MOBAGOGY- MOBILE LEARNING FOR A HIGHER EDUCATION COMMUNITY

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ABSTRACT

This paper reports on a project in which a learning community of higher educators was formed to investigate how best to use mobile technologies in their own learning and teaching. Activities of this group included investigating best practice approaches by interviewing experts in the field, exploring the literature on mobile learning and then initiating and testing some mobile learning pedagogies in the context of their own higher education subjects. The community met regularly to discuss emerging issues and applications. The paper shares some of the findings gained both from the expert interviews and from the experiences of members of the community, and discusses the challenges and constraints that were experienced. We conclude with recommendations for promoting mobile learning communities in higher education.

KEYWORDS

Mobile learning, community of learners, higher education.

1. INTRODUCTION

Mobile devices have come a long way with the development of technology and infrastructure and are now becoming an essential tool, "bringing the whole of the internet… to the palm of your hand" (NMC and Educause, 2008). Mobiles have been evolving and expanding rapidly with more and more features being added over the past few years and are now seen as the "next form of portable computer" (Johnson et al, 2008). They are considerably smaller and less expensive than laptops, yet have powerful multimedia, social networking, communication and geo-location (GPS) capabilities and are becoming more and more embedded, ubiquitous and networked (Johnson et al, 2008). As a result, mobile learning appears to offer numerous opportunities as well as challenges in higher education. Educators all over the world therefore have been looking into ways to use mobile technologies that will "transform learning into a seamless part of daily life, to the point where it is not recognized as learning at all" (Naismith et al, 2004, p5).

Given the ubiquity of mobile devices, an imperative has arisen for educators in higher education to familiarise themselves with the affordance of mobile technologies for learning so that they are able to capitalise on their students' usage of these devices for effective learning. This paper discusses a project implemented by a community of higher educators which had as its aims: familiarisation with mobile devices and their features; identification of ways that experts in the field of mobile learning were using mobile technologies; and the trialling of some teaching ideas using mobile technologies. The project was funded by a university teaching and learning grant which required a learning community to work together to develop innovative technology-based practices. In this paper we examine insights gained in our project regarding the following questions:

1.   How can mobile technologies be used in higher education for learning?
2.   In what ways can a community of learners support each other in mobile learning?
3.   What facilitators and constraints are experienced by the community in implementing a project on the use of mobile technologies in learning and teaching?

2. LITERATURE REVIEW

Like other recent technological developments, there is considerable interest in exploiting the huge appeal and availability of mobile devices for their pedagogical use. The various educational uses of mobile technologies both in schools and in the higher education sector are still being examined. The uses can range from simple transmission of information from teacher to student to more specific use as cognitive tools in authentic learning environments (Aubusson et al, 2009).

Universities are constantly looking for innovative ways in which to improve student learning experiences. Innovation is understood as constituting 'something new' resulting in incremental or radical change (Alexander, 2006). In the context of higher education, the purpose of initiating teaching innovations has been to 'increase the quality of learning, the productivity of learning, while at the same time increasing access to learning' (p.22). Mobile technologies have the potential to be employed innovatively as powerful learning tools in higher education. Their personal and portable nature would appear to be enabling of learning that is integrated with everyday life.

Some examples of the ways that various universities across the world are exploring the use of mobile technologies in innovative ways include mobile broadband applications used across various disciplines such as engineering and social sciences to enhance teaching, learning and creative expression (NMC and Educause, 2008). Mobile technologies have become an integral component of several learning activities that are project-based and which involve blogging, polling, and video podcasts, as in the case of Montclair State University in the US (NMC and Educause, 2008). Similarly, mobile phones can be used as data collection devices for fieldwork in the case of social sciences and related disciplines. The photographs captured allows for rich information to be stored and shared and even sent directly to the course instructor for feedback.

Engaging students and instant feedback during lectures has become popular through the use of SMS (short messaging service) applications with mobile phones (for example, Scornavacca et al, 2009). Mobile technology also provides opportunities for university students to undertake joint projects with the local community. An example of this can be found at the University of Oregon where students use … 'mobile devices to collaborate on projects with the community to work and develop suitable resources which are beneficial to the community members' (NMC and Educause, 2008). Many of the universities are also undertaking research projects in collaboration with companies to better understand how technology can be effectively used to improve student learning and experience. For example, two Australian universities used handheld technologies to explore and develop innovative applications for these technologies in education (Watson and White, 2006, p.27). In the US, Rutgers University in a bid to enhance student learning through the use of handheld computing devices, provides links to recommended hardware and software as well as engages in research projects on handheld computing (p.15). Students at Duke university have been using the iPod device to 'catch quotes, record and review lectures, record and analyze news events, speed up data collection in labs, assist in language learning and to illustrate engineering principles through the use of iTunes' (p.24). In the UK, the m-Learning project (with universities and company participants from EU countries) have developed prototype products and services that target young adults and focus on learning themes and 'bite-sized' modules to assist them in the development of lifelong learning objectives (p.23).

While mobile devices appear to have been used in a variety of ways, as indicated in the above examples, there are few discussions of how higher educators can develop their own understanding of these devices for learning and teaching, as they strive to evaluate and incorporate these devices into their teaching in higher education. This paper discusses the learning that occurred in a community of higher educators, which was endeavouring to investigate the affordances of mobile devices for learning and teaching.

3. METHODOLOGY

This study is informed by design-based research (DBR) methodology. DBR differs from "traditional evaluation … [because] design-based research goes beyond perfecting a particular product. The intention of design based research in education is to inquire more broadly into the nature of learning in a complex system and to refine generative or predictive theories of learning" (The Design-Based Research Collective, 2003, p.7). It is underpinned by a conjecture or idea that gives rise to the enactment of intervention(s) in an authentic setting or settings (The Design-Based Research Collective, 2003). In this study, the central

conjecture is that an enriched engagement with m-learning may be promoted by the establishment of a community of learners. The intervention arising was the establishment of a community of learners in a university to trial and engage in professional conversations about their views of, as well as activities and experiences with, m-learning. This intervention became known as the 'Mobagogy' project.

The design-based method (Brown, 1992) was central to this inquiry because the intervention was to be tested and modified, in a real world setting. This is broadly consistent with design-based interventions which are not frozen, applied and evaluated. Rather, they are required to respond to evidence about the process as it arises (The Design-based Research Collective, 2003). The research takes place in messy, socially interactive situations (O'Donnell, 2004) where the aim is to entwine research and practice to "orchestrate innovative learning experiences" (Bell, 2004, p. 244). The iterative process means that analysis of the circumstances and data lead to decisions to change the intervention while it is being trialed (The Design-based Research Collective, 2003). Therefore some significant changes to the intervention occur as it progresses.

3.1 Context and Intervention

A community of learners with shared interest in m-learning was formalised following discussion among colleagues in a Faculty of Arts and Social Sciences at an Australian university. Funding for a community of learners to develop an innovative digital intervention was provided by the University.

The group has much in common with a community of practice. Wenger (1998) has contrasted a community of practice with a project team arguing that a project team appears when a project starts and ends when it finishes. In contrast, a community of practice exists and maintains professional relationships beyond the scope of a single project. In this case the professional associations and collaborations of members existed prior to the formation of this project. However, the project provided impetus for increased formality of community processes and the development of a social system for knowledge production and exchange. The initial discussion among colleagues and invitations to others in the faculty resulted in the formation of a group of nine participants, most of whom had worked together for some years. Almost all members had previously researched and published with at least one other member of the group. The group included participants with varied expertise in m-learning pedagogy, ranging from researching in the field and extensive engagement with mobile learning to no previous use, engagement or research. The group committed to work towards establishing the Mobagogy Community of Learners. The proposed intervention included:

1. Meetings: Regular meetings to plan and maintain participation in the project
2. Immersion: Participation in a series of m-learning workshops and being provided with an iPod Touch to explore the potential of the device. (Participants had varied access to mobile technologies. For example their phones ranged from those which were used as phones only to those with Internet access and digital capture capabilities).
3. Interviews with experts to inform participant thinking about m-learning, its potential and opportunities relevant to current participant practices.
4. Individual plans of action for m-learning for participants themselves and/or for enactment with selected classes. The action plans are too numerous and elaborate to outline here. They ranged from a participant working/playing with a mobile device to improve the participant's technological capabilities to activities with students on teacher education practicum exploiting mobile technologies for access to information as well as learning conversations about experience.
5. Dialogue with a critical friend.

Throughout the interventions a variety of strategies were used to promote collaborative critical reflection (Ghaye and Ghaye, 1998) These included reports on experiences, shared reflections and discussion on a community blog, and in face to face meetings. Ideas, reflections and work in progress were shared, with invitations for responses, by means such as collaborative web-based documents and group emails. The group also collaborated in the preparation of and delivery of a workshop for others and a poster presentation at a teaching and learning conference. These activities promoted both the clarification of an emerging theoretical framework as well as the identification of what had and had not 'worked'.

3.2 Data Collection and Analysis

Data sources included:
1. Written materials arising from the project activities and communication such as blogs, emails, meeting notes, recordings of discussions of procedural matters and collaborative reflections, individual reflections, shared documents and action plans;
2. Interview and focus group transcripts;
3. Artefacts resulting from the enactment of the action plans

The project is concluding and at the time of the conference, all data will have been analysed. The data are primarily aimed at exploring the intervention as actually enacted, the rationale of the overarching design and any changes in understanding that have arisen during the conduct of the study as recommended by Hoadly (2004). Data are being analysed by thematic analysis (Bryman, 2004) to identify recurring themes with instances coded by themes. The classification of like themes has given rise to broad categories such as types of reflection; iterative cycles (e.g. … action - problem or puzzling event - new perspective - new action -); obstacles inhibiting progress and influences promoting progress; m-learning perceptions; attributes of activity (e.g. whether or not it involved contextualised experiences, work place location(s); communication with others, information access, short or long duration, sustained or brief engagement); personal and professional responses, likes and dislikes; and professional learning affordances. This paper focuses on data analysis informing findings about the three questions posed at the start of the paper: how are mobile technologies used in HE for learning; how does a community of learners support the m-learning process and what are the constraints and facilitators of the project.

4. RESULTS AND DISCUSSION

4.1 Experts' Thoughts

We interviewed six experts in the field of mobile learning: four academics from Australia and Europe and two K-12 Australian educators who are well known for their innovative teaching with mobile technologies. Their elicited views were discussed in group meetings and helped shape our collective understanding of mobile learning phenomena.

Interviewees referred to the following advantages of mobile learning: flexibility, convenience, user-friendliness, enhanced ability to undertake complex tasks, enhanced communication, opportunities for group learning and more sharing and interactions with local and global communities. They saw opportunities for contextualisation and personalisation of learning tasks, and support of project-based and inquiry-based learning approaches. The ubiquitous nature of mobile devices was mentioned by all respondents and one expert believed that mobile devices in general are acting as a conduit to technology use in institutions.

A range of examples in both formal and informal teaching contexts was described in the interviews. Many examples focused on user-generated media projects (especially learner-generated video). These included creation of digital narratives (collect and use media to create a story); capturing media, making a movie and celebrating it through a 'mobile phone film festival'; and video recording science phenomena and editing a presentation. Other examples involving content generation included gathering of media to create and distribute a podcast; recording an interview; capturing and uploading photos to a class wiki; (audio and text-based) note taking, concept mapping; blogging and micro-blogging.

More structured, scaffolded experiences also were mentioned, including use of mobile devices to take quizzes and opinion polls (lecture-based). One example involved students using QR-codes: "…the lecturer asks questions and students scan the required code." Other examples included language learning games, use of collaborative, Physics simulation software and distribution of (teacher recorded) questions and instructions on how to play games (for use by Physical Education students on their iPods). One expert mentioned the use of games using geolocation capabilities in Business studies. Use of mobile devices in assessment exercises was mentioned and included use of mobile phones in open-book exams and use of polls as a diagnostic assessment (using relevant findings as a focus for generating class discussions).

Technical barriers raised included connectivity issues (e.g. wireless in museums) and file compatibility problems (e.g. video files). Connection costs were raised as another significant barrier. Other obstacles

included teachers' perceptions of mobile technologies as 'personal' technologies (and therefore not suitable for use in formal institutional learning) and also their reluctance to change to teaching approaches that might be more conducive to supporting mobile learning. Ethical issues also were raised, such as spontaneously capturing and sharing images in social network sites without considering the implications. Cyber-bullying and copyright issues also were raised. There was considered a need for teacher education to address the need for developing prospective teachers' new digital literacy skills to help leverage mobile learning in education.

4.2 Example from the Mobagogy Community

'Areas of interest' emerging from our group activities included the use of mobile conversational spaces (e.g. using micro-blogging) to support peer and staff mentoring in practicum-based settings, field trips and museum excursions in science and social science education; iTunesU and new podcast communities in English Education; and student generated podcasts and vodcasts in research education. Also of interest were the use of selected mobile devices to enhance interactivity and dialogue in lectures and classrooms; to facilitate media capture and to provide dissemination tools in student-generated media projects (e.g. digital narratives); and support communication processes during project-based learning tasks in science education (e.g. using geolocation capabilities). This sub-section describes one of these trials: the use of micro-blogging to support student teachers in their school-based practicum. This trial helped temper the hype experienced after some of our other community experiences, and emphasised the crucial role of quality dialogue in mobile learning experiences.

Ten volunteer pre-service teachers participated in the micro-blogging trial. The purpose was for these student teachers to use Twitter to share their views and network with other prospective teachers and two staff from the community during their school-based practicum. Intended foci of 'tweets' included: reflections on their own professional learning as a prospective teacher; sharing interesting teaching experiences or artefacts (lesson plans, student work, photos from the field etc.); and sharing interesting teaching resources. Participants labelled their posts with a nominated group 'hashtag' and followed all posts via the *Twazzup* service. The names of their schools and the names of children and staff remained anonymous at all times.

The exercise was evaluated using artefact analysis (the Twittter feed) and a 30 minute interview with a sample of three participants (Anne, Dianne and Mark) involved in the trial. Posts (or 'tweets') were generally thought-provoking and as the trial progressed, they contained interesting photographs of classroom artefacts (e.g. students' work). Students generally liked the simplicity of micro-blogging communications as well as its convenience and immediacy, compared to traditional asynchronous discussion boards. However, participants were reluctant to react to others' tweets and the 140 character limit imposed by Twitter generally restricted meaningful discourse.

Anne used her phone to take photos on her practicum but tweeted from home at the end of the day. Tweeting made her think about specific incidents during the day and the restricted character limits in Twitter helped her "think about them concisely … " However, she found these limits challenging and she wanted to say more. She seemed to be very conscious of the potential audience for her tweets as she searched each day to post about "…things that were interesting." In her interview, she said she would prefer Facebook groups and associated discussion forums for this type of activity.

Dianne used her 3G phone 'live' in the classroom during her lessons. She asked permission first and took photos of children's work. The teacher was unconcerned about this process but the kids were very curious about her mobile use. As a regular 'tweeter', she thought the trial "lacked the normal 'conversation' style" and suggested a larger network was needed to make this exercise valuable. In her interview, she emphasised the time needed to grow an effective network and highlighted the need for a "twitter literacy" to read and understand posts.

Mark used his mobile phone to take photos of children's work but 'tweeted' on the computer at school (after lessons). He often found himself in the 'lurking role': reading others' posts and seeing what they had done, usually without responding. Like Dianne, he would like to see a larger network and share ideas with more people from his own discipline (Visual Arts). He also expanded on the Twitter literacy theme, claiming it took time to get to know people and their styles of communicating. He found himself reluctantly using SMS abbreviations to fit into Twitter's character limits. He thought the micro-blogging exercise could work better if Twitter was used more for asking questions or to 'put out' something provocative that could be critiqued.

This trial indicated that the simplicity and networking aspects of services like Twitter make micro-blogging an interesting but not necessarily effective professional m-learning activity during field-based experiences. A 'convenience dimension' becomes significant if a mobile device is used in the field experience to capture media and/or communicate via the network. However, despite these affordances, such activities need to articulate into forums (e.g. using blog or wiki-based platforms) with scope for more in-depth communications.

4.3 Learning in the Community

One of the most important aspects of this project is that it involved a community of learners. The community met on a regular basis to share their activities and to reflect on where these activities fitted in their theorising about mobile learning. Those members of the community who were already using mobile technologies in their teaching were happy to share their thoughts and activities with the group. The community started off with nine active members, who were physically located on different campuses of the university, some 18km apart. The majority of the community were located at a suburban campus, two members were at the city campus and two were part-time lecturers so were not based at either campus. The distance did prove to be a barrier in that the city participants tended not to attend the suburban meetings and, as a result, became more marginalised and consequently stopped attending the city meetings as well.

The group of five that were together on the suburban campus had all worked together on other projects and so were used to sharing and learning together. These five attended most or all of the meetings and indicated that they found the meetings to be really useful in a number of ways: they gained useful ideas about how to use m-technologies in their teaching; they learned about each other's practice with the devices; they acted as sounding boards for each other; and the meetings generated enthusiasm and interest in sustaining the project. There is little doubt that belonging to this learning community was a motivation and support for the m-learning that was taking place.

4.4 Obstacles and Barriers

Many of the usual barriers and obstacles that operate in developing e-learning environments occurred in this project. One problem was experienced early in the project. The one member of the community who was very familiar with all kinds of social networking technologies wanted the group to start a blog in which to share their experiences. Other members of the group were reluctant to expose their learning to a public audience and requested that the blog be confined to a internal university learning management system. In fact, the blog was hardly used at all by any member of the community.

Another obstacle was that the group did not have access to many tools for m-learning. The project funded the purchase of four iPod touches but these had limited use as they had no cameras. Three members of the group had iPhones and there was little doubt that having these devices encouraged them to explore uses more than others in the group. Time, as always, remained a critical factor, with a number of members of the group unable to achieve the goals they had set for themselves due to overwhelming workloads.

As noted above, a number of participants of the community became 'fringe' members. This marginalisation was due to a number of factors: geographical distance from the core group, lack of previous history of working with others in the group, and time problems. All of these experiences suggest that such barriers and obstacles need to be considered to promote better learning for the whole community.

5. CRITICAL FRIEND OBSERVATIONS AND DISCUSSION

It has been noted already that this project or initiative is part of on-going research reported at this stage of development to share findings with the wider m-learning community rather than definitive outcomes or results. Nonetheless, and given the obvious caveats outlined above, there are a number of valuable developments evident at this early stage which the wider community will benefit from reading, digesting and applying in their own contexts.

Firstly, it is illuminating to hear from a case study where a faculty wide project has been enacted to explore the phenomenon of m-learning through a broadly ethnographic methodology. Ranging from experts

through to mobile novices, the community of learners which has been created seeks to develop a deeper understanding of the m-learning phenomenon through actual participation themselves, both in a practical and academic sense. Often (too often some would argue) technology is treated as an isolated variable or factor without any deeper attempt to appreciate and gauge the subtle and complex interplay with other variables such as the people (agency) and contexts (structures) which play such a crucial part in the final mix. In this, the community of learners which has been formed is attempting to develop a more nuanced understanding of how a technology and the activities associated with it, play out through different structures (the faculty) with input and experiences from different members (agency), some using the device for very personal reasons (e.g. surfing the internet) and others using it as part of a wider professional development initiative. This matches the model or framework currently being explored by the London Learning Lab (Cook, Pachler, etc) who are also attempting to map the technology in a wider socio-cultural perspective and fashion.

Given its highly individualistic identity the mobile device, eptomised by the ubiquitous *personal* phone, might be seen to be the antithesis of the values, mores and principles which underpin a genuine community of learners. And so it could be seen as rather idiosyncratic that the faculty should enact this particular type of structure to investigate and study the ultimate symbol of postmodern individualism, the mobile device. But this interpretation would miss another feature of the m-learning phenomenon which resonates so well with the community of learners metaphor: collaborative co-construction of knowledge and understanding. Mobile learning has moved beyond the information access paradigm, enticing users to work as partners and collaborators in the co-construction of their collective wisdom and knowledge. Whether it be sharing the location of interesting landmarks or features via GPS, building a community photo-gallery with collective tags and annotations, or using voice enabled recording features to contribute to an oral folk archive, mobile learning is moving into a phase of development where the imperative for working alongside colleagues, even in physically remote locations, has never been greater or more realisable. Hence the opportunity for exploring what pedagogies are appropriate for this kind of learning from the perspective of a community of learners is entirely appropriate and very timely.

5.1 Recommendations for Further Investigation

For many students and learners the mobile phone has become the technology of choice, though they are unlikely to recognise it as technology in quite the same way it is discussed by academics and researchers. The device is likely to be instantly available should higher educators wish to utilise the potential learning opportunities which have been outlined above. And for the community of higher educators themselves there will be no shortage of opportunities to experiment with new ways of knowing and learning based around this technology. But in doing so the community are likely to face a number of challenges or opportunities (depending on one's point of view), which are briefly outlined as points for further discussion and consideration in the ongoing project:

1. How will the issues of student ownership of these devices interface with the existing university infrastructures which have traditionally exercised a largely paternalistic approach in terms of providing and supporting technology use? And what might be the issues of equity and access for students who are not able to supply their own technologies, or stay abreast of the latest developments and fashions in this fast moving arena (Traxler, 2009)?

2. As students begin to explore the potential value for learning with mobile technologies, particularly in collaboration with their peers, does this raise issues or concerns around the assessed elements of any work which might be produced through this process? Undertaking authentic learning tasks will undoubtedly become more of the norm as mobile devices move learning out of the classroom, but with this arises the issue of originality and the problematic nature of work that is completed cooperatively. If knowledge construction is seen to be emerging as the front runner in terms of the unique selling point of mobile devices (at least in terms of education) the thorny issues of assessing collaborative products will need to addressed and resolved.

3. Finally the tensions and issues arising from working as part of a community of learners will merit close attention. In the Mobagogy project faculty members have established the structural outlines to generate an embryonic community of practice. It will require considerable passion and commitment on the part of the members to sustain this initial enthusiasm. As Wenger (1998) notes, a community of practice is different from a community of interest in that it involves shared activity or practice. Activity is likely to be the key ingredient in determining the success of this exciting venture. As less experienced members of the group gain

greater understanding and awareness through their own use and experimentation with mobile devices we would expect to see a reciprocal exchange of ideas shared with students and this level of engagement by end-users will be an interesting barometer charting the effectiveness of the community itself.

6. CONCLUSION

The findings indicate that progress towards an enriched engagement with m-learning may be promoted by the establishment of a community of learners. The existing professional relationships facilitated community formation and enhanced the sense of commitment, shared responsibility and purpose. Nevertheless, the process has been more arduous and taken longer than anticipated. Each participant has progressed in his/her use of mobile devices for learning. Some have taken their first hesitant steps; others have tried sophisticated m-learning initiatives. As is typical of DBR it remains a work in progress. The current findings have informed plans for the expansion of the community with new members bringing experiences in m-learning applications as well as relevant expertise in software design and technological expertise. The larger team presents challenges for cohesiveness but it also offers opportunities for significant synergy.

REFERENCES

Alexander, S., 2006. Dissemination of innovations: A case study. Proceedings of the 23rd Annual Ascilite Conference: Who's learning? Whose technology?

Aubusson, P., Schuck, S and Burden, K., 2009. Mobile learning for teacher professional learning: benefits, obstacles and issues. ALT-J, 17(3), 233 — 247.

Bell, P., 2004. On the theoretical breadth of design-based research. Educational Psychologist, 39(4), 243 – 253.

Brown, A., 1992. Design Experiments: Theoretical and methodological challenges in creating complex interventions in classroom settings. The Journal of the Learning Sciences, 2(2), 141 – 178.

Bryman, A., 2004. Social research methods (2nd ed.). New York: Oxford University Press.

Design-Based Research Collective, 2003. Design-based research: An emerging paradigm for educational inquiry. Educational Researcher, 32(1): 5-8.

Ghaye, A. and Ghaye, K., 1998. Teaching and learning through critical reflective practice. London: David Fulton.

Hoadly, C. M., 2004. Methodological alignment in design-based research. Educational Psychologist, 39(4), 203 – 212.

Johnson, L., Levine, A., Smith, R., Smythe, T. and Stone, S., 2008. The 2008 Horizon Report: Australia – New Zealand edition. Austin, Texas: The New Media Consortium.

Naismith, L., Lonsdale, P., Vavoula, G. and Sharples, M., 2004. Report 11: Literature review of mobile technologies in Learning: Futurelab series. Retrieved July 2009 from http://www.futurelab.org.uk/research/lit_reviews.htm

NMC (The New Media Consortiuim) and Educause (2008). The Horizon Report – 2008 edition

O'Donnell, A. M., 2004. A commentary on design research. Educational Psychologist, 39(4), 255 – 260.

The Design-Based Research Collective. (2003). Educational Researcher, 32(1) 5 – 8.

Scornavacca, E., Huff, S. and Marshall, S. 2009. Mobile phones in the classroom: If you can't beat them, join them. Communications of the ACM, 52 (4).

Traxler, J., 2009. Students and mobile devices: choosing which dream. ALT-C Proceedings.

Watson, H and White, G., 2006. mLearning in Education – A Summary. education.au limited, 2006.

Wenger, E., 1998. Communities of practice: Learning meaning and identity. Cambridge: Cambridge University press.

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