Contemporary Music Students and Mobile Technology

Thomas Cochrane
Centre for Teaching and Learning Innovation, Unitec, New Zealand.

ABSTRACT

Five billion songs, and counting, have been downloaded (completely legally) through Apple Computer's online iTunes Store. The iTunes University links free educational content from over seventy tertiary institutions worldwide, and is now available to New Zealand tertiary institutions. The Internet has revolutionised the delivery and access of media and education – making access to a worldwide audience or market merely a Google (or iTunes Store) search away! But, what are the real-world practicalities of this for contemporary music students and teachers today? How can these tools be utilised to facilitate personalised learning environments. Within this context, this chapter presents and evaluates a mobile learning case study at Unitec in the Diploma of Contemporary Music on the Waitakere campus.

Keywords: mLearning, web 2.0, iPod, iPhone, Contemporary Music

1. INTRODUCTION

This section introduces the underpinning concepts related to mobile web 2.0 and personalized learning environments upon which the example research project is based. This introductory section is then followed by a section describing the case study, an evaluation of the results and findings, and finally a discussion on the future of the project for 2009.

1.1 Mobile Learning

While there have been many attempts to define the unique essence of mobile learning (mlearning), most have either focused on the mobility of the device, the learner, or on the facilitation of informal learning beyond the confines of the classroom (Kukulsa-Hulme & Traxler, 2005; Laurillard, 2007; M Sharples *et al.*, 2007; Wali *et al.*, 2008). Mobile learning, as defined by the author of this chapter, 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). Laurillard's definition of mlearning emphasises the critical role of the educator: "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). Mlearning can support and enhance both the face to face and off campus teaching and learning contexts by using the mobile wireless devices as a means to

leverage the potential of web 2.0 tools. The WMD's wireless connectivity and data gathering abilities (e.g. photoblogging, video recording, voice recording, and text input) allow for bridging the on and off campus learning contexts – facilitating "real world learning". 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.

1.2 Mobile Web 2.0

The term web 2.0 was coined in 2005 (O'Reilly, 2005) within a context of how businesses were changing the way they interacted with clients via new interactive web-based tools. The term has been popularised as a way of characterizing the emerging interactive, user-centred web based tools that have been revolutionizing the way the Internet is conceptualized and used. These tools include: blogs, wiki's, image-sharing (e.g. Flickr), video-sharing (e.g. YouTube), podcasting etc… Many educators have harnessed web 2.0 tools for creating engaging student-centred learning environments. This appropriation of web 2.0 tools within a social constructivist pedagogy facilitates what has been termed "pedagogy 2.0".

Pedagogy 2.0 integrates Web 2.0 tools that support knowledge sharing, peer-to-peer networking, and access to a global audience with socioconstructivist learning approaches to facilitate greater learner autonomy, agency, and personalization (McLoughlin & Lee, 2008).

Herrington (A. Herrington & Herrington, 2007) argues that "the advances in philosophical and practical developments in education have created justifiable conditions for the pedagogical use of mobile technologies" based on newer learning theories that find their roots in social constructivism such as: authentic learning, communities of practice, distributed intelligence, distributed cognition, connectivism, and activity theory. Social constructivism focuses upon students being involved in learning environments as an explorative and social process. This is in contrast to the instructivist pedagogies that have dominated tertiary education in the past that focus upon the teacher/lecturer as the expert holder of knowledge from whom students learn directly. In general, education based on social constructivist pedagogies is interested in enabling students to develop creative, critical thinking, and collaborative skills, rather than focusing upon course content. The underpinning pedagogy of a course will determine how particular tools and technologies are used and integrated within the course.

The main focus of this research project is on the support and enhancement of both the face to face teaching and learning context and the off-campus informal learning contexts by using wireless mobile devices (iPod Touch and iPhone in this case) as a means to leverage the potential of current and emerging collaborative and reflective e-learning tools (e.g. blogs, wikis, RSS, instant messaging, podcasting, social book marking, etc…). These are often called web 2.0 or "social software" tools. Many of these tools are formatted specifically for access via mobile devices, compensating for smaller screens and slower text input methods, and facilitating the use of built-in cameras and GPS (Global Positioning Systems) etc… The iPod's wireless connectivity and data gathering abilities (e.g. web browsing, photoblogging via email, video playback, voice playback, and text input) allow for bridging the on and off campus learning contexts – facilitating "real world learning".

The research is focusing on social constructivist approaches to education (Bijker *et al.*, 1987; Lave & Wenger, 1991; Vygotsky, 1978; Wenger *et al.*, 2002) and a conversational model

(Laurillard, 2001, 2007) of teaching and learning. The disruptive nature of web 2.0 and mobile technologies (Mike Sharples, 2000, 2001, 2005; Stead, 2006) facilitates a move from instructivist pedagogies to social constructivist pedagogies. The personal, social networking, and context awareness of mobile devices democratise power relationships and are best suited to open learning environments. Disruptive technologies are those technologies that challenge established systems and thinking, requiring change and are thus viewed by many as a threat to the status quo. Disruptive technologies democratise education environments challenging the established power relations between teachers and students. Mishra et al (2007) argue that "appropriate use of technology in teaching requires the thoughtful integration of content, pedagogy, and technology".

1.3 Personalised Learning Environments

Within the context of tertiary education, personalized learning environments (PLE) are those that facilitate student ownership, customization, and sharing of content and social networking. However most institutional learning management systems (LMS's), such as Blackboard or Moodle, are hosted by the institution and require secure login access, limiting customization and sharing beyond the enrolled class and lecturers. In contrast, a combination of the web 2.0 and mobile devices described above can be used to create flexible personalised learning environments (PLE). Many educators see this second approach as the future of online learning environments. Attwell (2006) aptly describes this concept:

Social software is used here in the meaning of software that lets people rendezvous, connect or collaborate by use of a computer network. It supports networks of people, content and services that are more adaptable and responsive to changing needs and goals. Social Software adapts to its environment, instead of requiring its environment to adapt to software. In this way social software is seen as overcoming… Social software underpins what is loosely referred to as Web 2. Whereas Web 1 was largely implemented as a push technology - to allow access to information on a dispersed basis, Web 2 is a two way process, allowing the internet to be used for creating and sharing information and knowledge, rather than merely accessing external artifacts… The idea of the Personal Learning environment is in effect a Web 2, social software concept (Attwell, 2006).

Jafari (Jafari *et al.*, 2006) presents a theoretical next-generation elearning environment based on these concepts:

Stakeholders across the spectrum want an anytime, all-the-time, personalized experience of teaching and learning - one that utilizes all the currently available social tools, intuitive tools, smart agents, and interactive environments of Web 2.0 and social computing. In short, faculty, students, and administrators are waiting for an e-learning environment that is smart, environmental, archival, multi-modal, collaborative, and mobile (Jafari et al., 2006).

The establishment of such personal learning environments is aimed at producing the following learning outcomes for students:

- Developing critical reflective skills
- Experiencing and developing group communication skills
- Developing a life-long online eportfolio that showcases their potential
- Developing a potentially world-wide peer support and critique and support network

- Learning how to maximise technology to enhance their learning experience across multiple contexts

1.3 The Wider Research Project

The case study summarized herein is part of a wider research project (Cochrane, 2008a) investigating the potential of mobile web 2.0 for enhancing tertiary education through a series of action research projects in a variety of disciplines, including: Bachelor of Product Design (using Nokia N95 smartphones and Apple iPhones), Diploma of Contemporary Music (using Apple iPod Touches and iPhones), and the Diploma of Landscape Design (using Sonyericsson P1i smartphones). Compilations of 2008 student and staff VODCasts (Online video recordings) are available on YouTube:

1. BProduct Design Year 1 http://www.youtube.com/watch?v=8QUfw9_sFmo
2. BProduct Design Year 2 http://www.youtube.com/watch?v=6jwAFXBZAz0
3. BProduct Design Year 3 (and Lecturers) http://www.youtube.com/watch?v=8Eh5ktXMji8
4. DipContemporary Music http://nz.youtube.com/watch?v=0It5XUfvOjQ
5. DipLandscape Architecture http://nz.youtube.com/watch?v=c8IZSVtaMmM

This chapter focuses upon the impact of mobile web 2.0 upon one of these projects (Diploma of Contemporary Music), analyzing feedback gathered from the students and the academic staff involved.

1.3.1 Methodology

The research uses a participatory action research methodology. Yoland (Wadsworth, 1998) identifies the key characteristics of 'participatory action research': the researcher is a participant, the researcher is the main research instrument, it is cyclical in nature, involves action followed by reflection followed by informed action, and is concerned with producing change. This change is ongoing throughout the process, and the research is interested in input from participants/stakeholders. This allows for the continual development and improvement of the projects based on the feedback from participants at regular points in the projects.

1.3.2 The research questions

1. What are the key factors in integrating Wireless Mobile Devices (WMDs) within tertiary education courses?
2. What challenges/advantages to established pedagogies do these disruptive technologies present?
3. To what extent can these WMDs be utilized to support learner interactivity, collaboration, communication, reflection and interest, and thus provide pedagogically rich learning environments that engage and motivate the learner?
4. To what extent can WMDs be used to harness the potential of current and emerging social constructivist e-learning tools?

1.3.3 Data gathering

1. Pre-trial surveys of lecturers and students, to establish current practice and expertise.
2. Post-trial surveys and focus groups, to measure the impact of the wireless mobile computing environment, and the implementation of the guidelines.

3. Lecturer and student reflections via their own blogs during the trial. The blog is also an online eportfolio facilitating the collection of rich media resources capturing critical incidents and providing a dynamic journal of student projects and lecturer input (both formative and summative).

The survey tool and focus group questions can be viewed in the appendix. An action research methodology is used, creating a reflective research environment that continually seeks to improve the student learning outcomes based on regular student and lecturer feedback.

Course lecturers were asked to reflect on the impact of mobile web 2.0 at several points throughout the trial, and used a variety of media to capture their reflections, including: posts to their blogs, VODCasts (video recordings uploaded to their blogs and YouTube), paper surveys, discussions and brainstorms with the researcher.

2. MLEARNING CASE STUDY: DIPLOMA OF CONTEMPORARY MUSIC

This section describes and analyses a mobile learning project that illustrates several issues surrounding the potential of mobile web 2.0 to facilitate personalized learning environments.

2.1 Background

The Diploma of Contemporary Music is a newly established two-year level five (equivalent to first year University) Diploma programme. Its unique elements include a focus on the local community, a broad overview of music performance, theory, composition, and technology within a relatively broad scope of musical styles (from classical to contemporary). Traditionally music education focuses upon a pedagogical model that is similar to apprenticeship, with an expert teacher/performer providing mainly one-on-one training and guidance to the student. However the course curriculum was written to allow for the embedding of new technologies with a focus on student-centred, social constructivist pedagogies, and group performance. 2008 was the second year of the programme, and it is in the process of building up a profile and student numbers within the local region. Compared to national statistics, the region is under-represented in tertiary education achievement, therefore most students enrolled in the course are classed as under-achievers or second-chance tertiary students. The use of mobile web 2.0 technologies within the course has been investigated for pedagogical reasons (to facilitate the move from traditional instructivist pedagogies to social constructivism), as well as a way to establish the programme as innovative and engaging to students. Contestable funding for innovation in programme delivery was made available for 2008, and a proposal from the researcher for funding to implement mobile web 2.0 within the programme was accepted. This allowed for the purchase (in February 2008) of a class set of iPod touch's, and funding to purchase a class set of 3G iPhones when they became available in New Zealand in July 2008.

The programme director was a member of a Community of Practice established in late 2007 to explore the educational potential of web 2.0 tools alongside of the addition of the Campuspack (adding Blog, wiki, and podcast tools to Blackboard) to the institutional Leaning Management System. Including other lecturers on the Music programme in a Community of Practice was logistically problematic, as most of the lecturers for the course are part-time. Hence the other two lecturers involved in the iPod/iPhone project did not have the previous experience of the Community of Practice or the educational use of web 2.0 tools before the start of the project.

2.2 Setting up the trial: Choices and Design

The iPod Touch was chosen as the wireless mobile device (WMD) for the Contemporary Music trial after discussions with the lecturers at the end of 2007 as it aligned closely with the curriculum and delivery choices of the programme. The course is based around Apple Macintosh computers and software, providing close integration with Apple software such as iTunes and Garageband. Students and lecturers were provided with an iPod Touch (16GB) for the duration of the 2008 trial. Participants signed an acceptable use policy, agreeing to look after and return the device at the end of the trial, and were encouraged to treat the device as if it were their own for the period of the trial, including customisation, downloading of media, and installation of third party applications. Internet connectivity is available via Unitec's WiFi network while on campus. This provides free web access while on campus. An intentional Community of Practice model is used to create a collaborative learning community between the lecturers, the students, and a 'technology steward' (Cochrane, 2007; Cochrane & Kligyte, 2007). Wenger (Wenger *et al.*, 2005) defines a 'technology steward' as a member of the community of practice with the experience and expertise to guide and advise the group on appropriate technologies to choose for supporting and facilitating the groups communication and goals. Thus the project was guided and supported by weekly "technology sessions" facilitated by the researcher as the 'technology steward'.

Students volunteered to participate in the iPod trial from across the Diploma of Contemporary Music programme. As a pre-requisite, students were required to have already passed two of the introductory core papers of the course.

Participants:

- 11 students – students volunteer to participate in the trial using the provided iPod Touch. The average age of the students is 22, and the gender mix is 6 female student and 5 male students.
- 2 Course Lecturers
- Technology Steward (Thom Cochrane – CTLI)

Table 1. Diploma of Contemporary Music Mobile Trial Milestones.

Date	Project Milestones
October to December 2007	• Community of Practice with lecturers focusing on the integration of Web 2.0 technologies and Blackboard.
December 2007 to February 2008	• Brainstorm mobile web 2.0 project goals and course integration with course Lecturers
20 February 2008	• Purchased iPod Touch's (16GB) • Investigated Synching via iTunes over the network to the xserve. • Setup Blackboard support course (iPASA)
26 February	• Provided course lecturers with iPod Touch and tutorials on setup.
7 March	• Provided students with iPod Touch and began weekly technology support sessions (Community of Practice with staff, students, and the 'technology steward').
March – June	• Supported students and staff during trial via weekly 'technology workshops' • Monitored student progress via their Vox Blogs/eportfolios

June	• Student and staff surveys • Focus group • Data analysis and report write up. • Re-evaluation of Trial for second semester 2008
July	• Re-launch of trial with iPhones replacing the iPod Touch's
November	• Final Data gathering, analysis, and report write up.

iPod Touch details: Apple iPod Touch. (New Zealand iPhone details TBA circa June/July 2008)

- WiFi
- 16GB flash memory
- Built-in virtual keyboard
- Multi-Touch screen
- iTunes synchronization via USB

Learning Management System: Blackboard 7 with added Campuspack for Podcasting, RSS, Wiki's , and Blogs.

2.3 Mobile Web 2.0 Pedagogies

The core activity of the project was the creation and maintenance of a reflective Blog as part of a course group project, creating a collaborative context independent learning environment. The blog host chosen (http://www.vox.com) provides free creation of a blog, an eportfolio (collections of student media), and social networking (via VOX's 'neighbourhood' feature), and provides access to a potentially worldwide peer learning community. The iPod can be used to enhance almost any aspect of the course. The project was centred on preparing students for the music technology paper that is part of the Diploma of Contemporary Music which is due to run for the first time in semester one of 2009. In this course students will experiment with and evaluate current music creation and delivery technologies, including podcasting and sharing via blogs, eportfolios, and social networking. The goal of the trial was to illustrate the potential of a PLE, facilitated by mobile web 2.0 technologies, that was unconstrained by the limitations of the institutional LMS. For semester one of the trial lecturers and students were provided with an iPod Touch (16GB) each, which was to be replaced by a 3G iPhone in semester two when they become officially released in New Zealand. While the iPod Touch is not a smartphone, it has WiFi and is essentially an iPhone without the phone or camera capability, thus it provides a limited connectivity version of the iPhone until they were made available. Although the iPod Touch has limited content creation capabilities (no camera for still image or video capture, no microphone input for audio recording, and no built-in GPS for geotagging or geolocation) it is a powerful mobile internet device suited to text-based input and one of the best mobile media viewing devices currently available. The iPod/iPhone includes a virtual keyboard for text entry as part of its touch-screen interface. Another limitation of the iPod Touch (and the iPhone) is the reliance upon media synchronization via iTunes software on a computer. The iPod Touch and iPhone thus require users to have access to a computer and an iTunes Store online account. User content creation was thus facilitated by using the Apple iMac computers in the Music Lab, using their

built-in webcams, microphone, and the use of external audio and midi equipment attached to the iMacs.

The project initially focused on investigating the use of the iPod Touch synchronized with iTunes software on desktop computers (Apple iMacs) for the following activities:

- A reflective Blog (http://www.vox.com)
- An eportfolio (http://www.vox.com)
- Email (GMail)
- RSS (Google Reader)
- Shared Calendars (Google Calenders)
- Image Blogging (Flickr)
- Video Blogging (YouTube)
- Podcasting
- Instant Messaging (http://www.mundu.com)
- Accessing the Course Management System (Blackboard http://bb.unitec.ac.nz)
- Document reading (Word, Excel, PowerPoint, PDF using email attachments and Google Docs)

Lecturers were encouraged to model the use and integration of mobile web 2.0 in their own daily work-flows and to provide regular formative feedback to students via posts on their blogs and other media. The following diagram (Fig.1) is a concept map outlining the integration of the key mobile web 2.0 tools used in the project. It was partially inspired by Jafari's (2006) conceptual diagram of future personal learning environments. The iPod Touch (or iPhone) is used to provide a bridge between learning contexts as a media synchronization and collaborative communications device. A variety of mobile friendly web-based tools are used to host, record and share the participants learning experiences. The iPod/iPhone provides a link between learning contexts, course content, user-generated content, peers and teachers, aligning with the interactive elements of Laurillard's conversational model of learning (2001). There is an interactive online concept map illustrating the generic model used for all the mobile web 2.0 projects available at http://ltxserver.unitec.ac.nz/~thom/mobileweb2concept2.htm.

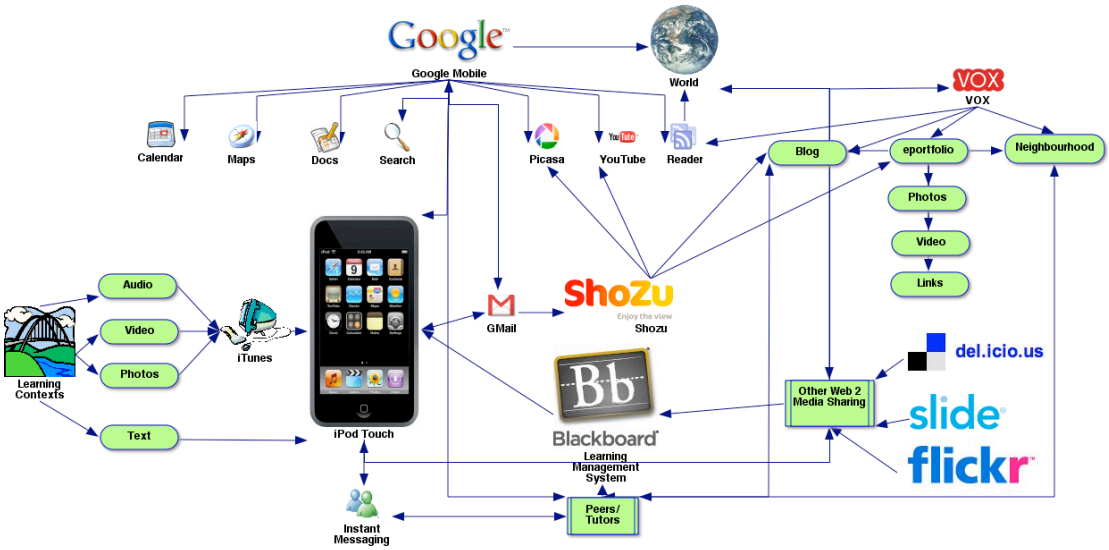

Fig 1. Mobile Web 2.0 concept map.

2.4 Supporting Mobile Web 2.0

The project was guided and supported by weekly "technology sessions" facilitated by a 'technology steward' (Wenger et al., 2005) who is the researcher and an Academic Advisor in elearning and learning technologies in the Centre for Teaching and Learning Innovation (CTLI) at Unitec. The project was a collaborative project between the 'technology steward', the course lecturers, and the students on the course. The institution's Learning Management System (LMS) was used to provide scaffolding and support for both lecturers and students, while externally hosted web 2.0 tools were used to create a more customisable and flexible personal learning environment for the students work. Table 2 below summaries the main topics and sequence of the weekly 'technology support sessions' throughout the project.

Table 2. Outline of mobile web 2.0 support session topics.

Topic	**Outline of Content**
Trial Documentation	Acceptable Use Policy, Research consent, initial participant survey
Setting up your iPod	Info to get you started, including • How to setup WiFi access • Basic Navigation • Email Setup • Creating Web Bookmarks
Blackboard Homepage	Edit your Blackboard Homepage (In the 'Tools' menu). Include the following info: • A headshot photo • A brief introduction of yourself • Your GMail address • Links to your Blog and Web2 accounts (To follow...)
GMail Setup	Creating a GMail account, accessing web-mail on the iPod Touch, and setting up the email client application on the iPod Touch.
Blog setup	Creating and customising your Vox Blog.
Subscribing to VOX Blogs	Using Google Reader to subscribe to each other's VOX blogs
Email uploading to your blog	Using Vox's email to post facility on the iPod touch.
Web 2.0, Web Apps	Setting up your Web2 services: Eportfolio YouTube Flickr Google Mobile RSS Feeds Etc...
Creating a VODCast Show	How to create a Video Cast using QuickTime Pro and YouTube
Using VOX to create a	Using Vox collections and RSS feeds to upload an audio file and

PODCast Show	create an online podcast show.
iTunes U	An overview of music related resources available via iTunes U
Lecturerial PODCasts	Video Demos of the iPod Touch - these are collated in the Podcast Show for the course - see the 'iPod tutorials' link on the left.
iPod Touch Updates	How to update the iPod Touch software and the benefits of updating
iPod/iPhone Applications	With the V2 software update (included on the iPhone 3G or a $12 update for he iPod Touch) the iPod/iPhone becomes a powerful multimedia device that can play games & work with web2 sites in a much more integrated way. A variety of free (and some paid) applications are explored.
iPod/iPhone Accessories	Enhancing the iPod/iPhone with external hardware
iPhone Vodafone NZ setup	Network settings for 'unlocking' the iPhone

The main limitation of the iPod Touch is it's wireless connectivity being limited to wifi hotspots only. With the update of the iPod Touch to the 1.1.4 software the iPod Touch became a capable wireless internet PDA (Personal Digital Assistant). The software update removed the reliance upon web-based tools by including an email application, a calendar, Google maps, notes, a YouTube player, and stocks. The version 2 software update opened the iPod Touch to the vast array of third party applications available through the iTunes application store. Below is a table summarizing a few of the third party applications that were experimented with.

Table 3. Overview of free iPod and iPhone applications.

Free iPod/iPhone Apps	**Description**
Blogit	A web app for text blogging using Safari on the iPod or iPhone
AIM	An instant messaging application for the AIM protocol
MySpace	An iPod/iPhone application for managing a MySpace account
NetNewsWire	An RSS reader application for iPod/iPhone
Facebook	An iPod/iPhone application for managing a Facebook account
Remote	A remote control application for wirelessly controlling iTunes
Scratch	A DJ sound effect application
Shozu	A multiclient web 2.0 media and blogging client for iPod/iPhone
PangeaVR	A QuickTime Virtual reality scene player and search application
Google	A shortcut for logging into the Google suite of iPhone optimized web apps
Wordpress	A wordpress blogging application for iPod/iPhone
Palringo	A multi-client instant messaging application for iPod/iPhone
2D Sense	A 2D mobile code decoder for the iPhone
Cellspin	A multi-client web 2.0 media and blogging client for the iPod/iPhone
MoPhoto	An application to manage a Flickr online image sharing account
Speedtest	An iPod/iPhone application to test the speed of a connected wireless network
Fring	A multi-client instant messaging and Skype application for iPod/iPhone

eZimba	A photo editing application for iPod/iPhone
Air Sharing	An application for wireless sharing of files between an iPod/iPhone and a computer without requiring an iTunes sync
iTM MidiLab	A wireless MIDI remote control application for iPod/iPhone for controlling MIDI and audio software on a computer.

The iPhone significantly improved over the iPod Touch's limited content creation capabilities, including a built-in camera for still image capture, a built-in microphone for recording audio, a built-in speaker for audio and video playback, and a GPS (for geotagging and various geolocation applications). Participants who were upgraded to an iPhone were also reimbursed the cost of a 200MB per month 3G data plan, but paid for their own accompanying voice and txt plans. The iPhone's 3G cellphone connectivity reduced the reliance of connectivity and communication via wifi hotspots. The iPhone reduced the dependence on a computer for media creation, and added the dimension of context independence for capturing, reflecting and collaborating on learning experiences. The main limitations of the iPhone for this project are its lack of video recording capability and lack of multitasking. Multitasking is especially important for using instant messaging, as the instant messaging application should be able to run 'in the background' while the user goes about other tasks on the device. The iPhone's lack of multitasking means that only one application can run at a time, limiting the usefulness of instant messaging.

2.5 Mobile Web 2.0 facilitating personal learning scenarios

2.5.1 YouTube

The YouTube application on the iPod and iPhone makes searching and viewing YouTube videos over a wireless connection simple. Students were encouraged to create YouTube video reflections of their course and performances and subscribe to each other's YouTube 'shows' in iTunes, and view them anywhere using their iPod/iPhone. In the process of doing this, both course lecturers discovered YouTube videos of some of their previous performances and MTV videos. One MTV video in particular that had been recorded in 1992 was found uploaded to YouTube, giving the lecturer's music a new lease of life and an object lesson of the potential of the medium for their students.

2.5.2 VODCasting

Participants were asked to regularly post to their Vox blogs short video recordings of themselves reviewing their thoughts on the use of the iPod/iPhone and later to provide reviews of music apps downloaded from the iTunes store to their iPod/iPhone. The VODCasts were recorded using the built-in webcams and microphones of the iMacs in the Music lab, then uploaded to students' YouTube accounts, and finally they were embedded into the student's Vox blog posts. The VODCasts were fun and engaging and generated the most collaborative peer review of the project in the form of Vox blog comments. A compilation of some of these VODCasts can be found on YouTube at http://www.youtube.com/watch?v=IXUekj8c86k .

2.5.3 Communication

Students and staff were encouraged to use instant messaging (IM) on the iPod or iPhone as a way of establishing a context independent collaborative learning environment. Email and instant

messaging were used on the iPod/iPhone for communication between students (for social activities and help with assignments), and between the students and the technology steward (asking for help with software and hardware issues), and between the students and course lecturers (for clarifying assessment requirements). Lecturers were reticent to engage with instant messaging as they had not appropriated it as a part of their lifestyles and have yet to be convinced that such communication is not merely "phatic" (as described by one lecturer) and requiring 24/7 commitment from the lecturers to answer student requests. However the use of instant messaging for communication with the technology steward was particularly useful for supporting the students, as the technology steward was based on a separate campus from the students and encouraged the students to contact him that way. An example chat session between the technology steward and a participating student is shown below. The student was using IM on their iPhone.

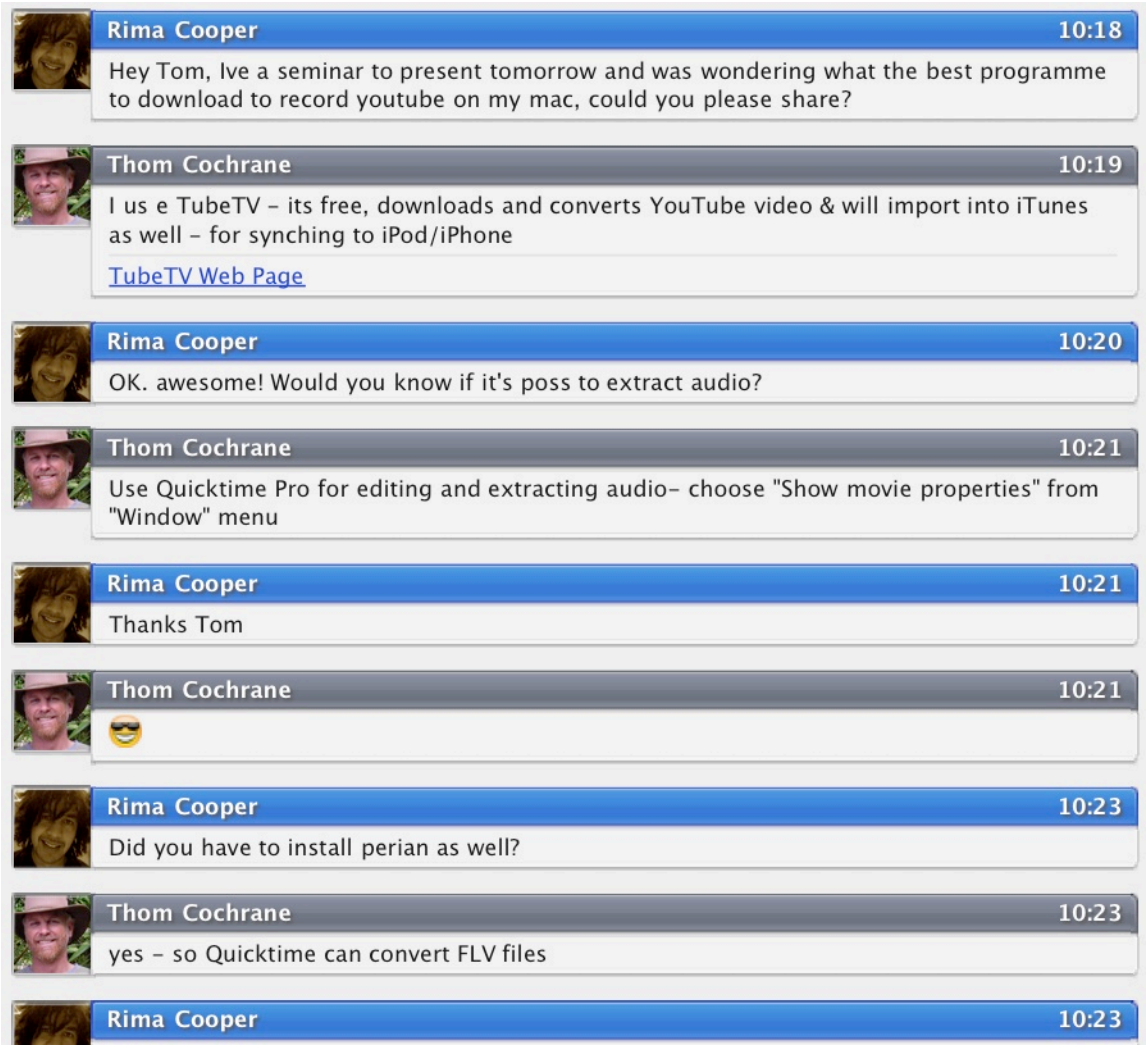

Fig 2. Example instant message chat session with technology steward and student.

2.5.4 Student and staff performances

Notifications of student performance venues and times were posted to a student's blog, informing other students' in their Vox neighbourhood via email or RSS to their iPhones of these upcoming

events. A second student videoed the student performing live with their band at the venue, and subsequently the video of the performance was uploaded and shared via the student's blog.

Staff members also used their Vox blogs to advertise their upcoming performances, and provide reviews of these performances, including uploading photos and video clips.

3. DISCUSSION

The mobile web 2.0 trial represented a significant learning curve for most participants. Fig 3 below summaries the participants previous use of wireless technology and popular web 2.0 tools. Virtually all participants were consumers of web 2.0 content, but prior to the trial few had ever created and uploaded their own content to web 2.0 sites. None had previously attempted mobile blogging. Cellphone ownership was almost ubiquitous, but no participants had previously owned an iPod touch or a 'smartphone'.

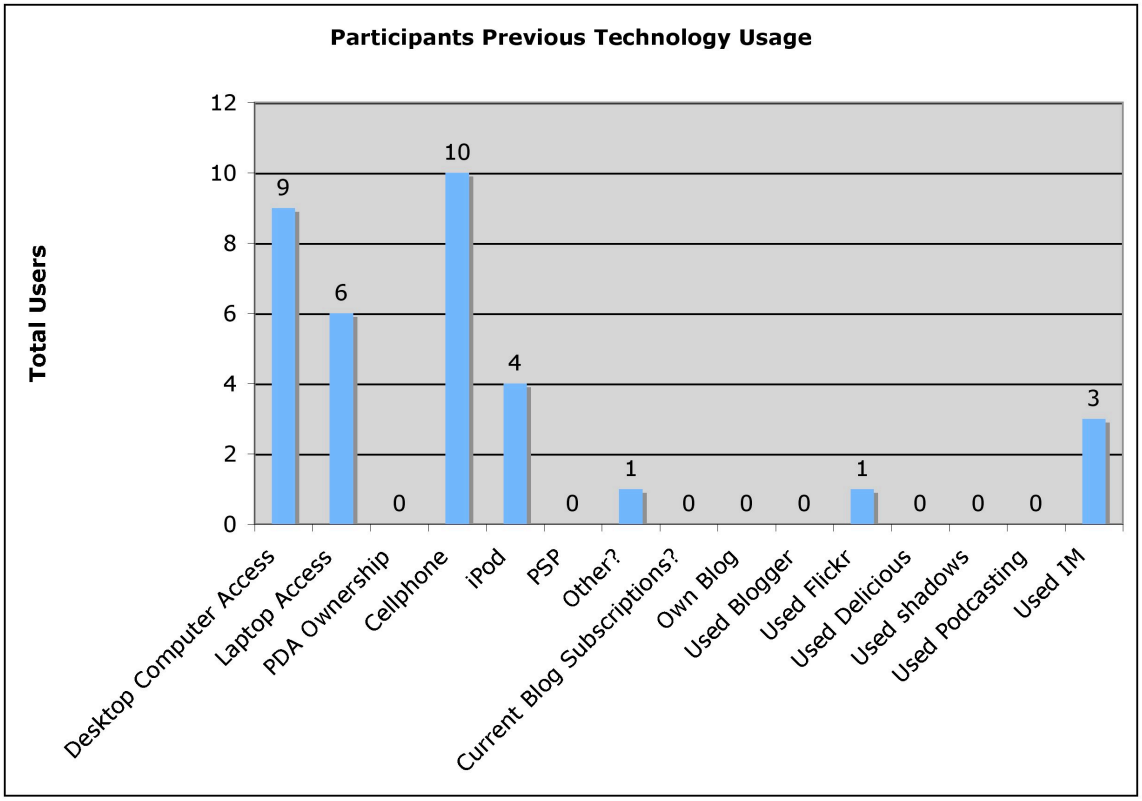

Fig 3. Trial participants previous use of wireless technology and web 2.0.

The innovative nature of the iPod Touch and the iPhone, coupled with the build-up of marketing hype surrounding the release of the iPhone in New Zealand, generated a lot of interest in the iPod/iPhone trial beyond the Contemporary Music course, both on and off campus, resulting in articles in the local newspaper and on the institutions website. Screenshots of two media releases about the project as viewed on an iPhone can be found at http://flickr.com/photos/thomcochrane/2842046366/ and http://flickr.com/photos/thomcochrane/2842051990/. The novelty of the iPod Touch initially

captured the imagination and attention of the participants, but later in the year as the pressure of assessments mounted many participants interaction reduced.

Although students loved the iPod Touch as a focal point of their personal multimedia collections, for media playback, web connectivity and messaging, there was limited buy-in from the majority of students for VOX blogging. This was due to several factors. Students participating in the trial volunteered from across the entire Diploma of Contemporary Music programme and were not necessarily in the same classes, therefore there was little cohesion within the group and a lack of a sense of a collaborative learning community. The trial was viewed as an optional extra to the curriculum, as an investigation of how the tools might be integrated into the course delivery and assessment in the future. Therefore there was no summative assessment associated with the trial, and when the pressure of assignment deadlines approached engagement in the optional Vox blogging died away.

The lecturers were new to the concepts of web 2.0 tools in education, and even more so regarding mobile web 2.0. The lecturers therefore have taken significant time to understand how they could appropriate the WMDs and mobile web 2.0 into the course assessment and their own pedagogical approaches. Instead, the Campuspack Blog tool within Blackboard was used by the lecturers as the official blogging tool for assessed activities in the course. This was a new activity for 2008, as a result of the Community of Practice in late 2007 involving the researcher, the programme director, and lecturers from various other programmes in the institution. The Blackboard Campuspack blog was used as an individual learning journal and virtual 'helpdesk' system rather than a collaborative social constructivist environment as was the aim of the Vox blogs. This and the fact that the Campuspack blog is not easily accessible via mobile devices led to very low student engagement in the official assessed Blackboard blogging activities. In comparison, those students (and staff) who used the Vox blog found it to be very mobile friendly, fun and generated a collaborative environment. Exploring how Vox mobile blogging can replace the Campuspack blogging activities will be explored with lecturers for 2009.

With the release of the iPhone 3G in New Zealand in July 2008 there was an opportunity to reinvigorate the project and motivate students and staff to engage in a more ubiquitously connected collaborative environment. To encourage the use of the Vox blogs, it was decided to offer the iPhone upgrade to students who met the following requirements:

To be eligible for an upgrade to the iPhone 3G you must fulfill the following over the next month (13 June to 13 July 2008, mid-year Semester break):

1. Regularly (at least two times per week) post to your VOX blog & comment on other students blog posts.

2. Upload a weekly PODCast (audio) or VODCast (video) recording to either your VOX collection or YouTube (1-2 minutes each). Listen/watch each others 'shows' and comment on them!

** These posts and PODCasts/VODCasts should reflect on aspects relevant to your DipMus course - e.g. a critique of musical works, comments on local musicians/bands, reflections on your assignments, interviews with local musicians etc...*

However, only five participants (3 students and 2 staff members) fulfilled these requirements. Therefore only five of the thirteen trial participants were upgraded to iPhones for semester two. This meant that the second half of the trial comprised of a mixed group of iPod Touch and iPhone users. The 'technology sessions' in semester two were targeted to be as relevant as possible to both groups of users, but inevitably the iPod Touch users felt left out and disengaged. Feedback from the end of the trial indicated that the iPhone users were more engaged and enthusiastic about the trial than the iPod Touch users, and the iPhone users satisfaction with the trial increased from their mid trial feedback.

A survey of how students were using the ipods/iPhones was taken during mid semester two (See fig 4 below). Several of the last question categories were not applicable to the iPod or iPhone, as the survey was a generic one used across all the mobile web 2.0 projects that the researcher has been involved in.

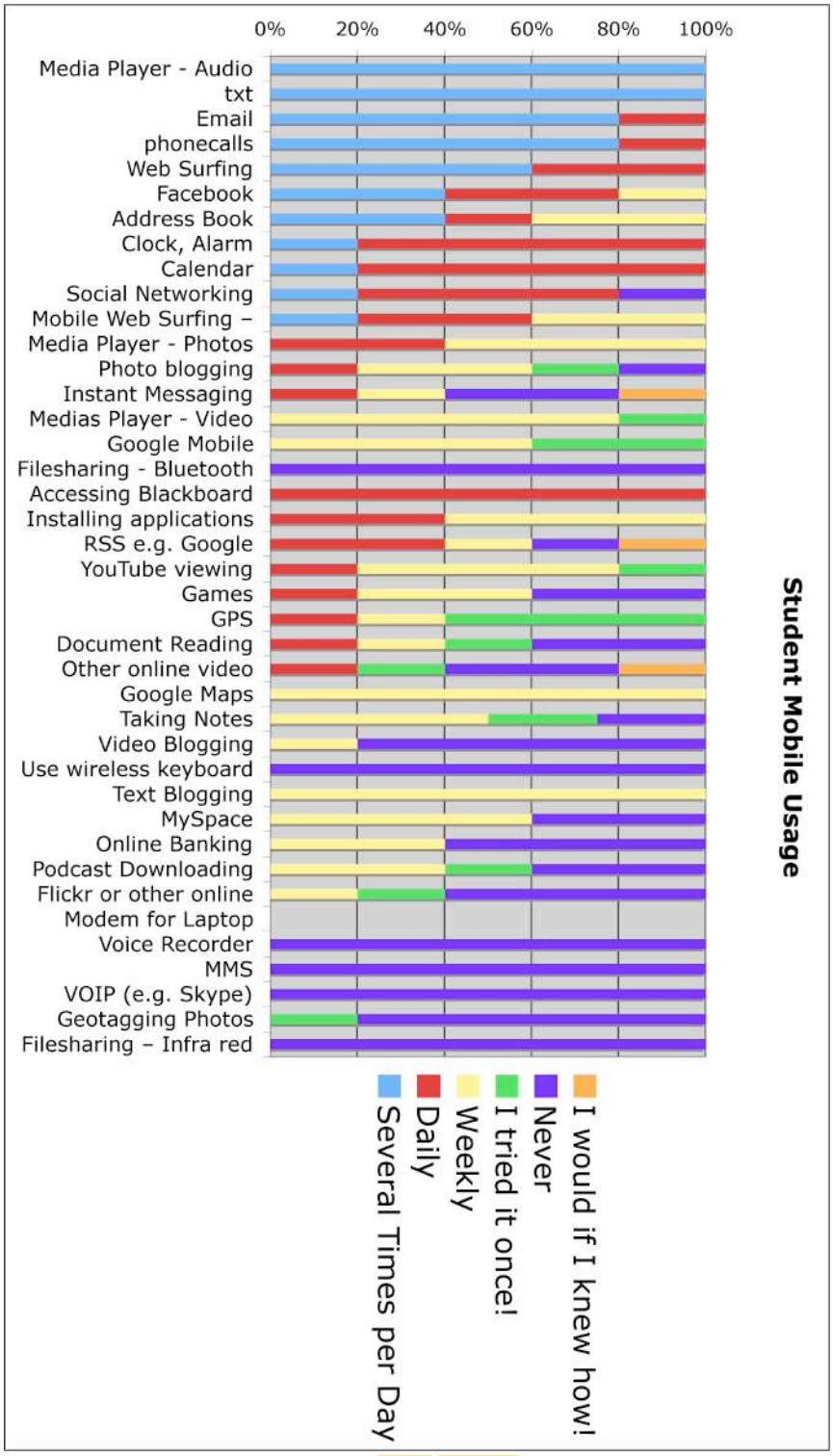

Fig 4. Student usage of the iPod/iPhone for various activities.

Fig 4 indicates that students used mainly the affordances of iPods/iPhones that aligned with their own personal learning, rather than directly relevant to the music course. The Students usage

patterns are also reflected in their evaluations of their perceived most useful functions of mobile devices (see Fig 5 below). As Fig 5 indicates, some of these perceptions changed over the period of the trial as participants learned firsthand what worked and what didn't with the WMDs. Use of the iPhone brought an appreciation of the value of a built-in camera for mobile blogging and capturing learning events, and of the communication and collaboration facilitated by txt and voice capabilities (see fig 6). In comparison to other mobile web 2.0 trials that the researcher has facilitated, the value assigned to accessing online course content on the iPod/iPhone was higher than for any other WMD used. This is a reflection on the unique mobile web experience that the iPod/iPhone provides. Course content was not a significant aspect of the trial, as the focus was on facilitating social constructivist environments with students (not staff) creating their own content and sharing and critiquing.

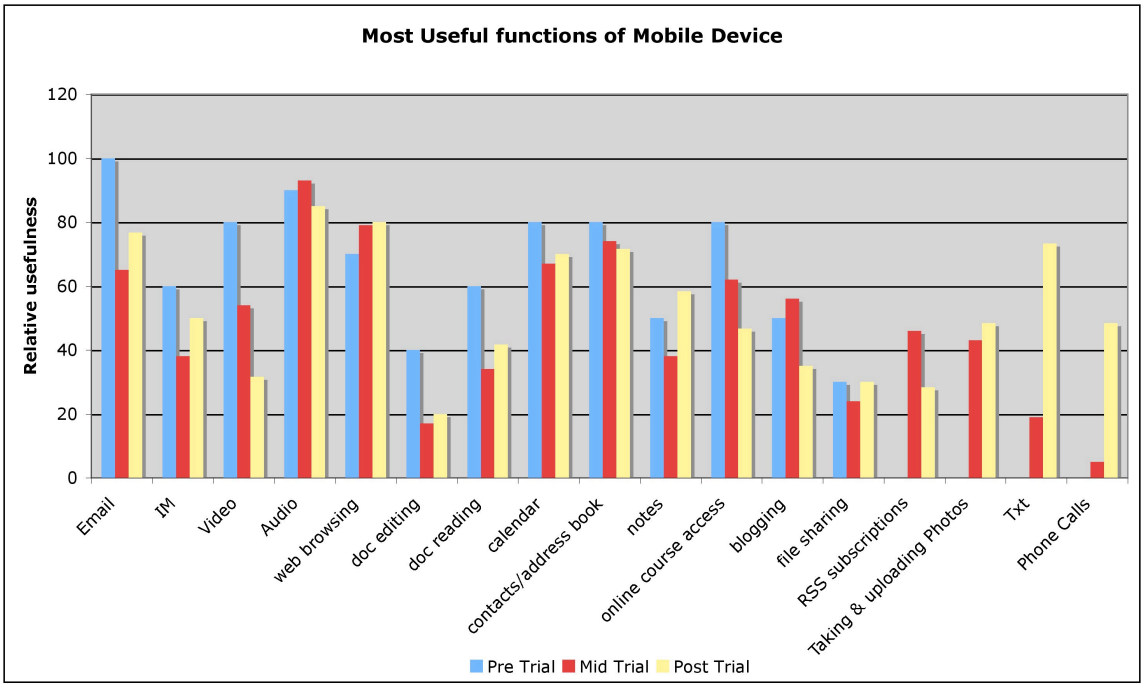

Fig 5. Comparison of participants pre, mid and post trial evaluation of the most useful functions of mobile devices.

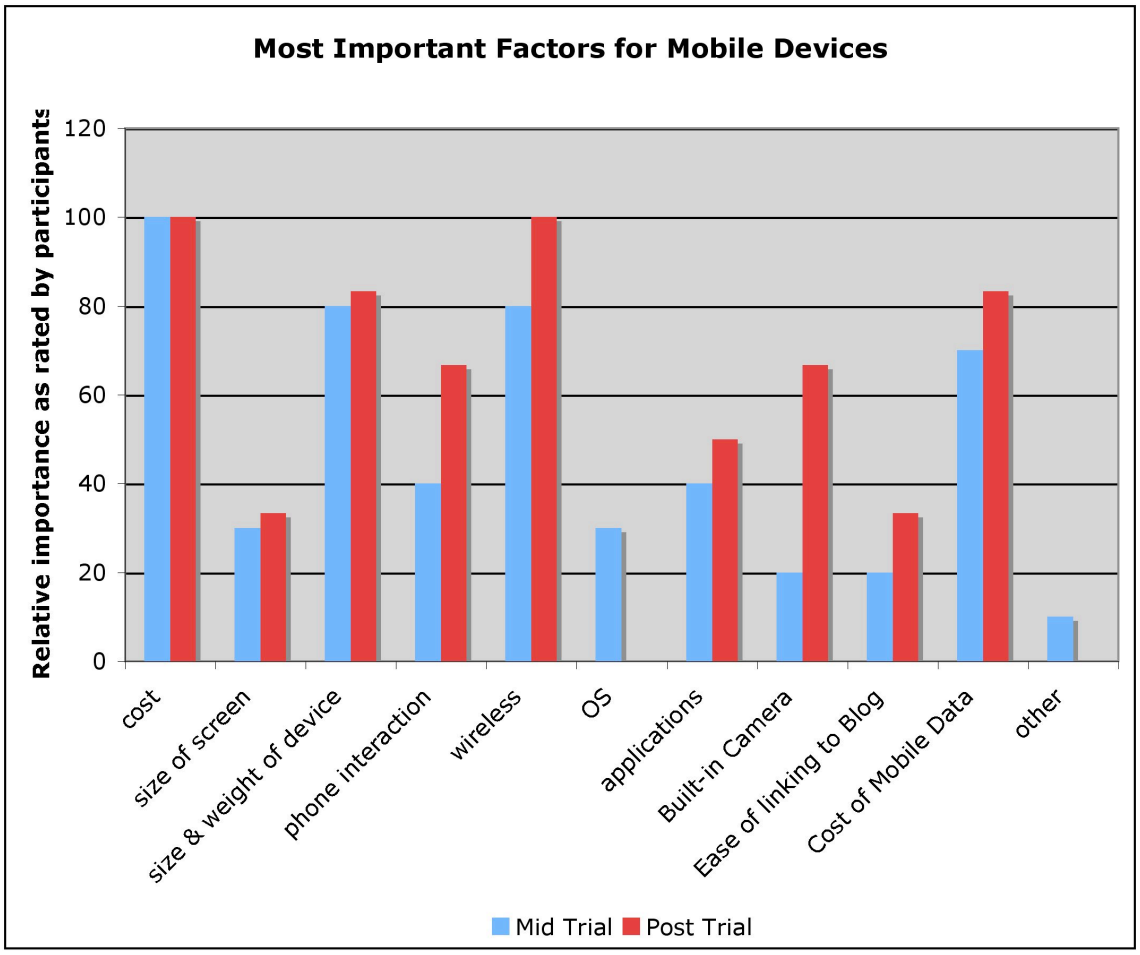

Fig 6. Comparison of participants evaluation of the most important features of mobile devices, mid and post trial.

There was a high level of fun attached to the trial (see fig 7), and most students were keen to see further integration of the WMD and mobile web 2.0 into the rest of their course (see fig 8). The drop-off in the enthusiasm for this after the second semester was a reflection on the relative disengagement of the remaining iPod users who where not upgraded to iPhones.

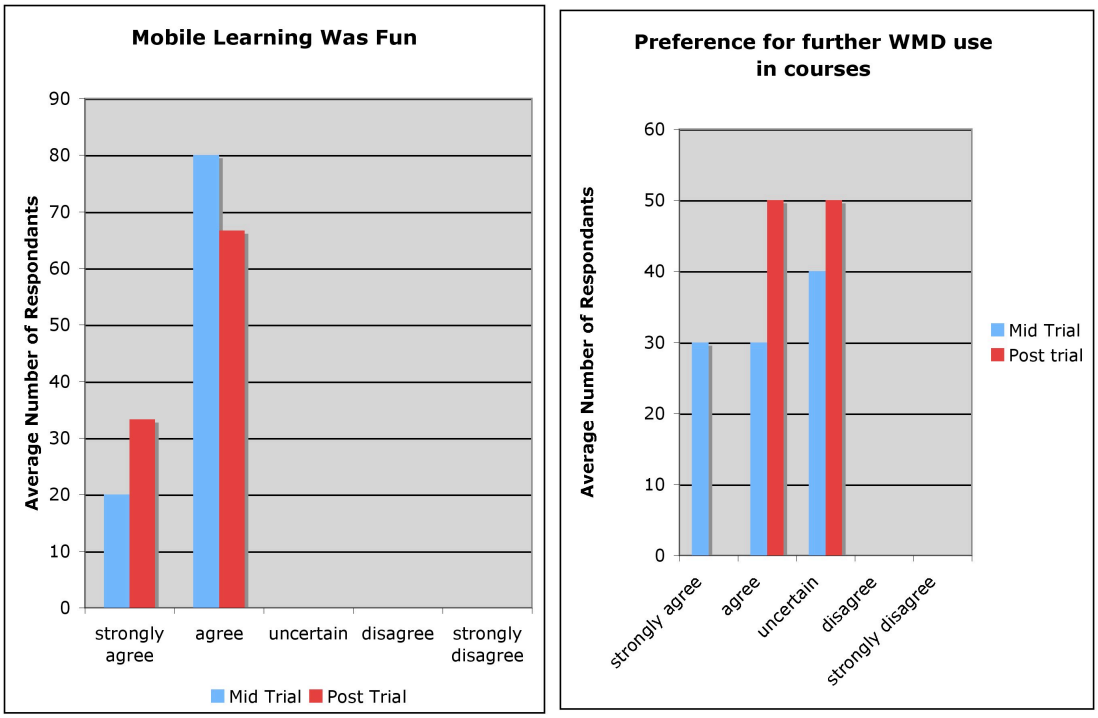

Fig 7 & 8. Participant Survey Results

The following sections summarise example student and staff responses to the mid and end of trial surveys and focus groups.

3.1 Student Feedback

The benefits of mobility and context independence facilitated by the iPod Touch and iPhone were key themes identified by students, e.g. "When away from the classroom it was easy to keep up to date". "It was a good way to communicate with the other students. It was excellent that I could ask questions of lecturers when I needed to know something – it's a fast way of communicating." An example student YouTube VODCast (video cast) show can be seen at http://www.youtube.com/rimzcoop/. Other student feedback included:

No matter where I was I could use it, spare time having lunch, toilet, even in the classroom while the teacher wanted some information about a particular person. Makes a huge difference (Student 1).

I quite enjoyed the course because I learnt about so much more about today's modern technology. Now I have more understanding on what I can do with the WMD, how I can utilise the device for communication and to gain access to information. All this was new for me. I enjoy learning about new technologies. Especially the new capabilities like chatting, blogging, surfing the net, and sending out multi emails. (Student 2).

I absolutely enjoyed the project. I gained knowledge of today's technology and how to incorporate that knowledge and understanding into today (Student 3).

By default the more motivated students became the iPhone users. They were differentiated from other students by their ability to take responsibility for their learning and ownership of developing a personal learning environment using the mobile web 2.0 tools. These students identified a lack of 'community' as limiting the engagement with the Vox blogging and the uptake of the mobile web 2.0 tools. This 'community' could be better achieved by locating the project within a specific class group of the programme, which would also provide an environment to 'scaffold' the less independent learners in the class via peer support.

3.2 Staff Feedback

Course lecturers were just as enthusiastic about the iPod Touch as the students, and they integrated the use of the device into their own personal daily routines. The main limitations identified by lecturers of the iPod Touch were its limited wireless connectivity (WiFi only), and getting used to the virtual keyboard for text entry.

The project is limited by wireless coverage available – but has great potential. It is beneficial being able to check/send email/blog while away from home. Instruction was good. Plethora of blogsites/online communities was a little confusing – advantages of specific sites over others could have been emphasized more/explained a bit better. I would now be better able to integrate the WMD into assignments rather better. (Lecturer 1)

It's a brilliant piece of hardware, and styley, but I still struggle with the small virtual keyboard. It's great for students who need to communicate for group projects. I will be taking mine overseas with me! (Lecturer 2)

An example teacher YouTube VODCast (video cast) show about the project can be seen at http://www.youtube.com/ipodtrial/.

The academic staff were also asked to reflect on four questions related to the main research questions:

1. What potential benefits do you see for mobile web 2.0 to enhance teaching and learning?
2. Have you (so far) seen increased engagement in the course from students when using this technology?
3. What are the key issues for integrating this technology into your courses?
4. In what ways has (or will) your teaching approach changed by using these tools?

Their answers to these questions are available on YouTube as VODCasts at http://www.youtube.com/thomcochrane. Their responses indicated that although they were enthusiastic about the personal use of the iPod/iPhone, they struggled to conceptualise the affordances of the devices for integration into the course curriculum. They did however agree that course integration of the tools was critical for the future. There was a perception among the lecturers that the Vox blogging was fun, but 'real' blogging within the course curriculum should be conducted using the Campuspack Blog tool within the institutional LMS, Blackboard. This is a key issue that will be addressed by the formation of a Community of Practice between the end of

the 2008 course and the start of the 2009 course to investigate ideas for course integration and appropriate assessment activities for 2009. The inability to see how to integrate the tools into the curriculum may merely be pragmatic (the lecturers need some new ideas, time for reflection and guidance), or it may be symptomatic of an ideological clash of pedagogical approaches. The project has focused upon facilitating a social constructivist environment, whereas the course lecturers appear to be more used to an instructivist, apprenticeship model of teaching and learning. Therefore this will form one of the core discussions of planning for 2009 projects.

3.3 Blog Analysis

Student and staff blogs provided a media-rich record of their engagement with the mobile web 2.0 trial. Mobile blogging was initially slow to take-off, but increased dramatically with the introduction of the iPhone due to its anywhere anytime 3G connectivity (see fig 9). Mobile blog posts and peer commenting both increased with the use of the iPhone (see fig 10). The iPhone thus better facilitated bridging learning contexts and creating personalized learning environments than the iPod Touch. However, the pressure of end of semester deadlines resulted in a decrease in the optional mobile blogging activity.

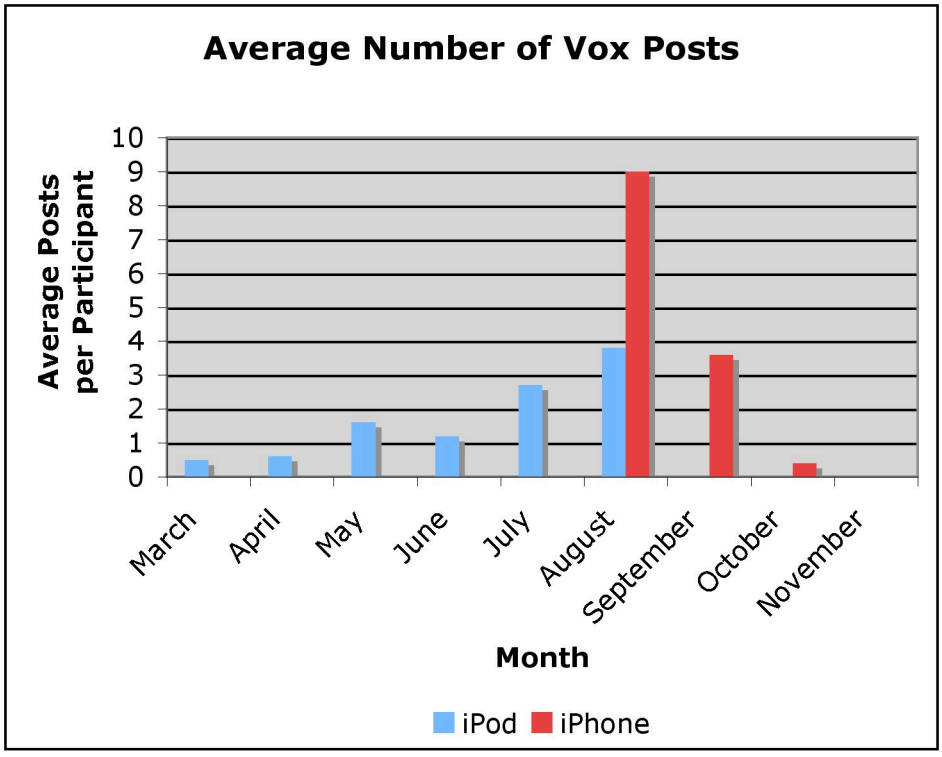

Fig 9. Comparison of average iPod and iPhone Vox posts.

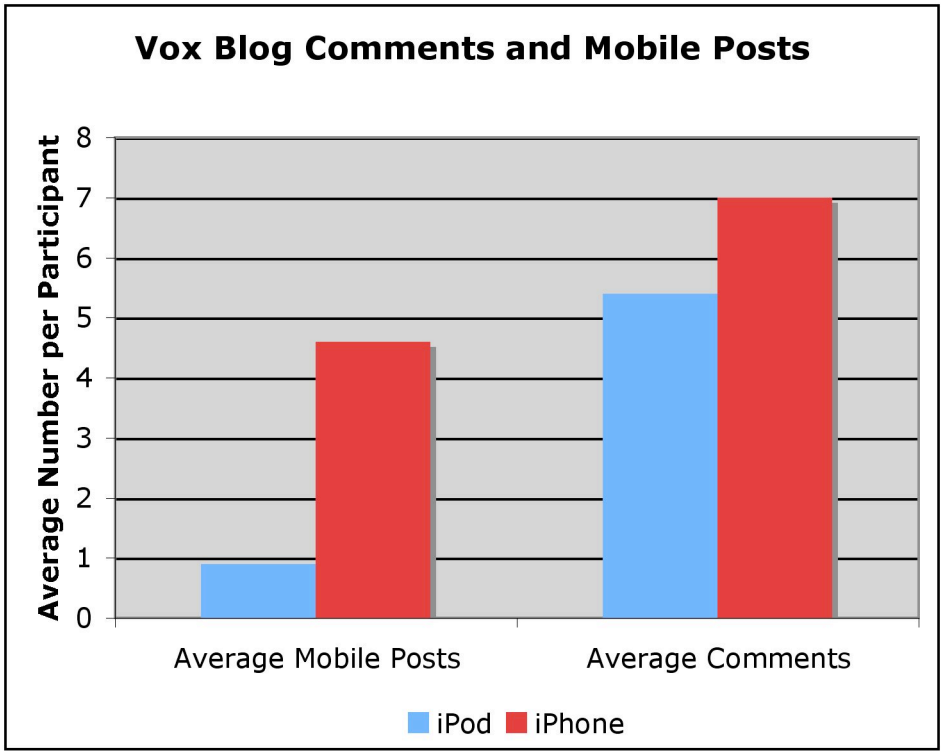

Fig 10. Comparison of iPod and iPhone Vox mobile posts and comments.

Fig 11 below summarises the type and amount of media embedded into participants Vox blogs. The numbers are somewhat deceptive in comparison between the iPod and iPhone timeframe, as the most active ipod media uploaders became the iPhone users, and the iPhone timeframe was shorter than that for the iPod use. Participants identified the lack of video recording capability of the iPhone as a significant limitation of the device.

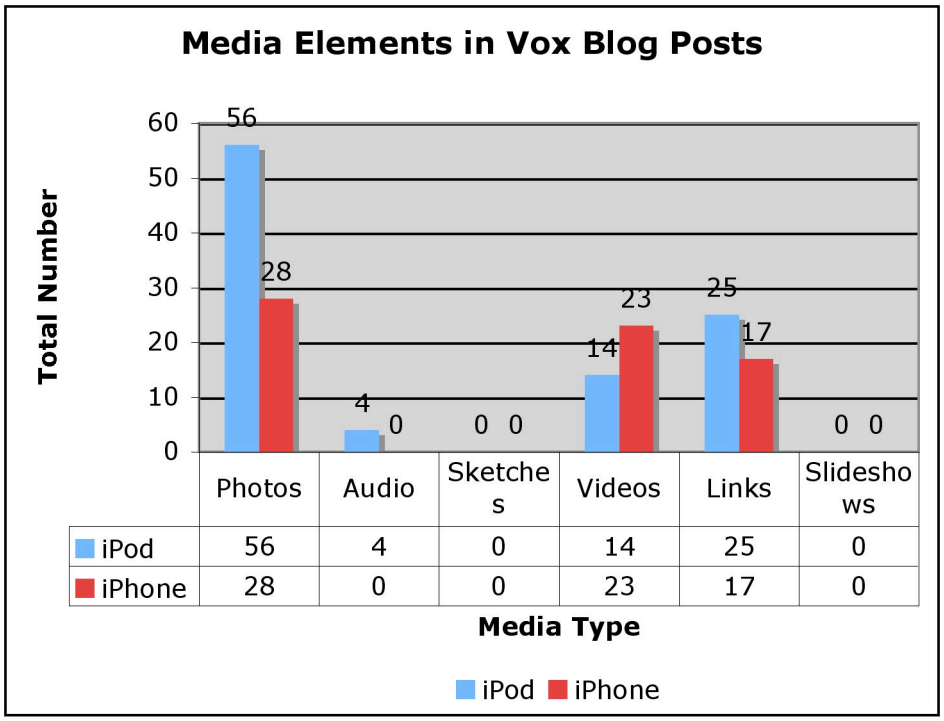

Fig 11. Comparison of total number of media elements used in Vox blogs.

3.4 Key Issues

The trial has highlighted several key issues that are related to the research questions.

1. What are the key factors in integrating Wireless Mobile Devices (WMDs) within tertiary education courses?

Carefully planned course integration including authentic assessment of the use of mobile web 2.0 tools is needed.
Course lecturers need to appropriate the mobile web 2.0 tools into their own daily routines and gain an understanding of the affordances of these tools for their pedagogical toolkits. This requires significant time for exploration of the affordances of the mobile web 2.0 tools, and lecturer professional development, and should be factored into such projects.

2. What challenges/advantages to established pedagogies do these disruptive technologies present?

Mobile web 2.0 tools are disruptive devices that facilitate social constructivist pedagogies, and therefore disrupt instructivist pedagogies.

3. To what extent can these WMDs be utilized to support learner interactivity, collaboration, communication, reflection and interest, and thus provide pedagogically rich learning environments that engage and motivate the learner?

Students are engaged by the use of these tools and will use them to enhance collaboration and communication, but to hold that engagement under the pressures of tertiary education requires integration into the course assessment strategies.

4. To what extent can WMDs be used to harness the potential of current and emerging social constructivist e-learning tools?

The iPod Touch and the iPhone demonstrate a new level of integration between wireless mobile devices and web 2.0 services. However, every wireless mobile device has strengths and weaknesses, the lack of video recording and multitasking of the iPhone is its key weaknesses in supporting mobile web 2.0. These weaknesses can be addressed by 'jailbreaking' the iPhone to enable a wider range of affordances, including: video recording, video streaming, browsing and accessing the files on the iPhone without restrictions, and enabling sharing of the iPhones 3G internet connection with a laptop computer etc… These will be explored in mobile web 2.0 projects in 2009.

This case study serves to illustrate several critical pedagogical success factors of mobile web 2.0 integration within tertiary education:

1. The level of pedagogical integration of the technology into the course criteria and assessment.
2. The level of lecturer modelling of the pedagogical use of the tools.
3. The use of regular formative feedback from both Lecturers and student peers.
4. Appropriate choice of mobile devices and software.
5. The importance of technological and pedagogical support.

Several of these critical success factors are also corroborated by studies such as the recent mobile learning projects at the University of Wollongong (J. Herrington *et al.*, 2008), which were based upon the nine characteristics of authentic learning (A. Herrington & Herrington, 2006). The above critical success factors were identified across several mobile web 2.0 projects during 2007 and 2008, of which the Diploma of Contemporary Music was one project. Each project was evaluated by:

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

3.5 Plans for 2009

Everyone on the trial indicated that they found the iPod Touch effective for increasing communication, and would be willing to purchase their own iPod Touch. The current high cost of the iPhone is a deterrent to student purchases. Student blogging made slow progress without specific integration into the course in 2008. The main limitation of the iPod Touch were the reliance upon WiFi hotspots, and the slow speed of the Unitec WiFi network at Waitakere. The introduction of the iPhone 3G effectively solved this issue. The ubiquitous connectivity of the iPhone better facilitates personalised learning environments within and between multiple contexts. The project is continuing into 2009, and will aim for better course integration and wider use of the iPhone.

The iPod Touch and iPhone version 2.0+ software coupled with the opening of the iTunes application store has opened the potential of the iPod Touch and iPhone platform to a vast array of applications that are very relevant to the music industry and music education. The potential for using some of these available and emerging applications within the course is to be investigated.

Feedback and evaluation of the other five mobile web 2.0 projects during 2008 demonstrated an enthusiastic response to continuing and developing these projects in 2009. Following this enthusiastic response from the students and lecturers, internal institutional funding was sought, and approved, for extending these small projects to a major large-scale mlearning project in 2009 involving the use of 250 smartphones, and 200 netbooks. In the 2009 Diploma of Contemporary Music programme, the iPods/iPhones will be integrated into the course delivery and assessment as part of a PODcast and VODcast sharing project with another similar course at another New Zealand institution. This will include elements of peer critique and review recorded on their VOX blogs. The iPods will be used within the first year of the course, as part of the performance course. The iPhones will be used within the second year of the course, as part of the new technologies paper. This will facilitate a stronger sense of development of a learning community.

An sms text messaging system will be explored for use in the mobile web 2.0 trials in 2009 as a communication and notification system operating as a plug-in from within the institutions learning management system.

The cost of prepay mobile data in New Zealand has dropped dramatically during the second half of 2008 and so options for sustainable funding of the iPhone and 3G data are better than they were in 2008.

Finally, plans for Lecturer professional development (using a community of practice model) in the technical and pedagogical underpinnings of mobile web 2.0 to tackle the issues of course integration are underway in preparation for the beginning of semester one 2008.

4. CONCLUSIONS

The Diploma of Contemporary Music case study has served as an initial investigation of some of the potential of mobile web 2.0 within the course. The trial highlighted the need for lecturer appropriation of the tools and identified the key issue of course integration including summative and formative assessment. Student engagement simply on the basis of using the ‘coolest’ phone or media player in the world is not sustainable when the pressures of course deadlines for assessments loom. The trial has set a sound basis from which to enhance the course for next year, and illustrates a potentially transferable model of implementation and support for mobile web 2.0 projects. This model is further developed and illustrated across a variety of contexts via concurrent mobile web 2.0 trials (Cochrane, 2008a, 2008b; Cochrane & Bateman, 2009). Now that course lecturers have experience with mobile web 2.0 tools, they will be better equipped for developing new pedagogical approaches for future projects that facilitate the establishment of personal learning environments for students beyond the confines of the institutionally hosted learning management systems. In particular 2009 projects will investigate the use of MySpace, student created podcasts, and microblogging as authentic mobile learning environments within the context of music delivery, promotion and critique.

5. APPENDIX

5.1 *Table 4. Wireless Mobile Study – end of trial questionnaire (DipLSD2007 Students):*

QUESTION: (This is an anonymous questionnaire)	**Your Answer: tick or circle most applicable answer/s, or write your answer in the space provided below.**					
1. What is your Student ID number?						
2. What is your age?						
3. What is your gender?	Male	Female				
4. What has been your experience of group work facilitated by Blogs and RSS?	Very Good	Good	Not Bad	Neither Good nor Bad	Not Good	Terrible
6. It was easy to use the smartphone (Nokia N80)?	Strongly agree	Agree	Uncertain	Disagree	Strongly disagree	
7. This mobile learning experience was fun.	Strongly agree	Agree	Uncertain	Disagree	Strongly disagree	
8. Based on my experience during this trial, I would use a smartphone in other courses	Strongly agree	Agree	Uncertain	Disagree	Strongly disagree	
9. I would be willing to purchase my own smartphone?	Yes	No				
10. Where did you use the Smartphone? Circle all that apply.	a. At home b. At Unitec in class c. At Unitec not in class d. While Travelling e. On site while investigating or building your project f. Other (specify)					
11. In your opinion, does mobile learning increase the quality of learning?	Strongly agree	Agree	Uncertain	Disagree	Strongly disagree	
12. Mobile blogging helped create a sense of community (group work)?	Strongly agree	Agree	Uncertain	Disagree	Strongly disagree	

13. Accessing your course blog was easy using the mobile device?	Strongly agree	Agree	Uncertain	Disagree	Strongly disagree
14. Mobile learning increases access to education?	Strongly agree	Agree	Uncertain	Disagree	Strongly disagree
15. Communication and feedback from the course lecturer/lecturer was made easier?	Strongly agree	Agree	Uncertain	Disagree	Strongly disagree
16. Mobile learning is convenient for communication with other students?	Strongly agree	Agree	Uncertain	Disagree	Strongly disagree
17. Rate the usefulness of the following applications using mobile devices? (0 = no use, 10 = extremely useful).	a. Email b. Instant Messaging c. Video d. Audio e. Web Browsing f. Document editing g. Document Reading h. Calendar i. Contacts/Addressbook j. Notes k. Accessing online course material l. Blogging m. File sharing n. RSS subscriptions o. Taking and uploading photos p. Txt q. Phone calls				
18. What factors would be most important in deciding upon mobile learning?	• Cost of device • Size of the screen • Size & weight of the mobile device • Phone integration • Wireless capability • The operating system: PocketPC, Palm OS, or Symbian • Availability of installable applications • A built-in camera • Ease of linking to your Blog • The cost of mobile data • Other				

19. Do you have any other comments on the mobile project?	

5.2 Questions for discussion

The main purpose of the focus group is to provide critical reflective feedback on the design and implementation of the learning activities and enhanced communication facilitated by the Wireless Mobile Device (WMD) used in the 'trial'. This feedback will provide valuable insights into the design of the following trial, and forms a critical reflective action research cycle of evaluation.

Focus Group Questions:

1. How would you rate the effectiveness of the WMD (Smartphone) for accessing your/your students' blogs?

2. How user friendly was the interface of the WMD?

3. How would you rate the effectiveness of the WMD for increasing communication:
    a. Between students
    b. Between Students and Lecturers/lecturers?

4. How useful were the WMDs for accessing course content?

5. Describe how the integration into the course of the WMDs may be improved.

6. (For Lecturers) How would you rate the usefulness of the WMDs for your own teaching?

7. What level of interactivity did the WMDs provide?

8. What were the benefits of wireless connectivity?

9. What were the support requirements for the WMDs?

10. What other uses did you find for the WMD?

11. In what situations would the WMDs be most effective?

12. What do you think worked well, and what would you do differently another time?

REFERENCES

Attwell, G. (2006). The wales-wide web. *What is a PLE? The future or just another buzz word?* Retrieved 1 July, 2006, from http://www.knownet.com/writing/weblogs/Graham_Attwell/entries/6521819364

Bijker, W., Hughes, T., & Pinch, T. (Eds.). (1987). *Social construction of technological systems: New directions in the sociology and history of technology*. Cambridge: MIT Press.

Cochrane, T. (2007, 16-19 October). *Moving mobile mainstream: Using communities of practice to develop educational technology literacy in tertiary academics.* Paper presented at the MLearn 2007 - Making the Connections 6th International Conference on Mobile Learning, Melbourne.

Cochrane, T. (2008a, 8-10 October). *Designing mobile learning environments: Mobile trials at unitec 2008.* Paper presented at the MLearn08: The bridge from text to context, University of Wolverhampton, School of Computing and IT.

Cochrane, T. (2008b, 1 - 4 December). *Mobile web2.0 the new frontier.* Paper presented at the ASCILITE 2008, Deakin University, Melbourne, Australia.

Cochrane, T., & Bateman, R. (2009). Transforming pedagogy using mobile web 2.0, *IADIS International Conference on Mobile Learning 2009*. Barcelona, Spain.

Cochrane, T., & Kligyte, G. (2007, 11-14 June). *Dummies2delight: Using communities of practice to develop educational technology literacy in tertiary academics.* Paper presented at the JISC online conference: Innovating eLearning, JISC online conference.

Herrington, A., & Herrington, J. (2007). *Authentic mobile learning in higher education.* Paper presented at the AARE 2007 International Educational Research Conference, Fremantle, Australia.

Herrington, A., & Herrington, J. (Eds.). (2006). *Authentic learning environments in higher education*. Hershy: Information Science Publishing.

Herrington, J., Mantei, J., Herrington, A., Olney, I., & Ferry, B. (2008, 1 - 4 December). *New technologies, new pedagogies: Mobile technologies and new ways of teaching and learning.* Paper presented at the ASCILITE 2008, Deakin University, Melbourne, Australia.

Jafari, A., McGee, P., & Carmean, C. (2006). Managing courses, defining learning: What faculty, students, and administrators want. *Educause review, July/August,* 50-70.

Kukulsa-Hulme, A., & Traxler, J. (2005). Mobile teaching and learning. In A. Kukulsa-Hulme & J. Traxler (Eds.), *Mobile learning* (pp. 25 - 44). Oxon: Routledge.

Laurillard, D. (2001). *Rethinking university teaching: A framework for the effective use of educational technology* (Second ed.). London: Routledge.

Laurillard, D. (2007). Pedagogical forms of mobile learning: Framing research questions. In N. Pachler (Ed.), *Mobile learning: Towards a research agenda* (Vol. 1, pp. 33-54). London: WLE Centre, Institute of Education.

Lave, J., & Wenger, E. (1991). *Situated learning: Legitimate peripheral participation*. Cambridge: Cambridge University Press.

McLoughlin, C., & Lee, M. J. W. (2008). Future learning landscapes: Transforming pedagogy through social software. *Innovate: Journal of Online Education, 4*(5).

Mishra, P., Koehler, M. J., & Zhao, Y. (Eds.). (2007). *Faculty development by design: Integrating technology in higher education*. Charlotte: Information Age Publishing.

O'Reilly, T. (2005). What is web 2.0: Design patterns and business models for the next generation of software. Retrieved March, 2006, from http://www.oreillynet.com/pub/a/oreilly/tim/news/2005/09/30/what-is-web-20.html

Sharples, M. (2000). Disruptive devices: Personal technologies and education. Retrieved 27 June, 2006, from http://www.eee.bham.ac.uk/handler/ePapers/disruptive.pdf

Sharples, M. (2001). Disruptive devices: Mobile technology for conversational learning. *International Journal of Continuing Education and Lifelong Learning, 12*(5/6), 504-520.

Sharples, M. (2005). *Learning as conversation: Transforming education in the mobile age.* Paper presented at the Conference on Seeing, Understanding, Learning in the Mobile Age, Budapest, Hungary.

Sharples, M., Milrad, M., Sanchez, I. A., & Vavoula, G. (2007). Mobile learning: Small devices, big issues. In N. Balacheff, S. Ludvigsen, T. de Jong, A. Lazonder, S. Barnes & L. Montandon (Eds.), *Technology enhanced learning: Principles and products* (Vol. chapter 14, pp. 20).

Stead, G. (2006). Mobile technologies: Transforming the future of learning. *Emerging Technologies for Learning* Retrieved 6 April, 2006, from http://www.becta.org.uk/corporate/publications/

Uden, L. (2007). Activity theory for designing mobile learning. *International Journal of Mobile Learning and Organisation, 1*(1), 81-102.

Vygotsky, L. (1978). *Mind in society*. Cambridge, MA: Harvard University Press.

Wadsworth, Y. (1998). What is participatory action research? Retrieved May 3, 2002, from http://www.scu.edu.au/schools/gcm/ar/ari/p-ywadsworth98.html

Wali, E., Winters, N., & Oliver, M. (2008). Maintaining, changing and crossing contexts: An activity theoretic reinterpretation of mobile learning. *ALT-J, Research in Learning Technologies, 16*(1), 41-57.

Wenger, E., McDermott, R., & Snyder, W. (2002). *Cultivating communities of practice: A guide to managing knowledge*. Boston: Harvard Business School Press.

Wenger, E., White, N., Smith, J., & spa, K. R.-. (2005). Technology for communities. Retrieved 14 July, 2006, from http://technologyforcommunities.com/