MLEARNING PRAXIS: A PRAGMATIC GUIDE TO IMPLEMENTING MOBILE LEARNING

ABSTRACT

This paper explores approaches to implementing mlearning that focus upon using student-owned mobile devices to enable student-generated content (Bruns, 2008) and student-generated learning contexts (Luckin, et al., 2010). The author explores how this can be achieved and supported with such a variety of mobile devices available and used by students today. The paper evaluates the current options for mobile devices, and discusses an mlearning design framework that can be used to implement social constructivist pedagogy using mobile web 2.0 on a variety of student-owned mobile devices with a minimum of technical expertise from the course lecturer/s. This is informed by drawing upon examples from over thirty mlearning projects implemented by the author during the past five years, evaluated within a participatory action research methodology. Examples of mobile web 2.0 implementation outlined include integrating into the curriculum the student use of: Twitter, mportfolios, VODCasting (for example mobile videos uploaded to YouTube and Vimeo), PODCasting, the use of mobile codes, geotagging, geolocation, and Augmented Reality.

Keywords: mlearning, communities of practice, social constructivism

INTRODUCTION

Mlearning is a rapidly developing form of computer assisted learning that is defined by its focus upon the mobility of the learner, and consequently the potential to frame learning within authentic situations and bridge multiple learning contexts, on and off campus, linking formal and informal learning. This is best achieved by focusing upon the unique affordances of mobile web 2.0 tools rather than replicating on a small screen what can be achieved on larger less mobile computing devices such as laptops and desktop computers.

Beyond the LMS – Pedagogical Transformation

Mlearning provides a catalyst for moving from a lecturer-directed pedagogy (Kukulska-Hulme, 2010), often characterised by a focus upon the institutions LMS (Learning Management System), to a student-centred social constructivist pedagogy where the focus is upon enabling student-generated content (Bruns, 2008) and student-generated learning contexts (Luckin, et al., 2010). Traxler (2011) defines five types of learning scenarios where mlearning has had significant impact on learning:

1. Contingent mobile learning and teaching, where learners can react and respond to their environment and their changing experiences, where learning and teaching opportunities are no longer pre-determined beforehand.
2. Situated learning, where learning takes place in surroundings that make learning meaningful.
3. Authentic learning, where learning tasks are meaningfully related to immediate learning goals.
4. Context- aware learning, where learning is informed by the history, surroundings and environment of the learner.
5. Personalised learning, where learning is customised for the interests, preferences and abilities of individual learners or groups of learners. (Traxler, 2011, pp. 6-7)

Web 2.0 Appropriation

The researcher's mlearning strategy has focused upon enabling the pedagogical use of elearning tools beyond the LMS, with a particular focus upon developing rich-media student-generated eportfolios. The use of Wireless Mobile Devices (WMDs) utilising the affordances of web 2.0 has been a core catalyst in enabling these student-generated eportfolios.

WMDs

Initial mlearning projects between 2006 to 2011 (Figure 1) focused upon developing mlearning projects using Wireless Mobile Devices (WMDs) provided by the institution and loaned to students throughout the length of each project, typically spanning one to two

semesters. These projects formed research cycles within a longitudinal research project using a participatory action research methodology.

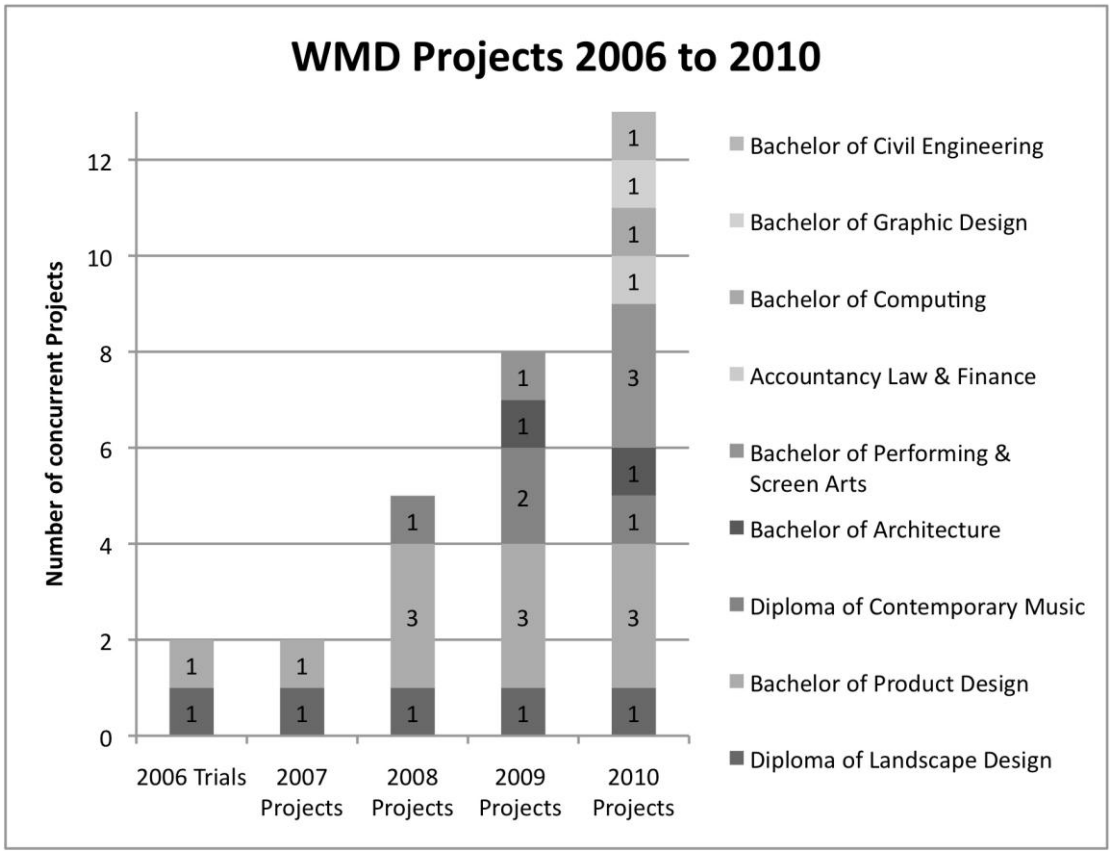

Figure 1: WMD project development 2006 to 2010.

Acceptable use agreements for participants in the WMD projects, and processes for organizing the distribution and collection of WMDs for the projects as well as an agreement with the institutional computer supplier enabled device loans to participants, storage and re-imaging between projects. The researcher worked with lecturers to establish appropriate WMDs for each different course context, ensuring there was innovative pedagogical and curriculum alignment embedded within each of the projects.

The experience of managing and implementing thirty mlearning projects using a wide variety of devices between 2006 and 2011 has enabled the researcher to create an mlearning design framework that is essentially device independent.

The WMD projects (2006 to 2009) identified six Critical Success Factors for the implementation of mobile web 2.0 (Author1, 2010a, 2010b). These have relevance for any educational technology adoption where the focus is upon social constructivist pedagogy or a 'living curriculum'. The six critical success factors include:

1. The pedagogical integration of the technology into the course and assessment.
2. Lecturer modeling of the pedagogical use of the tools.
3. Creating a supportive learning community
4. Appropriate choice of mobile devices and web 2.0 social software.
5. Technological and pedagogical support.
6. Creating sustained interaction that facilitates the development of ontological shifts, both for the lecturers and the students, bridging the pedagogy-andragogy-heutagogy continuum (Garnett, 2010; Luckin, et al., 2010) from lecturer-directed pedagogy to student-directed heutagogy.

The WMD projects therefore established the critical nature of the development of supporting communities of practice (COPs) around technology adoption. This informed the development of the new elearning strategy. The implementation of the new elearning strategy is embedded

within a participatory action research project methodology (Swantz, 2008), enabling continuous reflection and refinement of the strategy.

STUDENT OWNED DEVICES

Pre-project surveys of 2010 participating students found that on average 90% of students owned a cameraphone (though the majority were 'feature phones' rather than 'smartphones'), and student laptop ownership ranged from 75% to 90% across the project groups. To create a sustainable model for the integration of mlearning within courses a focus upon student-owned devices is necessary (Traxler, 2010, 2011), and now achievable with the devices that virtually every student already own – a cameraphone. Supporting student-owned devices brings significant implementation and support issues, explored in the following sections.

The nature of mobile computing (Wireless Mobile Devices or WMDs) is a far more rapidly changing market than that of desktop or laptop computing. The life span of mobile devices is typically less than a year, rather than the 2-3 years of traditional computers. Students rapidly lose interest in 'last-years' model. Therefore the future of WMD uptake is clearly to focus upon creatively supporting student-owned WMDs (smartphones, tablets, and netbooks). Student owned WMDs are potentially disruptive, pedagogical transforming devices.

> Mobile devices allow students to access and store images and information of their own choosing and perhaps create and distribute new images and information independently of the lecturers and of the university. The long-term consequence must be to challenge the authority of the curriculum and the institutions of formal learning. (Traxler, 2010, p. 10)

However, Laurillard's (2007) definition of mobile learning emphasizes the critical pedagogical design input of the teacher: "M-learning, being the digital support of adaptive, investigative, communicative, collaborative, and productive learning activities in remote locations, proposes a wide variety of environments in which the teacher can operate" (Laurillard, 2007, p. 172). To achieve this, lecturers need to be brought up to speed with embedding the use of these tools within their own teaching. Facilitating Departmental COPs that investigate the pedagogical integration of WMDs is critical, particularly as the WMD landscape is such a rapidly changing/developing market. An implementation strategy is presented based upon the researcher's unique expertise and experience in utilising WMDs for enabling student-generated content and student-generated contexts, rather than an approach focused upon the delivery of course content to small screen devices.

THE MOBILE DEVICE MARKET

A focus on student-owned WMDs presents a wide range of devices that an mlearning strategy must be designed for. With the rise of mobile application ecosystems many mobile web 2.0 application developers provide apps with similar functionality for the main mobile platforms. Mobile application ecosystems include: the iTunes Store for dissemination of iOS WMD applications and media, the Android Market for Android WMD devices, and the Nokia Ovi Store for Symbian based smartphones. These mobile ecosystems bridge information, content and productivity with laptop or desktop computing via web 2.0 platforms, creating a mobile learning framework that can be easily appropriated by a wide range of educators enabling mainstream adoption of mlearning in tertiary education. At the time of writing (GSMArena, 2011; Perez, 2011), the largest mobile app ecosystems include:

- iOS (Apple iPhone, iPod Touch, and iPad) iTunes App Store with 500000+ apps.
- Android Market for AndroidOS-based smartphones and tablets with 250000+
- Symbian Ovi Store with 30000+ apps
- Blackberry App Store with 20000+ apps
- Windows Phone7 with 9000+ apps

The 2011 iOS economy encompasses a range of mobile devices including the iPod, the iPod Touch, the iPad, and the iPhone. Apple has built up a significant lead over competing mobile ecosystems (Android, Blackberry, Symbian, Windows Phone7, WebOS) in developing a mature mobile ecosystem. Whitney (2011) quotes Jack Kent, an IHS mobile media analyst, "Apple, in contrast, has been able to maintain advantage by leveraging its tightly controlled

ecosystem--combining compelling hardware and content with the capability to offer consumers a trusted, integrated, and simple billing service via iTunes" (Whitney, 2011, p. 1). While Apple is often decried for making this iOS ecosystem tightly controlled and closed, the more “open” Google-owned Android mobile ecosystem has been playing catch-up and recently suffered a spate of malware attacks within the Android Market (Kirk, 2011). The Android Market, the equivalent of the iTunes App Store, is reportedly vulnerable to over seventy types of malware (Browning, 2011). Getting the best out of the Android ecosystem currently remains the domain of power users capable of tweaking and updating the OS to get the best out of it. In contrast, Nokia’s Symbian ecosystem was recently described by its CEO as a “burning oil platform” (Ricknas, 2011), resulting in a partnership with Microsoft’s Windows Phone 7 OS that has yet to attract significant market share. In comparison, the iOS ecosystem presents a maturing, safe and user-friendly environment supported by over 500000 apps, including 75000+ iPad apps, making it the popular mobile platform choice in education. However, the iOS economy is not without its foibles, chief among these is the restrictive file structure imposed upon iOS apps that requires application developers and users to develop creative ways of sharing content and data between applications, often relying upon cloud-based services. The next iteration of Apple’s iOS (iOS5) significantly reduces that reliance of the iPod Touch, the iPhone and the iPad upon a desktop or laptop running iTunes, as iOS5 will enable direct wireless interaction and synchronisation with Apple’s new iCloud web-based service.

AN MLEARNING DESIGN FRAMEWORK

This section introduces an mlearning design framework (*Table 1*) that can be used to implement social constructivist pedagogy using mobile web 2.0 on a variety of student-owned mobile devices with a minimum of technical expertise from the course lecturer/s.

The WMD case studies indicated the critical role of the level of pedagogical integration of the technology into the course criteria and assessment. This involves scoping and planning appropriate course activities and assessments based upon the chosen pedagogical model (social constructivism), creating pedagogical alignment (Biggs, 2003). The point of acceptance into course integration of the mobile web 2.0 tools is typically reached as lecturers realize the flexibility of learning context and feedback that these tools facilitate. Learning activities typically begin as translations of more traditional paper based activities into a mobile web 2.0 alternative (Herrington & Herrington, 2007). As lecturers become more acquainted with the possibilities afforded by mobile web 2.0 tools more creative learning activities are developed and integrated into the courses. A key tool used to facilitate redeveloping course outlines has been Google Docs (http://docs.google.com) for collaborative course and assessment planning between the course lecturers and the technology steward (researcher). As a result, a design framework was developed to guide the integration of mobile web 2.0 tools into the courses. This framework was developed iteratively over the life of the research. Curriculum integration must start with the learning practice that is to be achieved (As illustrated in *Table 1*), 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. The researcher’s design framework for each of the projects is shown in *Table 1*. 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).

Table 1: 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

EXAMPLES OF MOBILE WEB 2.0 IMPLEMENTATION

Examples of mobile web 2.0 implementation outlined include integrating into the curriculum the student use of: Twitter, mportfolios, VODCasting (for example mobile videos uploaded to YouTube and Vimeo), PODCasting, the use of mobile codes, geotagging, geolocation, and Augmented Reality. Student and lecturer feedback is used to illustrate the impact of mobile web 2.0 implementation and the pedagogical changes (Garnett, 2010) that result. These examples draw upon the transformative disruption to instructivist content delivery pedagogy that student owned WMDs can enable.

Twitter

Essentially a text-based asynchronous communication and collaboration tool, Twitter can be used on any cellphone via SMS. New Zealand is one of several countries that provide specific short codes for SMS posting of Tweets (http://support.twitter.com/groups/34-apps-sms-and-mobile/topics/153-twitter-via-sms/articles/14226-how-to-find-your-twitter-short-code-or-long-code). Because Twitter is asynchronous and records messages in a users microblog it presents a collaboration and communication tool that can be used particularly well across geographic and time zone barriers – enabling international collaboration and community building. Twitter has also been successfully used by the researcher to enhance face-to-face classroom discussions, and to enhance student engagement during presentations via an interactive 'backchannel'. Following like-minded peers or international experts via Twitter can lead to serendipitous learning (unplanned but fortuitous links and interaction) (Buchem, 2011). For example, an international collaborative project using Twitter in 2009 facilitated by the researcher created an internet 'superstar' of one of the student participants (Author1, 2010c).

Mobile ePortfolios

Mobile blogging can be achieved via MMS (Multimedia Messaging Service) to any blog host (for example: Typepad, Blogger, Wordpress), online photo host (for example: Picasaweb,

Flickr), or video host (for example: YouTube, Vimeo) that supports email upload of text, images and video. An MMS message is essentially an email and can be sent to any email address without setting up an email account on the users cellphone. Media attached to an MMS becomes embedded content in the users web 2.0 site when sent to their email upload address, usually found in the users preferences or account settings for the site. A 2008 Product Design student used their mportfolio to showcase their design skills, resulting in a design job offer by an exclusive international design company (Author1 & Bateman, 2010). Mobile VODCasting and PODCasting can be used to create enhanced multimedia eportfolios of student-generated content.

VODCasting

Video PODCasting is achievable on any cameraphone that can record video and then upload the video either via MMS, email, or a mobile app such as Pixelpipe, to online video hosts such as YouTube or Vimeo. These VODCasts can document student projects, share experiences or events, be student reflections, or student interviews with experts. Thus mobile VODCasting can be used within situated or authentic learning contexts, and bridge informal and formal learning. An example collation of student VODCast reflections from 2009 and 2010 mlearning projects can be found at http://www.youtube.com/watch?v=pmydqBO6ltI.

PODCasting

Audio PODCasting is achievable on any cellphone – as every cellphone includes a built-in microphone capable of recording audio and then upload the audio either via MMS, email, or a mobile app such as Pixelpipe, to online audio hosts. Freely available PODCast hosts include: Audioboo, and Soundcloud. Smartphones can create enhanced PODCasts via free applications downloadable from the Android Market, Ovi, or the iTunes Appstore. For example the Audioboo smartphone app includes geotagging of audio recordings and automatic announcements via social media such as Twitter or Facebook. Contemporary Music students used iPhones in 2009 and iPads in 2010 to record and upload environmental sounds via Audioboo (Author1, 2009; Author1, Narayan, & Oldfield, 2011).

Mobile Codes

Mobile Codes are supported by freely downloadable applications for almost any cameraphone. Mobile codes are two-dimension codes similar to bar codes found on product information labels. There are a variety of mobile code formats, with the most popular being QR Codes (Quick Response Codes). QR Codes can represent a variety of information, including: URL's, a paragraph of text, an SMS message, a business card, or a geolocation (longitude and latitude information for an object). QR Codes can be simply generated using a variety of freely accessible web forms, such as: http://mobilecodes.nokia.com, http://www.splashurl.net, http://zxing.appspot.com/generator/. These codes can then be uploaded to websites, printed, or projected for decoding in a variety of contexts. A QR Code is decoded by an application on a cameraphone that uses the phones built-in camera to scan the code. During 2011 Building Technology lecturers created links between building site materials, Google Sketchup plans, and illustrative YouTube videos for students to scan with their cameraphones on site, enabling contingent and personalised learning situated on site, thus bridging the theory and practice of building technologies http://www.youtube.com/watch?v=B04gFx4elx4.

Augmented Reality

Augmented reality involves enhancing the physical environment as seen through a smartphone's camera with layers of interactive digital information including geolocation data. Augmented reality is the domain of high-end smartphones, relying upon devices that embed not only mobile cameras but also an integrated compass, GPS and accelerometers. This class of WMD includes: Nokia NSeries smartphones, most Android smartphones, Windows 7 smartphones, the iPhone, and to a limited extent the iPad2 and the iPod Touch 4+. Web 2.0 augmented reality applications include a range of freely available augmented reality browsers that allow users to generate their own content via interactive points of interest, for example: Wikitude, Layar, Junaio. Another interesting use of mobile augmented reality includes the use of mobile devices to control and stream live video from wirelessly connected 'robots' such as the ARdrone quadracopter that is fitted with two wireless webcams, used recently to explore

quake-stricken buildings in Christchurch (Hampton, 2011). Augmented reality can be used within projects that feature student-generated content and student-generated contexts. For example: in field trips, and recording and locating geographic information. Architecture students in a 2010 mlearning project created a Wikitude layer illustrating poor architectural design throughout Auckland city http://archifail.wordpress.com.

CONCLUSION

Mlearning can be a significant catalyst for pedagogical transformation, enabling a focus upon student-generated content and student-generated learning contexts beyond the classroom. However, the way forward for sustainable integration and implementation of mlearning in tertiary education is to create environments where student-owned devices are leveraged. The paper presents a strategy that appropriates the affordances of the platform independence of mobile web 2.0 while keeping the pedagogical goals as the key focus rather than the variety of platforms that must be supported. Several key platform independent mobile web 2.0 tools and activities are presented in the paper as practical examples of what can be achieved by this approach.

REFERENCES

Biggs, J. (2003). *Teaching for Quality Learning at University* (Second ed.). Buckingham: The Society for Research into Higher Education.

Browning, J. (2011). Google's Android phones face more attacks via apps. *SFGate.com*. Retrieved from http://sfgate.com/cgi-bin/article.cgi?f=/c/a/2011/04/22/BUL51J5G3C.DTL

Bruns, A. (2008). *Blogs, Wikipedia, Second Life, and Beyond: From Production to Produsage*. New York: Peter Lang Publishing.

Buchem, I. (2011). Serendipitous learning: Recognizing and fostering the potential of microblogging. *Form@re, 2011*(74 February/March), 3.

Author1, T. (2009). Contemporary Music Students and Mobile technology. In J. Odonoghue (Ed.), *Technology Supported Environment for Personalised Learning: Methods and Case Studies* (pp. 429 - 454). Hershey, PA 17033, USA: IGI Global.

Author1, T. (2010a). Exploring Mobile Learning success factors. *ALT-J, Research in Learning Technology, 18*(2), 133-148.

Author1, T. (2010b, 26-30 October). *An mlearning Journey: Mobile Web 2.0 Critical Success Factors.* Paper presented at the MLearn 2010: The 9th International Conference on Mobile Learning, Valletta, Malta.

Author1, T. (2010c). *Twitter Tales:Facilitating international collaboration with mobile web 2.0*. Paper presented at the 27th ASCILITE Conference, ASCILITE 2010. Retrieved from http://www.ascilite.org.au/conferences/sydney10/

Author1, T., & Bateman, R. (2010). Smartphones give you wings: Pedagogical affordances of mobile web 2.0. *Australasian Journal of Educational Technology, 26*(1), 1-14.

Author1, T., Narayan, V., & Oldfield, J. (2011). *iPadagogy: Appropriating the iPad within Pedagogical Contexts*. Paper presented at the mLearn2011, 10th World Conference on Mobile and Contextual Learning. Retrieved from http://mlearn.bnu.edu.cn/

Garnett, F. (2010, 18th November). Heutagogy and The Craft of Teaching. *The Heutagogic Archives* Retrieved 19th November, 2010, from http://heutagogicarchive.wordpress.com/2010/11/18/heutagogy-the-craft-of-teaching/#more-340

GSMArena. (2011). Android Market catching up to Apple Store in app numbers. Retrieved 8 April, 2011, from http://www.gsmarena.com/android_market_catching_up_to_apple_app_store_in_app_numbers-news-2430.php

Hampton, J. (2011, 15 June). Flying drone gives inside scoop on cathedral damage. Retrieved 16 June, 2011, from http://www.3news.co.nz/Flying-drone-gives-inside-scoop-on-cathedral-damage/tabid/423/articleID/215242/Default.aspx

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

Kirk, J. (2011). After attacks, Google vows to fortify Android Market. *iOS Central* 8 March. Retrieved 8 March, 2011, from

http://www.macworld.com/article/158389/2011/03/android_security.html#lsrc.rss_weblogs_ioscentral

Kukulska-Hulme, A. (2010). Mobile learning as a catalyst for change. *Open Learning: The Journal of Open and Distance Learning, 25*(3), 181 - 185.

Laurillard, D. (2007). Pedagogcal forms of mobile learning: framing research questions. In N. Pachler (Ed.), *Mobile learning: towards a research agenda* (pp. 33-54). London: WLE Centre, Institute of Education.

Luckin, R., Clark, W., Garnett, F., Whitworth, A., Akass, J., Cook, J., et al. (2010). Learner-Generated Contexts: A Framework to Support the Effective Use of Technology for Learning. In M. Lee & C. McLoughlin (Eds.), *Web 2.0-Based E-Learning: Applying Social Informatics for Tertiary Teaching* (pp. 70-84). Hershey, PA: IGI Global.

Perez, S. (2011). Nokia Announces 30,000 Ovi Apps, Talks Strategy. *ReadWrite Mobile* Retrieved 8 April, 2011, from http://www.readwriteweb.com/mobile/2011/01/nokia-announces-30000-ovi-apps-talks-strategy.php

Ricknas, M. (2011). 'Burning' Memo From Nokia's Elop Sets Stage for OS Shake-up. *PCWorld,* (10 February). Retrieved from http://www.pcworld.com/article/219107/burning_memo_from_nokias_elop_sets_stage_for_os_shakeup.html

Sharples, M., Crook, C., Jones, I., Kay, D., Chowcat, I., Balmer, K., et al. (2009). *CAPITAL Year One Final Report* (Draft): University of Nottingham.

Swantz, M. L. (2008). Participatory Action Research as Practice. In P. Reason & H. Bradbury (Eds.), *The SAGE Handbook of Action Research: Participative Inquiry and Practice* (Second ed., pp. 31- 48). London: SAGE Publications.

Traxler, J. (2010). Will Student Devices Deliver Innovation, Inclusion, and Transformation? *Journal of the Research Center for Educational Technology (RCET), 6*(1), 3-15.

Traxler, J. (2011). Introduction. In J. Traxler & J. Wishart (Eds.), *Making mobile learning work: case studies of practice* (pp. 4-12). Bristol: ESCalate, University of Bristol, Graduate School of Education.

Whitney, L. (2011). Report: Apple remains king of app-store market. *cnet News, 2011*(February 15). Retrieved from http://news.cnet.com/8301-13579_3-20032012-37.html#ixzz1EpRMIfWJ