photos, geolocate events on Google Maps	Flickr, Twitter, Google Maps http://tinyurl.com/5a85yh	Enable rich data sharing.
Micro-blogging	Post short updates and collaborate using micro-blogging services	Twitter http://tinyurl.com/2j5sz3	Asynchronous communication, collaboration and support.
Txt notifications	Course notices and support	Txttools plugin for Moodle and Blackboard txt and twitter polls: http://www.polleverywhere.com/ http://twitter.polldaddy.com http://twtpoll.com/	Scaffolding, learning and administrative support
Direct image and video blogging	Capture and upload images and video of ideas and events	Flickr, YouTube, Vox	Student journals, eportfolios, presentations, peer and lecturer critique.
Mobile Codes	2D Codes scanned by cameraphone to	QR Codes, Datamatrix 2D Codes http://tinyurl.com/af2u6d	Situated Learning – providing context

	reveal URL, text etc…		linking
Enhanced Student Podcasts	Remote recording of audio, tagged with GPS and images etc…	AudioBoo	Situated and collaborative Learning – providing context linking
Augmented Reality	Overlaying the real world with digital information	Wikitude Layar	Situated Learning and Metacognition
Social Networking	Collaborate in groups using social networking tools	Vox groups, Ning, peer and lecturer comments on Blog and media posts http://tinyurl.com/4uz6rj	Formative peer and lecturer feedback.

The researcher has focused upon utilising freely available Web 2.0 services that are easily accessible via smartphones. The smartphone's constant connectivity, and built-in media capturing affordances allow students to capture, share and critique ideas and continue learning conversations within virtually any context. The following concept map (Figure 1) illustrates this process with some of the 'core' Web 2.0 tools used in the research projects, which are expanded upon in the following section.

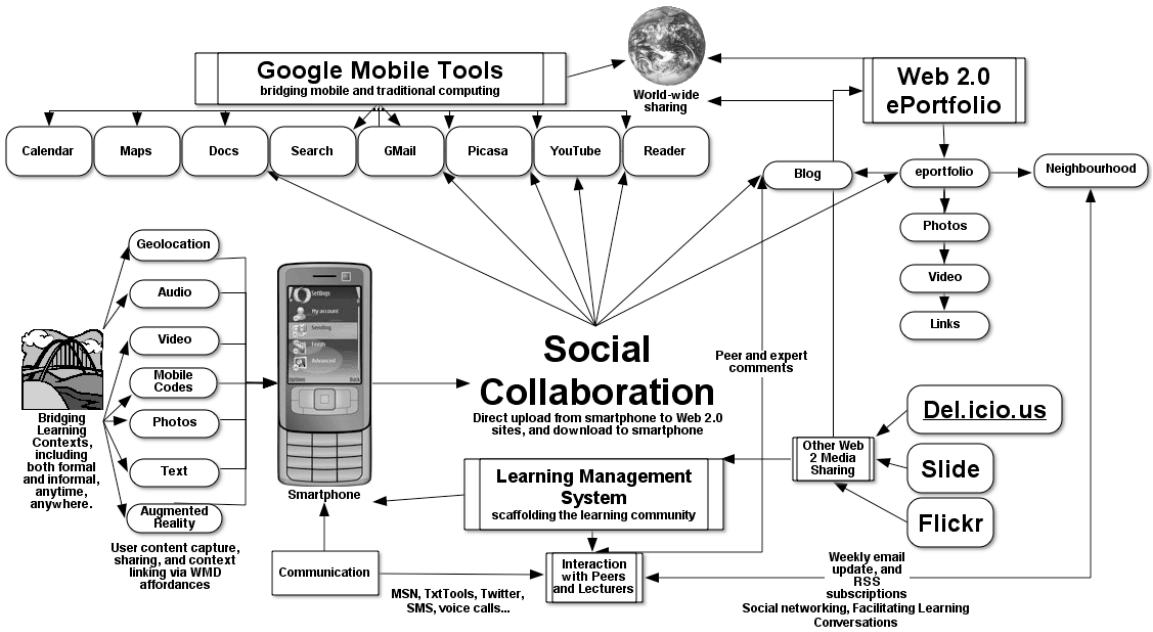

Figure 1: Mobile Web 2.0 concept map.

Google Mobile

Google provide a gateway into the Google Mobile services (http://mobile.google.com) via a phones web browser. iGoogle (http://www.google.com/ig/i) is a customisable mobile Google homepage.

Pedagogy:
Links to mobile formatted software tools that support social constructivist pedagogies.

I. Maps

Google Maps (http://maps.google.com), a free world-wide mapping service is optimised for use on mobile devices. Additionally, most smartphones now include an integrated GPS for geotagging of photos and videos and geolocation via mapping services such as Google Maps. Geolocation adds an extra layer of information to mobile captured content, and along with a built-in compass provides the foundation for Augmented Reality application interaction.

Pedagogy:
Context awareness and sharing of geolocation data.

II. Calendar

Google Calendars (http://calendar.google.com) can be shared between groups of people via invitation. Google Calendars use an open format that provides interoperability between many calendar systems – for example iCal on Mac OSX.

Pedagogy:
Time scheduling and collaboration of group activities.

III. Reader

RSS enables subscribing, tracking and sharing of online activity. RSS provides a link between all Web 2.0 media sites. Google reader (http://reader.google.com) is a mobile formatted web based RSS reader, and there are also RSS client applications for synchronizing Google Reader subscriptions via PC, Mac or mobile.

Pedagogy:
Collaboration, collation, categorising and sharing of multiple sources of information.

IV. Picasa

Dedicated image sharing repositories such as Flickr (http://www.flickr.com) and Picasaweb (http://picasaweb.google.com) offer interactive features beyond image repositories – including interactive slideshows and the ability to annotate and tag student captured images. These are linkable and embeddable in Vox and other Blogging systems. Direct mobile upload to online image sharing sites can be achieved via either mobile application clients, or email. Picasaweb mobile is supported via mobile media sharing systems such as Shozu or Pixelpipe.

Pedagogy:
Event, data and resource capturing and collaboration. Creativity.

V. GMail

GMail (http://gmail.com) provides a free email account that can be used on almost any Internet capable device. A GMail account also opens free access to all other Google web services. The Google Java application optimises GMail for a wide range of cellphones.

Pedagogy:
Communication and collaboration

VI. Docs
Google Docs (http://docs.google.com) is Microsoft Word, Excel and PowerPoint compatible. Documents can be uploaded, shared and edited by a group. They are viewable online in a web browser without MS Office. Docs can be created on mobile devices by emailing the document to a private Google Docs address. To edit uploaded documents you need a full PC web browser, or a full version of mobile applications such as 'QuickOffice' on your smartphone - a mobile version of MS Office.

Pedagogy:
Documentation, reflection, critique, description, and collaborative document publishing.

VII. YouTube
YouTube (http://www.youtube.com) is currently the most popular video sharing site. The mobile version (http://m.youtube.com) supports viewing of videos online in the mobiles web browser, or via a downloadable Java client for specific phones. Uploading mobile videos to YouTube is achieved via email attachments or as a Shozu destination.

Pedagogy:
Event, data and resource capturing and collaboration. Creativity.

VIII. Search
Google's mobile search feature enables voice activated web searches for quick access to information on the go.

Pedagogy:
Information literacy, flexible information access and evaluation.

IX. World-wide Sharing
Blog posts and online media can be shared with a world-wide audience via RSS feeds or URLs from either VOX or the Google tools. This enables the creation of world-wide virtual learning communities.

Pedagogy:
Collaboration, peer support and critique.

X. Interaction with Peers and Tutors
The core support element of the mLearning projects is a weekly "community of practice" investigating the use and integration of the smartphones and Web 2.0 tools involving: the technology steward, the course tutors, and the students. Each trial "learning community" is also supported by the "neighbourhood" social networking feature of Vox, and the use of instant messaging for facilitating communication and a sense of social presence.

Pedagogy:
These tools facilitate context independent learning conversations.

Learning Management System

Moodle is a mobile friendly Learning Management System, hosted on a production level Unitec server. Course notes, discussion forums, and various activities can be hosted on Moodle. Learning management systems are controlled by the institution and courses are administered by the course lecturers. In the researcher's projects students' content is hosted outside of Moodle on Web 2.0 site accounts, while Moodle is used as a tutorial space for scaffolding the technology support for the projects.

Pedagogy:
Scaffolding and support.

Blogging

A blog post (including media) can be uploaded directly to VOX using the Vox client on Nokia smartphones, or Shozu (http://www.shozu.com), or emailed to a user's VOX email address xxxxxx@moblog.vox.com

Pedagogy:
Developing critical and reflective thinking, journaling.

Smartphone

Students and teaching staff are provided with a 3G smartphone paying for their own 3G data and voice call usage. Internet connectivity is also available via the Unitec WiFi network while on campus. This provides faster, free web access while on campus. The smartphone's wireless connectivity and data gathering abilities (For example: photoblogging, video recording, voice recording, and text input) allow for bridging the on and off campus learning contexts - facilitating "real world learning".

The core activity of each project is the creation and maintenance of a reflective Blog as part of a course group project. Additionally a variety of mobile friendly Web 2.0 tools are used in conjunction with the smartphone. The choice of mobile device for each project is based on the best fit of features with the key requirements of each course. Previous projects identified the importance of a ubiquitous connection to the Internet for student productivity across multiple contexts, and the preference of students and tutors to carry a single device (i.e. a cellphone); hence preference was given to smartphones over WiFi capable PDAs. Common specifications required include: WiFi capability for free web access while on campus, 3G for fast web access off campus, a built-in camera, media playback, alternative text entry capability, support for key Web 2.0 applications. Windows Mobile devices were not considered based on their small marketshare and inherent "uncoolness" for students. Palm smartphones had been trialed initially in 2007 but had been rejected by students because of the poor quality of the built-in camera, 'clunky' form-factor, and aging OS. Budget was another factor, limiting the cost of the device to $700NZ each. To keep the cost of the devices down, the smartphones were purchased 'unlocked' through parallel importers.

Communication

Instant Messaging (IM) is a synchronous communications technology, with the most popular IM service being MSN. There are many mobile IM clients available. Fring (http://www.fring.com) is a free Instant Messaging and Skype client for most mobile phones. It allows messaging between the most popular IM systems. It works best over a WiFi connection, or good 3G connection.

Microblogging is a cross between SMS texting, blogging, and instant messaging. Microblogging is an asynchronous, collaborative communication technology, suited to use on mobile devices. The most popular microblogging service is currently Twitter. Twitter usage had exponential growth during 2008, with an increase of 752% to over 3 million users world-wide.

Pedagogy:
Communication and collaboration

Social Collaboration

Mobile Media Sharing
Mobile media sharing services provide web based portals for bridging Web 2.0 media services. Two examples are Pixelpipe and Shozu (http://www.shozu.com). These services link all your online mobile Blog and media sites together via either (for example) the Shozu client application, or an email sent to go@m.shozu.com

Pedagogy:
Collaboration, sharing and collation of student generated content.

ePortfolio
An example of a mobile friendly ePortfolio is VOX (http://www.vox.com). Vox includes media sharing (video, audio, documents, images, links) and linking (YouTube, Flickr) as well as social networking.

Pedagogy:
Collaborative sharing of media and peer critique, also form the basis for a career portfolio.

Social Networking
Vox's Neighbourhood feature allows Vox users to define a group and give secure access to content. A weekly neighbourhood email update facilitates a community environment.

Almost all smartphones now include a built-in camera that is capable of capturing still images and video. Most smartphones also include a built-in GPS (Global Positioning Service) that works via satellites to provide longitude and latitude information for geotagging and geolocation. This facilitates geotagging original photos, and the ability to geolocate events on Google Maps, adding a location dimension to captured images and video. Web 2.0 services that support geotagged photos include Flickr and Vox.

The built-in camera on smartphones can record video and audio at up to almost DVD quality. This facilitates students recording events, interviews, and reflections with a visual dimension, and sharing these online via a variety of mobile friendly video sites such as YouTube. Video streaming applications such as Qik and Flixwagon allow real-time sharing of video directly from smartphones to these web-based services. Qik and Flixwagon then archive the video stream for later viewing, sharing and commenting. Additionally video streaming sites integrate with other mobile Web 2.0 technologies such as Twitter - creating an automatic announcement on Twitter regarding a live video stream that a student's Twitter followers could then watch in almost real-time. Qik and Flixwagon also feature the ability to forward video streams to a user’s YouTube

account for sharing on that service as well. Qik supports the association of geolocation data with video streams, providing a Google Maps link to the actual location of the recorded event.

The built-in microphone of smartphones can be used to record audio and then upload that audio file to an online Blog or other Web 2.0 site that supports audio. Most web 2 sites support the uploading of audio files in either mp3 or .wav formats. Some support a popular mobile audio format, .amr. Podcasting is a popular form of audio recording that has an associated RSS feed for subscribing to new audio recordings. For example, students could record themselves reflecting or reporting on their progress in an assignment or project, or they could record an interview with an expert in the field.

Bridging Learning Contexts

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. Mobile learning, as defined in this project, involves the use of wireless enabled mobile digital devices (Wireless Mobile Devices or WMD's) within and between pedagogically designed learning environments or contexts. From an activity theory perspective, WMD's are the tools that mediate a wide range of learning activities and facilitate collaborative learning environments (Uden, 2007).

Pedagogy:
Collaborative sharing of media and peer critique, learner generated contexts.

DESIGNING AND IMPLEMENTING MOBILE WEB 2.0 IN TERTIARY EDUCATION

Key issues (that have been identified across the researcher's thirteen mobile web 2.0 projects 2007-2009) for integrating mobile web 2.0 within an education course include:

- The integration of the mobile web 2.0 tools into the course assessment criteria
- The authentic use of the mobile web 2.0 tools – that is, they are not just added as a 'gimmick'.
- Lecturer modeling of the pedagogical use of the mobile web 2.0 tools
- Creating the sense of a learning community around the integration of the mobile web 2.0 tools
- Providing adequate pedagogical and technological support for the lecturers and students

These are illustrated and explored in the following two case study examples from the researcher's mobile web 2.0 projects. Explorations of several of the researcher's other mLearning case studies can be found in various journal papers (Cochrane, 2010; Cochrane & Bateman, 2009; Cochrane, Flitta, & Bateman, 2009).

Case Study 1: Diploma of Contemporary Music

The 2009 mLearning project within the Diploma of Contemporary Music was informed by the lessons learnt from the 2008 trial. A compilation of 2008 student reflections as Vodcasts (Online video recordings) of the 2009 mLearning project is available on YouTube: http://nz.youtube.com/watch?v=0It5XUfvOj.

During 2008, no assessment tasks were directly related to the use of the iPhones or iPod Touch's, and this resulted in varying commitment to the project by the students. While all iPhone recipients regularly used the device, there was limited use for directly course-related activities. This suggested that while the students appropriated the use of the tools into their personal and informal learning, they had not been convinced (neither modeled by the lecturers) of the potential for the iPhones and associated activities to be useful in their formal learning environment. It also suggested that students are more likely to respond to tasks for which they receive credit. It became clear that the iPhone project needed to be embedded in a course, with clearly related assessment tasks, for the students to participate more fully in it. In particular 2009 projects were designed to investigate the use of MySpace, student created podcasts, and microblogging as authentic mobile learning environments within the context of music delivery, promotion and critique.

The 2009 project (See Table 4) was explicitly linked to two courses, one within the second year of the Diploma of Contemporary Music, the other within the first year of the course with second year students as peer mentors. Thus the integration of mLearning was staged across the two years of the course, and the use of Mobile Web 2.0 tools were integrated into the course assessment. MLearning was explicitly integrated into the Web Technologies paper (PASA5011) during semester one of the second year of the Diploma of Contemporary Music course. All students in the paper were issued with iPhones for use within the course throughout 2009, and were also encouraged to personalise the use of the iPhone into their daily routines. Internet access was available for free via the campus WiFi network, but students and staff were responsible for any voice and 3G data costs accrued. The focus of the semester one project was on the Contemporary Music students using iPhones as tools to record and share environmental sounds from a variety of off-campus contexts, as well as creating online profiles on Vox (http://www.Vox.com) and MySpace (http://www.myspace.com), evaluating the use of new technologies for music generation, sharing, marketing, and distribution. Thus the iPhones facilitated both learner-generated content (Bruns, 2007) and learner-generated contexts (Cook, Bradley, Lance, Smith, & Haynes, 2007; Luckin, et al., 2008). Several assessed projects within the course involved the direct use of the iPhone and web 2.0 tools, as described in the summarised course outline below:

Table 4: Outline of 2009 Diploma of Contemporary Music mLearning project.

Course: **Diploma of Contemporary Music 2009**	
Participants	• 24 students • 2 Course Lecturers • Technology Steward (Thom Cochrane - CTLI)
Mobile Technology	12 students using iPhone, participants responsible for 3G data, voice & txt costs. 12 students using iPod Touch – during Semester2.
Pedagogical Model	From Pedagogy to Andragogy
Pedagogical Focus	1. (5011) An investigation of the current and future uses of web 2.0 technologies in music production and distribution. Students research and report on various technologies using a weekly podcast/vodcast that is peer critiqued by the other students in the course. 2. (4006) Recording and peer critique of student performances.
Community of Practice	Weekly throughout the entire course
Support LMS	Blackboard plus an institutionally hosted Wiki

Deliverables	An assessed online Blog/eportfolio documenting and showcasing students' design processes and forming the basis of a collaborative hub with worldwide peers and potential employers/clients. And the weekly use of instant messaging, microblogging, and VODCasts.
YouTube Links	• Project Summary http://www.youtube.com/watch?v=hLNNTK1_wGQ • Lecturer2 Reflections http://www.youtube.com/watch?v=o9p4i23CsPE • Student Reflections http://www.youtube.com/watch?v=5wbryYTmW88
Blog Links	• Course Tutorial Wiki http://ctliwiki.unitec.ac.nz/index.php/IphoneTutorials • Example student Blog http://rima803.vox.com/ • Example student AudioBoo http://audioboo.fm/profile/ting019 • Example student Group Blog http://groupb.groups.vox.com/
Course Project Outlines	1. Environmental Recording Assignment http://docs.google.com/Doc?docid=0Adkx7n-UKqvBZGNocjRyZ2dfNDNkenRwbTdqOQ&hl=en_GB 2. MySpace Assignment http://docs.google.com/Doc?docid=0Adkx7n-UKqvBZGNocjRyZ2dfNDJkZ2s5N2ZjbQ&hl=en_GB 3. 4006 Performance Groups http://docs.google.com/Doc?docid=0Adkx7n-UKqvBZGNocjRyZ2dfNDFmOXczanhjaw&hl=en_GB
Timeframe	March 2009 through to July 2009 for PASA5011. July to November 2009 for PASA4006.

Implications of Case Study1: 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. 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.

Case Study 2: Bachelor of Performing and Screen Arts

This project focused upon an investigation of the potential of mobile web 2.0 technologies within the field of Film and Television within the Bachelor of Performing and Screen Arts (PASA). The PASA mLearning integration was focused on the context of the mLearning tools themselves as key new technologies that are becoming important in reinventing and democratizing the recording and distribution of film that will have significant impact on the industry. The tools themselves were thus the focus of learning as well as used to record students' learning journeys, thus acting as mediators (Uden, 2007) and bridges of external learning contexts (Vavoula, 2007). Topics covered by the mLearning project included: mobile video streaming and sharing, collation and broadcasting mobile video using Livestream or UStream, creating an online identity, and associated business practices. The course lecturer created a Vox group, and all resources for the project were shared with the class via this group page (http://unutechsy309.groups.Vox.com/),

including links to several Google Docs. Table 5 below summarises the 2009 PASA mLearning project.

Table 5: Outline of 2009 Performing and Screen Arts mLearning project.

Course: **Bachelor of Performing and Screen Arts, third year Film and TV class 2009**	
Participants	• 25 students • 4 Course Lecturers • Technology Steward (Thom Cochrane - CTLI)
Mobile Technology	Dell Mini9 3G netbook, plus Nokia XpressMusic 5800 WiFi smartphone (or similar), participants responsible for 3G data, voice and txt costs.
Pedagogical Model	From Pedagogy to Andragogy
Pedagogical Focus	Film and TV major students investigate the current and future uses of web 2.0 technologies in performing arts film production and distribution. Students research and report on various technologies using a weekly podcast/vodcast that is peer critiqued by students on the course. Students experiment with live video streaming and collation of video using Livestream.com. The focus is upon students developing an understanding of the importance of a quality online profile and presence in the emerging crowd-source web 2.0 environment.
Community of Practice	Six introductory COP sessions at the start of the course
Support LMS	Moodle
Deliverables	An assessed online Blog/eportfolio documenting and showcasing students' design processes and forming the basis of a collaborative hub with worldwide peers and potential employers/clients. Scripting, shooting, editing and presentation of a mobile video short film.
YouTube Links	• Introduction to the assessed student project http://www.youtube.com/watch?v=00d-t0F9AzY • Student reflections on the use of the WMDs http://www.youtube.com/watch?v=jEA7EEcAQCA
Blog Links	• http://unutechsy309.groups.vox.com/ • http://karenperedo.vox.com/ • http://helloagnes.vox.com/
Course Project Outlines	1. Assessment Outline http://docs.google.com/Doc?docid=0ATo8wcQiO76XZDI3Z2QzZl8yNGdmNjdxY2Ru&hl=en 2. Project Workshops Outline http://docs.google.com/Doc?docid=0ATo8wcQiO76XZDI3Z2QzZl8yOWNucDk5NWM1&hl=en_GB
Timeframe	March 2009 through to July 2009 with Lecturers. Student projects begin Semester 2 2009.

Implications of Case Study2: Bachelor of Performing and Screen Arts 2009

The Performing and Screen Arts mLearning project was one of the most ambitious of the mLearning projects 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 (A. Herrington, Herrington, & Mantei, 2009; J. Herrington & Oliver, 2000) 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.

Student Feedback

The PASA students demonstrated a high level of personal, social and emotional attachment to the smartphones, exhibiting a reluctance to return the smartphones at the end of the project. The connectivity of both the netbooks and smartphones was highly appreciated by the students, who had very limited connectivity options within their course previous to the mLearning project. Some examples of PASA student feedback on the 2009 mLearning project are given below.

I find with the WMD you have a phone, a camera, a notebook, a flash drive, a pen to write with, music and entertainment (PASA student 2009 survey feedback).

It worked really well, but you get really used to the system and it's going to be sad to give the devices back (PASA student 2009 survey feedback).

I was always online at Uni, work and at home. I could check my mail while lounging on the couch or lying in bed. As a camera student, we don't have PCs at school, so I used it a lot (PASA student 2009 survey feedback).

We are actually sharing tips and teaching each other how to use these new technologies... :) it has kind of united us even more... all for the same cause (PASA student blog post July 2009).

I'm currently sitting in bed, watching Entourage on my PC on the desk and typing this with my new netbook, while idly playing Zelda on my Nintendo DS. I could also be writing this post on my phone and then doing a mobile upload, but it's easier to type on one of these. So I've been thinking, is this too much technology? Do I really need all of these things? Now that I'm twittered and blogged and Facebooked and Flickred and Qiked and everything, I feel a little overwhelmed... So do I really need a smartphone, a netbook, a PC, and everything else that goes with it? I certainly like it… So now I can take photos on my DSLR, upload them to my netbook, put my sim card in that and upload photos to the web with 3G, add them to my blog and then send the link around with twitter. CRAZINESS! (PASA student blog post July 2009).

The contemporary music students' appropriated a wide range of the iPhone's affordances both into their daily lives and into their course workflow. The portability, connectivity, and wealth of music-related applications for the iPhone were all highly rated by students. A selection of representative 2009 student feedback on the mLearning project integration is included in the following paragraphs.

As I went about my daily life I took my iPhone everywhere with me so that when I heard something that I thought I could use I could just record using Cycorder, which was really useful. This was very interesting because I was more aware of the sounds around me, other times I usually block them out, distracted by my own thoughts. ... I found musical elements in these sounds, through dynamics of engines to the rhythm of enthusiasm towards voting and politics, and the beeping of the horn of course (2009 Student1 blog post).

I've found the iPhone really useful. I use it a lot for surfing the net, and music related applications, and games, checking my emails, and just the ease of using something so small to do so much: Txting, making calls, all on one device, videoing, and using the recording apps, such as iTalk. I used to do a lot of MSN, but I use Twitter more now. I don't use Blackboard on it much, as it's not really iPhone friendly, and you have to do a lot of zooming to navigate around Blackboard. ... I've used it to record environmental sounds, record video, use Qik, geotagging, check my emails for the course, NetNewsWire for all the RSS feeds of the rest of the classes online sites, and Twitter has been great for keeping in contact with people, and Fring – especially for direct contact with Thom whenever I needed help, and accessing the web wherever there is WiFi access (2009 Student2 reflection).

There are huge benefits for any student using the iPhone – WiFi access, all the different applications and games you can get on the iPhone… These devices keep us up to date with each other. I use the iPhone for blogging, recording lectures and rehearsals, so I can take these home and review them and find ways to better our sound. I know how to use the Internet now much more than just sending emails. People have been amazed at what I can do with the iPhone – photos, videos, internet access, music applications, communicating, and even using it as a musical instrument – I have used the iPhone as a flute using the Ocarina application during live performances on stage (2009 Student3 reflection).

Lecturer Feedback

Lecturers were asked to record Vodcast reflections on the impact of the mLearning project within the course for 2009. Examples are transcribed in the following two paragraphs. Overall the 2009 lecturer feedback was very positive and evidenced a progression in their understanding of the pedagogical potential of mLearning within their courses.

I've found the iPhone really useful using Cycorder for recording student performances and then upload through YouTube onto their Vox blog so they can then actually review their performances and see what they've done (Part-time Lecturer 2009).

I'm something of a skeptic when it comes to using the iPhones to assist with course work. So the goal for me was to integrate them into the coursework and not use them for the sake of it, but actually try and use them in a way where it would be the best way to do things. And I think we've seen to some extent, and particularly with the recording project that the students have been working on recently, that the technology of the iPhone can be very useful for their learning, and I think we're also starting to see the students working in very different ways than what we've seen before (Contemporary Music Lecturer 2009).

I can't say enough about your contribution to our Year 3 New Technologies mobile learning project this year. You facilitated it seamlessly, laying the initial groundwork by up-skilling the staff – all the while imbuing your training with the social-constructivist applications of the gear. This provided an initial context for these new communication tools, with which the Screen Arts staff involved shall always associate and use them (PASA lecturer, 2009).

Pedagogical Strategies

Curriculum integration of mobile web 2.0

A key strategy to facilitate a move along the PAH continuum is curriculum integration of mobile web 2.0. 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. To achieve this, curriculum integration must start with the learning practice that is to be achieved (As illustrated in Table 1 above), 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.

Modeling the pedagogical use of the WMDs and social software

Lecturers must model the use of the mobile web 2.0 tools within their own daily workflows and within authentic course-related contexts. The various mLearning projects undertaken have illustrated that pedagogical integration of mLearning into a course or curriculum requires a paradigm shift on behalf of the lecturers involved, and that this takes significant time. Hameed (2009) describes this process as a "cultural re-alignment". An intentional Community Of Practice model (Langelier, 2005) has been found to be effective for guiding and supporting the mobile web 2.0 projects. This comprises weekly "technology sessions" (Community of Practice) with small groups of lecturers facilitated by an appropriate 'technology steward' (Wenger, White, & Smith, 2009; Wenger, et al., 2005).

Stage and scaffold the learning load

Mobile web 2.0 integration into a course produces and requires significant rethinking of lecturer pedagogies and assessment procedures. To minimise the level of technological load and scaffolding required by the students (and lecturers), the implementation of mobile web 2.0 should be staged and scaffolded using a select range of activities over significant timeframes. 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.

Implementation Strategies

Implementation Model

Based upon the researcher's experiences, in order to achieve an explicit move to a social constructivist learning environment using mobile web 2.0 tools, a staged, and scaffolded approach has been adopted (illustrated below in Table 6). 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. Additionally, as the life-span of mobile computing is generally shorter than that of desktop computing, a staged roll-out of WMD computing for students involved in three year long courses can be achieved to minimise the redundancy of the student-owned WMDs. Lecturer professional development and technological support have been found to be critical in facilitating the pedagogical focus of this roll-out.

Table 6: Example mLearning roll-out timeframe.

Deliverable	**Timeframe**	**Outcome**
Establish weekly COP with lecturers and technology steward. Establish support requirements (with IT Services and Telco)	Semester 1	Staff develop competency with mLearning. Staff develop pedagogical mLearning activities based on social constructivist pedagogies
mLearning projects with staff and students. Implementation of the mLearning activities within each course and assessment.	Semester 2	Increased student engagement. Flexible delivery. Facilitating social constructivist pedagogies and bridging learning contexts.
Lecturers publish and present case studies based on project implementation	End of Semester 2 and beginning of Semester 3	Conference, Journal publications and symposia presentations

A staged integration of mLearning (mobile web 2.0) across the three years of a programme can be structured as follows in Table 7 below:

Table 7: Scaffolding the roll-out of mobile web 2.0 throughout various course levels.

Stage	**Web 2.0 Tools**	**MLearning Tools**	**Indicative Student course related costs (NZ)**	**Course Timeframe**	**PAH alignment**
Level 1	Social Collaboration with peers and lecturer. Student generated content.	Use of student-owned netbook or mid-range smartphone, LMS and basic web2.0 sites	Netbook $700 Internet paid access $250	1 year Certificate programmes, or first year of longer programmes	Pedagogy (Lecturer directed)
Level 2	Social collaboration with peers and 'authentic environments'. Context Aware	Student-owned laptop and/or mid-range smartphone	Laptop cost $750 ($1500 spread over 2 years) And/or smartphone $750 Internet paid access $250	Second year of two year or longer programmes	From Pedagogy to Andragogy (Students become the content creators)
Level 3	Context Independent. Student generated contexts.	Student-owned laptop and/or high-end smartphone	Laptop cost $750 ($1500 spread over 2 years) And/or smartphone $750	Third year of programme	From Andragogy to Heutagogy (Students become

			Internet paid access $250		independent learners)

FUTURE RESEARCH DIRECTIONS

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.

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.

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.

CONCLUSION

The combination of the user content creation and sharing capabilities of web 2.0 with the ubiquitous connectivity and unique context aware affordances of smartphones provides a rich tool for facilitating social constructivist learning environments. This chapter has outlined a research-informed approach to implementing mobile web 2.0 in tertiary education. While a lot can be achieved with a standard cameraphone combined with web 2.0, the cost of smartphones with built-in GPS, compass, and quality camera continues to reduce, bringing these tools into the pockets of more students. Harnessing the power of these tools within education can transform teaching and learning in unique ways. Achieving this involves a design framework, lecturer development and support, and student scaffolding and technology support.

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KEY TERMS & DEFINITIONS

Mobile Web 2.0: Web 2.0 sites optimised for the affordances of mobile devices.

Social Constructivism: A social theory of learning that postulates students learn via social interaction and personal experimentation and investigation.

Pedagogy – Teacher-directed learning

Andragogy – Student-centred (Adult) learning

Heutagogy – Self-directed learning

Community Of Practice (COP) – a peer support group with a common interest and practice

Zone of Proximal Development (ZPD) – the difference between what a learner can learn on their own and what they can learn with the guidance of an expert
WMD – Wireless Mobile Device
WiFi – wireless ethernet connectivity.
3G – third generation mobile 'broadband'.
Web 2.0 – interactive, customisable web services, facilitating user-generated content.
Mlearning – mobile learning
Smartphones – mobile phones with an extensible operating system
RSS – Rich Site Summary: for subscribing to update information to web 2.0 sites.
LMS – Learning Management System: for example Blackboard or Moodle.
Blog – Weblog: online journal
Wiki – editable collaborative web page
Eportfolio – collection of online media