

Balancing the possibilities for mobile technologies in higher education

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Abstract

In recent years universities have made significant investments in corporate technology systems to support various aspects of students' studies and learning. These include gateways and learning management systems, all of which work on the assumption of attracting or "pulling" students into the online environment of the university. On the other hand, students come increasingly equipped with mobile devices, most notably mobile phones, which allow quick and easy communication and information sharing. These devices are an emerging phenomenon of significance for online teaching and learning as they represent opportunities for technology solutions where students can be primed and supported in novel ways in their university education. The challenge is one of achieving a balanced and sustainable use of corporate systems designed to "pull" students into the learning environment, and mobile technology solutions which can push information out to students, so that each adds value to and complements the other. This paper examines how this balance might be achieved in the context of work being undertaken in one University with major commitments to e-learning.

Keywords

mobile technology, M-Learning, SMS, online learning communities

Introduction

As soon as universities think the dust is settling and their technology environments are stabilising, another raft of new technologies arrive with potential applications for online teaching and learning. The heavy investments made in technology and infrastructure supporting university online environments are premised on the need to draw students in for educational and administrative purposes. However, to be effective, these online environments need to be quite compelling in their value in order to motivate students to go to, and engage with, their contents. This engagement usually happens through a personal computer, which is normally located at the university campus or the student's work or home. Therefore, the value of any online environment is limited by how accessible it is to students and the level of student engagement, such that if students can't or don't access the online environment they potentially miss out on information critical to their learning experience. In contrast, the almost ubiquitous nature of mobile phones in the student population presents opportunities for universities to "push" information to students to a greater extent than previously possible. In this paper we examine how mobile technologies in general, and the mobile phone in particular, could be used to support and manage the ongoing implementation of e-learning in higher education.

We argue that mobile technologies cannot be ignored as part of the e-learning mix and their importance will only grow over time. They are a large part of the future of information and communication technologies in work and social life, and increasing numbers of students entering the university system own and use mobile technologies, particularly mobile phones. Students will work out for themselves ways of using these devices for their learning, and so it would seem that there are benefits to universities working with them in exploring possibilities for supporting students in their educational life. Moreover, we argue for the need to think carefully about the relationship between the corporate e-learning technologies designed to "pull" students into a learning environment, and the newer mobile technologies that can "push" information to students. The benefits of integrating these types of technologies to achieve balance of focus and action are examined in the context of challenges facing universities generally and opportunities with high potential for piloting of new mobile learning approaches. One University's exploration of possibilities, in association with external industry input, is considered. This paper elaborates on discussions from a forum convened in early 2005 to discuss possibilities for mobile technologies. Reflections from the forum are discussed and progress on the process to date and future directions are shared.

Trends in e-learning and student support systems in universities

Deakin University's online environment seems indicative of those of many other universities in Australian higher education. In the last 5 years substantial investments have been made in corporate-wide information communication technology (ICT) infrastructure, systems and applications to support all facets of the organisation's business. Along with major upgrading of university administrative systems at Deakin, the University has adopted gateways, portals, synchronous communication tools, streaming technologies and a plethora of specialist systems, e.g., learning management; digital object management; tutorial sign-up. All of these institution-wide technologies have been adopted and implemented through strong central, coordinated direction and strategic funding. The turn of the millennium saw a dramatic swing from more decentralised and local technology developments to centralised approaches. Over the past few years, the overriding agenda of action at Deakin has been shaped by those who saw great efficiencies in moving to a strong integrated and coordinated corporate level approach as well as providing all educational offerings within the one online teaching and learning system (Holt, Rice, Smissen, & Bowly, 2001). The consequence of this strategy is that presently the average Deakin student can now access what is, in effect, a "one-stop shop" through the Deakin website that provides information and services relevant to all aspects of the educational experience.

Despite the fact that these online environments have much to offer, it is still necessary to rely on students knowing that the information is available and how to access it online. As we discuss later, the average student now spends less time on campus and is increasingly involved in paid employment in addition to study commitments. This creates difficulties for "self-serve solutions" such as the typical university online environment. The increasing demand for rapid and easily accessible information has prompted both students and teachers to look for ways of value adding to the educational experience and one avenue they are currently experimenting with is mobile technologies. For example, a frequently asked question on Deakin's Information Technology Services (ITS) website is whether students can download lectures and listen to them on their home computers, iPods and mobile phones. At the present time there is no downloading available (although MP3 files are being made available on CDs for possible transfer to portal playback devices), but Deakin are hoping to launch a service in the near future to allow students to download lectures as MP3 files which can be played on portable devices. This is an example of students shaping and driving the technology agenda so that the University responds by implementing services that fit with how they prefer to use technology. With students pressing the University's ITS division to implement these sorts of simple, mobile solutions, a fresh challenge is emerging in balancing the value and integration of the big central corporate pull solutions with the small, mobile and local push solutions that are being sought at ground level.

Trends in the adoption and use of mobile technologies

Uptake of mobile phones in Australia has been strong and continues to grow. As at 30 June 2003, Telstra estimated that market penetration was approximately 72% (Telstra, 2005). The high level of mobile phone penetration in Australia makes these devices ideal targets for mobile learning applications. Presently students mainly make use of their mobile phones educationally to contact staff and fellow students. This is most usually via voice, but students also use short message service (SMS), although to a lesser extent (Cheung, 2004). Although voice makes up the bulk of carrier revenue in Australia, the prediction is that non-voice services such as SMS, multimedia messaging service (MMS) and mobile packet data services will show strong growth over the next few years (Chaisatien, 2004). Another trend identified by Chaisatien is the use of multiple-SIMs. If these predictions are accurate, then we could expect to see an increase in the use of mobile phones for transferring data, (e.g., sending pictures, video, files, etc., web browsing), and having mobile phone accounts for specific purposes.

This high penetration of mobile phones is evident on university campuses. Casual observation shows that the average university student has a mobile phone, while considerably fewer own a PDA (Personal Digital Assistant) or a laptop computer. Farmer (2003) observes that many of the students entering university now are younger than the microcomputer or personal computer. These students have grown up with computers, and technology has continued to evolve and enhance their lives. Technology has transformed how students interact with each other and their lecturers. Students can now communicate face to face, over the phone, and via email, SMS and online discussion areas. Zimitat (2004) reports that, at Griffith University, over the past few years the use of SMS messaging to contact students and staff has increased dramatically. This is attributed to the availability of mobile phones and the immediacy of contact compared with email. Many universities now use SMS to communicate with students about enrolment and exam results, which is only efficient and effective because of the high level of mobile phone ownership amongst this group. Although using mobile technologies in this way can support students in their studies, these low-end applications support administrative functions rather than teaching and learning.

In contrast, we believe that the value of m-Learning (i.e., using mobile technologies to support teaching and learning) lies in integrating mobile technologies with the current e-learning environments in which universities have made major investments. This in turn requires capitalising on the commonplace nature of these devices to promote communication, collaboration and learning. However, this can only be achieved by understanding and accepting the limitations of mobile technologies and making sensible decisions about how to use them. In this regard, the research and literature on e-learning will provide many valuable lessons and may help avoid repeating mistakes of the past.

Using mobile technologies to enhance learning in higher education

Whenever the topic of M-Learning is raised, so too are concerns about moving too heavily and too quickly down the mobile technology track. A number of members of our forum expressed concerns of this nature, with concerns about the use of mobile devices tending to fall into two categories. The first relates to compounding many of the problems created by the introduction of other technologies. These problems include the manageability of an ever-growing portfolio of e-learning technologies, the desirability of providing too wide a choice of ICTs to staff and students, the balance between productivity gains and losses in adopting mobile devices, the ever present degradation of genuine academic discourse and language under the assault of Chat/SMS language genres and the chasm that always needs to be jumped in taking any new technology into the mainstream. The second concern is that any mobile technology application should be appropriate for its purpose. In particular, where it is to be used to support teaching and learning activities, then it should not only be easy to use, readily available and accessible, but the application should adhere to educational principles.

Based on extensive research of the experiences of learning and teaching in higher education, Ramsden (2003) has identified six principles of effective tertiary teaching and learning. These are:

- Interest and explanation
- Concern and respect for students and their learning
- Appropriate assessment and feedback
- Clear goals and intellectual challenge
- Independence, control and engagement
- Learning from students.

These principles need to be kept in mind when evaluating the potential efficacy of mobile technologies for learning. Depending on the nature of the student cohort, we see educational benefits that could be created through judicious use of mobile technologies to:

- deliver multimedia materials designed specifically for mobile devices
- deliver interactive tasks, e.g., online quizzes
- add value and incentive to attend and actively participate in lectures
- allow students to browse what is available in the online environment
- break communication bottlenecks by communicating directly with students.

How these possibilities fit with contemporary practice and concerns at Deakin University is discussed next in the context of key challenges facing academic institutions. These challenges include how to draw students into the university environment and support them in their academic pursuits, delivering information to students in flexible and timely ways and preparing students for their future professional lives.

Creating a sense of academic community

Deakin University is a multi-campus university with a strong tradition of distance education. One compelling reason for adopting a learning management system was to provide an online environment that catered for the needs of both on- and off-campus students that could also be customised (for example by campus or enrolment mode) and individualised (for example with student-specific information about enrolment, timetables etc.). Deakin's learning management system is called Deakin Studies Online (DSO) and provides students with access to a range of resources including learning materials (such as unit study guides, lecture notes, PowerPoint presentations, and interactive learning activities) and communication tools (electronic announcements, discussion boards and chat rooms), as well as access to a gradebook and calendar tool.

DSO is linked to the university's student administration and information technology databases so that once a student is enrolled and has a valid username and password, access is granted to a range of resources available in unit websites in DSO.

Students log into DSO via the university's web portal, which provides another layer of customisation for the student in the form of information about campus events, news items, etc. Access to DSO and the portal is available from any Internet connected computer. However, at present students cannot access materials or information from DSO or the portal using mobile devices. Enabling access via a mobile device, such as a mobile phone or PDA, could potentially increase the level of use of DSO and the web portal by students by providing a convenient, "just in time" means of obtaining information. In this sense, providing accessibility to the online environment may help draw in students and in turn help them to become more involved and in touch with other students and the university community.

Keeping students informed, involved and up-to-date is critical. Involving them in the life of the university is important to create a sense of belonging and in supporting students during their studies. As is the case at many other universities, at Deakin, mobile technology is playing an increasingly important role in delivering administrative services within the institution, notably the provision of examination results via SMS. However, many academics, particularly those involved in teaching units run wholly online where all teaching happens online in the corporate learning management system (DSO), recognise that mobile technologies can be used more directly in support of teaching and learning. One view of this emphasises the role mobile devices could play in acting as a bridge between students and DSO. Such a link would allow students to be primed on key content and activities in DSO, including receipt to the mobile device of major DSO news and announcements. The 'bridging' role would allow important information from DSO to be pushed to the mobile device, to prompt or remind students of the need to access DSO for major online teaching and learning content and activities. Another view emphasises the role of mobile devices more centrally in supporting e-learning through delivery of resources in various media formats, and rapid communications between students, and between teaching staff and students.

Staff at the forum also saw immediate value in the rationalisation of the now multiple avenues of communication that students currently use to communicate with them and other students. The use of a number of different communication avenues by students is becoming an increasingly hot issue at Deakin (Holt, Barton & Barton 2004). Currently, they can communicate with staff face-to-face and on the phone, as well as through private email, voice-mail, SMS, and the internal messaging, chat and discussion board features of DSO. Some staff are not aware that all these communication channels are open, and sometimes fail to read and respond to messages delivered through certain avenues. This in turn can lead to confusion, frustration and time wasting being experienced by both staff and students. A uniform messaging system that integrates computer and mobile technologies, along with the direct use of such devices to push information out to encourage students to engage with DSO was strongly supported by staff attending our forum.

In relation to staff and student connection, Farmer (2003, p. 9) notes that, 'Immediate and constant (24 by 7) connectivity is essential if communication is to be truly useful within education'. Highlighting the importance of students learning from students, Zemsky and Massy (2004, p. 3) conclude that 'students do want to be connected, but principally to one another...'. Perhaps then it should be less of a concern if they are not connecting with their teachers, as long as there are facilitative technologies helping them to interact with each other. Using the technologies that students are already accustomed to using to provide emotional and social support in other areas of their lives would seem logical if the goal is to connect students to each other in their educational pursuits.

Garrison and Anderson (2003) stress the importance of communications technologies for enabling constructive transaction amongst parties in the educational process. If, as Garrison and Anderson argue, the transformative potential of e-learning lies in its powers to enable 'constructive communities of inquiry' then mobile technologies might play an important role in helping to develop online communities of students. Cultivating social presence online is critical in underpinning online teaching for cognitive presence and higher order cognitive outcomes. Social presence relates to participants being able to be their authentic selves emotionally and socially in online communicative spaces with indicators of strong social presence being the ability to express emotions, undertake risk-free expression and encouragement for collaboration (Garrison & Anderson, 2003). Mobile technologies, in conjunction with other communicative environments and tools, could play a major enabling role in helping to establish this all-important social presence at the beginning of the online learning experience. For example, messages sent to students on their mobile phones could welcome them and provide orientation to the learning environment, and its various requirements.

In addition to playing a role in establishing online communities, mobile technologies could be useful for off-campus students. As a distance education provider, the off-campus student cohort is a major area of focus and concern for Deakin. While much has been reported on the changing nature of study and work for on-campus school leaver students, we suspect that work demands have also intensified for many of our full-time employed, mature aged, off-campus students. The academics who attended our mobile learning forum commented that off-campus students often report that quality study time is difficult to schedule, with any study being squeezed in and around the demands of paid employment and personal/family commitments.

It seems likely, therefore, that off-campus students have smaller and less predictable parcels of time available due to growing work demands and changing expectations of acceptable engagement with family life. With this squeeze there is always the possibility of off-campus students becoming further alienated from their studies and disconnected from the University. This in turn can place their academic progress in jeopardy. To address the issue of time poverty, Deakin has attempted to put in place a fully integrated, coordinated and inclusive online environment, in the form of DSO and the web portal, to reasonably and fairly support student learning irrespective of mode of study, location and time constraints. Even with such efforts, the off-campus students can still be neglected, leading to feelings of disconnection from the learning community. High potential exists for the use of mobile devices to re-connect this student cohort, for example by delivering personalised audio materials such as audio-augmented feedback on assignments, and interactive exercises with feedback which can be done quickly in-between work and family commitments.

The nature of the on-campus student experience is also changing. McInnes, James and Hartley (2000) reported that increasing numbers of on-campus students are working longer part-time hours and therefore are spending less time on-campus with peers and teachers. In effect, there is an increasing disconnection between on-campus students, predominantly the school leaver group, with traditional face-to-face teaching and learning environments at various campus localities. This can be seen particularly at Deakin University's major Melbourne metropolitan campus where the majority of students live significant distances from the campus requiring extensive travel time. In these circumstances, there are disincentives to travel to the campuses daily unless it is possible to spend considerable time on-campus once there. Moreover, McInnis, James and McNaught (1995) have argued that first year students require greater support from the University and academics than in later years. Krause and Duchesne (2000) also stress the importance of social interactions on campus and their role in the first year experience, further highlighting the issues of recognition, belonging and connection. Thus, the needs of commencing students, who are negotiating the transition to university studies, have become a critical educational challenge for universities. Creating a sense of belonging and connectedness to a University academic community is difficult when students are spending less time participating in the physical environs of these communities, and, are increasingly involved in paid employment while carrying full study loads. Investment in institution-wide online environments (such as Deakin's DSO) is one means of enabling reconnection through virtual learning communities that are open and accessible to all of our student cohorts. To be successfully integrated and accepted, mobile technology solutions must be situated within a broader view of the constituent components of an institution-wide virtual community of learners. The focus must be on the ways in which mobile technologies can further open up access to the organisation's academic and administrative information sources and services, and to a range of parties involved in supporting student learning.

New types of mobile technology services could also be used to make attendance and participation on-campus more compelling. The establishment of more extensive wireless hotspots for the delivery of ongoing, breaking local news and information to mobile devices might enhance the liveliness of campus life. Mobile devices might also play a role in enlivening the lecture format by making it a more interactive and immersive learning environment. The first author has been involved in pilot work at LaTrobe University investigating the use of SMS voting in lectures. Preliminary findings indicate the value of providing students with opportunities to provide the lecturer with feedback on their understanding of the lecture material anonymously. Other trials of mobile devices include the use of SMS for providing connection and community for first year students (Hortsmanshof, 2004), SMS messaging for microeconomic experiments (Cheung 2004), mobile graphing (Kennedy, Vogel, & Xu 2004), using mobile phones and SMS for conducting primary research (Selanikio, Kemmer, Bovill, & Geisler, 2002), to facilitate language learning (Kiernan & Aizawa, 2004), and to enhance first year students' communication skills (Oliver & Barrett 2004). More generally, we see value in applications that allow lecture materials and discussion points to be created, delivered, augmented and shared by students in and around the lectures using mobile devices. As already noted, there is a rapid growth of SMS, while presently only a small smattering of Hotspots at Deakin University campuses. Although mobile phones are becoming increasingly sophisticated, the current reality is that most staff and students still have low-end mobile phones as their chief mobile device. The University's ITS Division therefore needs to support existing and emergent technology in order to achieve ubiquity of use within the University community.

Delivery of information to students

The current limitations in screen 'real estate' for most mobile devices is a critical constraining factor in delivering large amounts of text information originally designed for printed form. This is problematic for those staff steeped in the traditions of 'writing' study guides as part of traditional distance education. While screen size may change in time, to take advantage of mobile devices new ways of thinking about and presenting information will inevitably need to be considered.

For example, it may not be possible for students to simply download lecture notes or other material to their mobile phones and use them directly. Rather, if learning materials are to be used exclusively on a mobile device then the information most likely will need to be provided in an appropriate format, such as visually, in a layered or diagrammatic form or key messages presented aurally. Moreover, information and resources will need to be developed in ways which lend themselves to 'just-in-time' delivery in a range of media through various platforms and devices. This requires developing online materials assuming more than one delivery method and format, for example, for delivery via DSO and via a mobile device. Investments in digital object management systems and streaming technology that Deakin and other universities have made or are considering would facilitate this.

Rather than looking exclusively to adapting existing methods to mobile technologies, consideration of new possibilities is required. The increased importance of practical placements in undergraduate courses is one area where we see potential for using mobile technologies effectively for the transfer of information and learning resources. Off-site partners in the educational experience, such as industry mentors supporting students undertaking work placements, become another key external party that needs to be incorporated into the educational exchange. In these important contexts of learning, mobile technologies might play various enabling roles such as:

- providing a simple and accessible means for students to capture and send video images of key aspects of local fieldwork sites for immediate comment;
- prompting students on deadlines for required tasks as part of work placements, for example, completion of learning journals, portfolios, final presentations;
- facilitating timely and rapid feedback between academic teaching staff, industry mentors and students on work placement arrangements, experiences, problems, opportunities, etc.;
- notifying students of special events, media broadcasts etc which might be of relevance to work placement experiences.

In addition to actual workplace experience, virtual simulations are considered by many academics to be equally valuable for student learning (Challis, Holt, & Rice, 2005). Regardless of whether the experience is live or virtual, we see the possibilities of live interactions between campus and workplace, and the value of e-simulations being further enhanced through the use of mobile devices. In both real and virtual work experience, experiential learning requires the undertaking of professionally relevant work, and critical reflections on learning outcomes. The efficacy of using mobile phones to support practical workplace experience has already been established in the areas of teacher training practicum (Sepälä & Alamäki, 2003), and for medical education and practice (Smørdal & Gregory, 2003).

Preparing students for their professional lives

Universities have become increasingly concerned with developing in their students capacities, generally viewed as generic or transferable attributes, which will equip them to be competent entry-level practitioners in their chosen professional fields. This is seen in turn as enhancing graduates' employability. Along with this commitment has come greater emphasis on various forms of experiential learning, most notably the expansion of opportunities for students to undertake some type of community or work placement as an integral part of their undergraduate studies. The effective integration of work placements into the academic curriculum becomes a key means of bringing together academic knowledge/learning with practical knowledge/learning (Holt, Mackay, & Smith, 2004). This integration of the different domains of knowledge, knowing and learning can be seen as a hallmark of excellence in professional education and the design of contemporary learning environments.

The practicum or clinical placement has been a major component of many professional programs offered at Deakin University in the fields of education, the health sciences, (for example, nursing, social work), engineering and architecture and building. Additionally, an expanded range of opportunities has been provided in various arts' disciplines, business studies and IT/IS studies in recent times in response to institutional commitments to experiential learning. Moreover, many areas require fieldwork and studio activities to be undertaken in dispersed environments on different campuses, for example, performing arts and physical education. With academic teaching staff and students not in regular face-to-face contact for periods of time when students are undertaking off-site placements and excursions, or spread around campuses undertaking various practical tasks, issues emerge relating to the educational value of rapid, helpful communications and information exchange between parties.

Wholly online units taught at Deakin University are particularly aimed at developing key graduate skills in information technology and information literacy relevant to the discipline or professional field, and hence contributing to the lifelong learning capacity development.

Frاند (2000) hints at the possible role of the emergent mobile technologies in his observation that there is a need to recognise the information-age mindset of new generations of students entering universities and the implications this has for reconceiving educational relationship experiences in the context of lifelong learning:

We need to think in terms of transforming the educational experience so that it is meaningful to the information-age learner. ...When viewed from the perspective of a human network – a community of life-long learners – the educational infrastructure [read including mobile technologies] becomes a means for broadening and deepening the educational experience of students and for enhancing and extending the educational experience of alumni. Each of our current and past (and future?) students is a “node”. ...From this perspective, one goal of higher education needs to be to provide on-campus students with the tools, knowledge, and skills they need to continue to participate as members of our learning community long after they graduate. ...*Our institutions need to expand their primary focus from the internal, on-campus, temporal experience to include the external, global, lifelong experience* (p. 24, our emphasis added).

Increasingly, the meshing of various lifelong learning capacities must incorporate adaptability to different forms of ICT, including the emergent mobile devices. Deakin students are being challenged already through the provision of more limited amounts of printed material, and greater provision of learning resources on CD and/or in DSO in multiple media formats. Wholly online learning experiences represent a further dramatic leap into the online learning world, with the result that students can become even more confused as to what constitutes their learning environment, learning resources and learning modus operandi. “Where is it?” and “Where and when do I start?” are questions frequently asked by students commencing wholly online units at Deakin. Prompts, reminders and words of encouragement to the students’ mobiles might help orientate them to, and entice their involvement in, the University’s online teaching/learning environment, DSO. Moreover, it could be used to regularly and automatically prompt students who may not be spending the recommended amount of time online each week based on an assessment of student tracking data which can be generated in learning management systems such as DSO.

Another important development relates to the growing expectation of professional associations that their members will undertake a certain amount of continuing professional education (CPE) annually in order to maintain and enhance their professional competencies. Also, such CPE is required to maintain membership rights of the association. The delivery of CPE activities through e-learning and the use of portable handheld devices is an emergent possibility with all the attendant benefits of accessibility and flexibility. One Canadian example of this relates to a CPE e-learning opportunity provided to nurses using handheld devices, *Caring for a Diabetic Patient With Acute Coronary Syndrome*, (see Engage Interactive, 2005). In this case, the interactive courseware engine has been designed for maximum ease of use and simplicity. It is supported by Pocket Internet Explorer on any Pocket PC 2002 or Pocket PC 2003 enabled device that supports the Macromedia Flash 6 Player. If this example is indicative of the way of the future, then lifelong learning capacities may require aptitude in using mobile technologies to engage with CPE in a timely and relevant fashion. In addition to structured forms of off-the-job CPE, will be the ongoing in- and around-the-job forms of informal and incidental professional learning again likely to be increasingly supported by the use of both e-learning and mobile technologies.

Finally, ICT is increasingly taking curriculum centre stage in many professionally and vocationally oriented courses in higher education. In some units information technology is a key area where students have to demonstrate mastery, while in others it is the subject of discussion and critical scrutiny (for example courses on professional ethics and information technology). ICT is shaping and being shaped in various professional domains and, consequently, ICT capacities are increasingly being required to excel professionally in these domains. An immediate opportunity for exploration of mobile technology possibilities as ‘curriculum content’ is in the context of business information systems. At Deakin there are units that lend themselves to experimentation using mobile devices, such as the wholly online undergraduate unit on information systems networking and a unit on mobile business that is part of an undergraduate e-commerce major. In both units there is the opportunity to use technology in support of experiential learning about the technology. Moreover, it is recognised that in understanding the impact of mobile technology on different commercial business models, this could shed further light on possibilities relating to the business of education.

Conclusion

While many of the possibilities raised here appear to be of value, caution and planning are necessary in order to avoid some of the pitfalls experienced when e-learning first arrived on the education scene. Accordingly, the course of action that the academics who attended our mobile learning forum advocated was to trial the use of mobile phones in three key contexts. The first opportunity identified by the participants in the forum relates to the development of a new wholly online undergraduate unit in Information Technology Practice and the trialling of mobile phones in the context of this unit in 2006.

The development of this unit coincides well with the consideration of mobile options and hence the trial could be embedded within the development of the unit curriculum, pedagogy, online resources (which in this case involves working in a virtual organisation) and assessment approaches. The second opportunity for a trial involves the use of the high-end features of mobile phones, such as web browsing and video capture, by students enrolled in a mobile business module relating to an undergraduate e-commerce unit. The trial would involve the use of the technology in both learning about the module and its subject matter relating to the impact of mobile technologies on emerging business models. The third proposed trial relates to the use of the low-end features of mobile phones, such as SMS, in supporting students' learning experiences in a postgraduate e-commerce unit dealing with ethical and legal issues. The unit will trial the use of instant polling type approaches in determining learners' views on issues raised in the unit. The three projects capture a range of issues related to the use of mobile devices to support teaching and learning.

It seems that the world of e-learning in higher education is in flux and transformation. New e-learning technologies are emerging, including the use of mobile devices in support of the educational process. The constant challenge is to integrate the possibilities of the emergent with ongoing commitments to the established corporate technologies. We have framed discussion of this issue in relation to the integration of pull and push e-learning technologies. In this regard, we are only at the beginning of an exploration of what the major new benefits to be gained from integrating mobile technologies might be, and how they could be realised on a sustainable basis.

References

- Chaisatien, W. (2004). Australian cellular 2004–2008 forecast and analysis: Upwardly mobile. *IDC Market Analysis*, #AU202116L, Vol. 1.
- Challis, D., Holt, D. M., & Rice, M. (2005). Staff perceptions of the role of technology in experiential learning: A case study from an Australian university. *Australasian Journal of Educational Technology* (AJET), 21(1), 19–39. Retrieved from <http://www.ascilite.org.au/ajet/ajet.html>
- Cheung, S. L. (2004). Fun and games with mobile phones: SMS messaging in microeconomics experiments. In R. Atkinson, C. McBeath, D. Jonas-Dwyer, & R. Phillips (Eds.), *Beyond the comfort zone: Proceedings of the 21st annual conference of the Australasian Society for Computers in Learning in Tertiary Education*, Perth, pp. 180–183.
- Engage Interactive. (2005). *Caring for a diabetic patient with acute coronary syndrome*. Retrieved June 22, 2005, from http://www.engageinteractive.com/handheld/index_large.html
- Farmer, R. (2003). Instant messaging — collaborative tool or educator's nightmare! Retrieved March 24, 2005, from <http://naweb.unb.ca/proceedings/2003/PaperFarmer.html>
- Garrison, D. R., & Anderson, T. (2003). *E-learning in the 21st century: A framework for research and practice*. London: RoutledgeFalmer.
- Frاند, J. L. (2000, September/October). The information-age mindset: Changes in students and implications for higher education. *EDUCAUSE Review*, 15–24.
- Holt, D. M., Barton, G., & Barton, S. M. (2004). From the comforts of print to the possibilities of digital media: Leading the way in teaching political leadership in a faculty of Arts. In R. Atkinson, C. McBeath, D. Jonas-Dwyer, & R. Phillips (Eds.), *Beyond the comfort zone: Proceedings of the 21st annual conference of the Australasian Society for Computers in Learning in Tertiary Education*, Perth, pp. 403–412.
- Holt, D. M., Mackay, D., & Smith, R. (2004). Developing professional expertise in the knowledge economy: Integrating industry-based learning with the academic curriculum in the field of information technology. *Asia-Pacific Journal of Cooperative Education*, 5(2), 1–8.
- Holt, D. M., Rice, M., Smissen, I., & Bowly, J. (2001). Towards institution-wide online teaching and learning systems: Trends, drivers and issues. In G. Kennedy, M. Keppell, C. McNaught, & T. Petrovic, (Eds.), *Meeting at the crossroads: Proceedings of the 18th annual ascilite conference* (pp. 271–280). Melbourne: University of Melbourne.
- Hortsmanshof, L. (2004). Using SMS as a way of providing connection and community for first year students. In R. Atkinson, C. McBeath, D. Jonas-Dwyer, & R. Phillips (Eds.), *Beyond the comfort zone: Proceedings of the 21st annual conference of the Australasian Society for Computers in Learning in Tertiary Education*, Perth, pp. 423–427.

- Kennedy, D. M., Vogel, D. R., & Xu, T. (2004). Increased opportunities for learning: Mobile graphing. In R. Atkinson, C. McBeath, D. Jonas-Dwyer, & R. Phillips (Eds.), *Beyond the comfort zone: Proceedings of the 21st annual conference of the Australasian Society for Computers in Learning in Tertiary Education*, Perth, pp. 493–502.
- Kiernan, P. J., & Aizawa, K. (2004). Cell phones in task based learning: Are cell phones useful language learning tools? *ReCALL*, 16(1), 71–84.
- Krause, K-L., & Duchesne, S. (2000). *With a little help from my friends: Social interactions on campus and their role in the first year experience*. Sydney: School of Education, Macquarie University. Retrieved March 24, 2005, from <http://www.qut.edu.au/talss/fye/papers/KrausePaper.doc>
- McInnis, C., James, R., & Hartley, R. (2000). *Trends in the first year experience in Australian universities*. Canberra: Australian Government Publishing Service.
- McInnis, C., & James, R., with McNaught, C. (1995). *First year on campus: Diversity in the initial experiences of Australian undergraduates*. Commissioned project of the Committee for the Advancement of University Teaching, The University of Melbourne, Centre for the Study of Higher Education.
- Oliver, B., & Barrett, C. (2004). Comfort + ubiquity = adoption: Enhancing first year students' communication skills with handheld computers. In R. Atkinson, C. McBeath, D. Jonas-Dwyer, & R. Phillips (Eds.), *Beyond the comfort zone: Proceedings of the 21st annual conference of the Australasian Society for Computers in Learning in Tertiary Education*, Perth, pp. 709–712.
- Ramsden, P. (2003). *Learning to teach in higher education*. London: RoutledgeFalmer.
- Selanikio, J. D., Kemmer, T. M., Bovill, M., & Geisler, K. (2002). Mobile computing in the humanitarian assistance setting: An introduction and some first steps. *Journal of Medical Systems*, 26(2), 113–125.
- Sepälä, P., & Alamäki, H. (2003). Mobile learning in teacher training. *Journal of Computer Assisted Learning*, 19, 330–335.
- Smørdal, O., & Gregory, J. (2003). Personal digital assistants in medical education and practice. *Journal of Computer Assisted Learning*, 19, 320–329.
- Telstra Corporation Limited. (2005). Facts sheets — mobile goods and services. Retrieved July 19, 2005, from <http://www.telstra.com.au/abouttelstra/corp/mobiles.cfm>
- Zemsky, R., & Massy, W. F. (2004). *Thwarted innovation: What happened to e-learning and why*. A final report for The Weatherstation Project of The Learning Alliance at the University of Pennsylvania, in cooperation with the Thomson Corporation, The Learning Alliance at the University of Pennsylvania.
- Zimitat, C. (2004). Changing student use and perceptions of learning technologies, 2002–2004. In R. Atkinson, C. McBeath, D. Jonas-Dwyer, & R. Phillips (Eds.), *Beyond the comfort zone: Proceedings of the 21st annual conference of the Australasian Society for Computers in Learning in Tertiary Education*, Perth, pp. 984–993.

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