Using mobile technologies to support learning in large on campus university classes

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The delivery of courses and units through large classes in on-campus settings is an economic necessity for many higher education institutions, particularly within their undergraduate programs. Lecture presentations to cohorts of over 200 students are common in most universities. Such settings can present challenges for both learners and teachers. It is now apparent that mobile and wireless technologies can provide opportunities for participation, engagement and active learning within these settings. These technologies enable teachers to cater for a range of abilities, interests and learning styles. This paper describes activities in an Australian university setting where mobile technologies have been used successfully to support learning in large class on-campus settings.

Keywords: university, large-classes, mobile-learning, technology, higher education

Large classes in university settings

Large classes are common entities in contemporary universities for many reasons. With the massification of university education, there are now many more students enrolled than was previously the case. At the same time universities are expected to do more with less so there is a need to use economical and efficient delivery processes in the delivery of courses and units. Whilst large classes are very common in universities, there are many problems and issues that arise as a consequence (McInnes & Devlin, 2002; Stanley & Porter, 2002).

Learning in a large class can be a difficult experience for many learners. Large classes can pose problems for learners that include such difficulties as a lack of individual attention, learning activities that lack interactivity and engagement, problems with access to learning resources and difficulties with learning support and assistance (Chalmers, 2003). In large classes, teachers are often constrained by the need to design and deliver a course that seeks to serve the need and interests of a diverse range of learners. The delivery of a structured program of learning across such a large number of students with individual needs can create difficulties for many learners (Carbone, 1998).

In many universities, the preponderance of large classes exist in the early years of academic programs where the student numbers tend to be greatest. First year programs are prime candidates for large class settings. This can add to the problems faced by the teachers and students. For example, students entering university come from a variety of backgrounds and it is no longer the case that the majority of students in university classes will be school leavers. It is now common in Australian universities, for example, for the majority of students entering university for the first time to be other than school-leavers (Oliver, 2006).

The variation in entry pathways often leads to a diversity in background, and it is a difficult process for institutions to plan courses that can adequately cater for the learning needs of all students and cohorts. Teachers have always been confronted by individual differences among their students and have actively sought ways to redress the issues (Medici & Montgomerie, 2001). The individual differences that are often confronted among students in large university classes include differences in prior learning experiences and background knowledge and preferred learning styles. As well differences can exist in students' levels of learner metacognitive skills and learning independence; and motivation and enthusiasm for learning. (Hong & Kinshuk, 2004).

There are a variety of strategies that teachers can employ to cater for diversity in a student group without necessarily creating distinct classes. Among possible actions is the provision of a curriculum that is student-centred and enables students to make choices and decisions in the learning activities they undertake. Such student-centred curricula can come in many forms, for example, problem-based learning, project-based learning, online learning or combinations of all of these. (Sluijsmans, Moerkerke, Dochy & van Merrienboer, 2002). In such settings, students are able to undertake projects that can be attempted within their own limits and capabilities and as a result are seen as potentially more able to cater for their

individual needs. Elsewhere students are removed from their normal classes to attend classes designed to meet their special needs, for example, special programs for students with learning needs and for those deemed gifted and talented. (Siegle, 2005).

At the same time, in large classes, teachers are often reluctant to employ such measures across whole cohorts (e.g. Jonassen. 2000). Studies of problem-based learning in university classes have demonstrated the need for participating students to be able to manage their own learning, and to have developing levels of metacognition (Oliver, 2001), skills that are often underdeveloped in students in their early years of tertiary studies. As a consequence, teachers often restrict the use of student-centred approaches with problem-solving requirements for more senior cohorts, and those that are smaller and more manageable.

Writers often identify a range of areas where teachers can act to promote learning in large classes. Strategies are frequently suggested in relation to course design, planning and assessment, establishing learning communities, promoting active and collaborative learning, and using learning technologies (Stanley & Porter, 2002). With recent developments in technology use in education, there is now growing opportunity for teachers to seek to use this as a means to cater more successfully for learners in large class settings.

Technology-facilitated learning

Technology is often proposed as a potential solution for catering with individual differences in educational settings particularly in instances where large classes are involved (Laurillard, 1993). Technology provides many affordances that can be used to provide meaningful learning settings for learners and to provide appropriate learning supports. Many universities today employ large scale technology supports for their teaching programs and use these to cater for the needs of individual learners (Collis & Moonen, 2001). But despite these systems, we still often see a curriculum where “one size fits all” and students end up studying the same course despite significant differences in their backgrounds and needs (Bonk & Cunningham, 1998).

There are a raft of Web-based supports that have been shown to provide opportunities for supporting student-centred learning modes (Dabbagh & Kitsantas, 2005). Web-based tools exist that provide communications capabilities and interactivity that can extend teaching and learning strategies and opportunities beyond those achievable through conventional means. These include collaboration and exchange tools, and content and creation tools. The capacity of such tools to cater for the learning needs of advanced students comes from their ability to scaffold learner-centred individual and group-based learning. These tools can provide strong scaffolds in instances when students are able to take the initiative for their own learning in project-based and inquiry-based settings. In such cases, the technology provides supports for students to be monitored in their activity, to have various scaffolds provided to guide and inform their learning (Collis & Moonen, 2001).

As well as software and systems, contemporary technologies now provide teachers and learners with a range of powerful mobile communications devices for learning, including portable digital assistants and laptops with seamless wireless Internet and network connectivity. Many projects have reported the success of such mobile devices being used to support teaching and learning across all sectors of education (Kennedy, 2003; Hill, Reeves, Grant, Hang & Wan, 2003). In many settings, mobile laptops have been shown to provide enhancements for student-centred learning in the form of scaffolding and support and access to a rich information and content base (Hill et al., 2003).

Mobile learning in large classes

Mobile learning distinguishes itself from conventional forms of e-learning through its use of movable rather than fixed devices. There is a growing number of devices that can be used for mobile learning and these include telephones, mp3 players, wireless enabled laptops and personal digital assistants. With increasing ownership of these devices, there comes increased opportunities for their use in learning settings. Mobile learning transcends the divide between formal and informal learning and creates opportunities that make the best of both worlds. In various learning settings, mobile learning devices provide opportunities to enhance learning opportunities because they represent technologies that students can bring with them and that would not normally be present in the classroom context. Mobile technologies enable students to participate in learning activities using private or shared learning tools that might not normally be available (Alexander, 2004).

In large class settings such a lectures, there can be many hundreds of students and teachers have traditionally only able to assume that learners might bring with them to class pen and papers and books. Increasingly teachers are looking in large lecture settings to discover strategies provide more opportunities for engagement and interaction (Chalmers, 2003). There is usually little opportunity for interactions because with so many students, only a very small number might ever be able to interact. The physical size of many lecture theatres often means that even if students were able to interact, they could not be heard or seen by the teacher or others in the class. With mobile technologies using wireless communications channels and receivers, the capacity to communicate and interact is greatly enhanced.

In a typical large class settings in universities worldwide, student ownership of mobile devices is increasing rapidly and it is likely that in any cohort of several hundred students, the level of technology ownership (and access) will run to several hundred mobile phones, a lesser number of mobile music devices, for example mp3 players, and a significant number of wireless enabled laptop computers. As these devices become more and more standard equipment for university students, teachers gain many teaching and learning opportunities that make use of them.

Examples of mobile learning in large university classes

Edith Cowan University in Western Australia has been using learning technologies in its learning programs for many years and has an extensive infrastructure for facilitating technology-supported learning. The University has an extensive wireless network providing all students with ready access to the University network and the Internet. Most teachers use technology in the delivery of their units and courses both as an administrative aid and to provide enhanced learning opportunities. In recent years, we have been exploring the use of various forms of technology to support learning in large classes and many of these activities shave involved mobile learning technologies. The following examples showcase typical applications of mobile learning within the University and discuss the learning opportunities and enhancements that have been achieved.

Mobile learning enhancing interactivity in large classes

Audience response systems, also known as electronic voting systems (Draper, Cargill & Cutts, 2002), use small handheld devices to enable students to interact with computer-based activities. The technology involves portable clickers that interact through wireless or infrared to a receiver attached to the teacher's computer. Students typically respond to questions and activities posed for class discussion and through their interactions provide responses that can be viewed instantly and used to prompt discussion and comment (Draper & Brown, 2004; Simpson & Oliver, 2007). Audience response systems typically connect to such software as PowerPoint and the responses of the students eg. responses to multiple choice questions, show instantly though an overhead display.

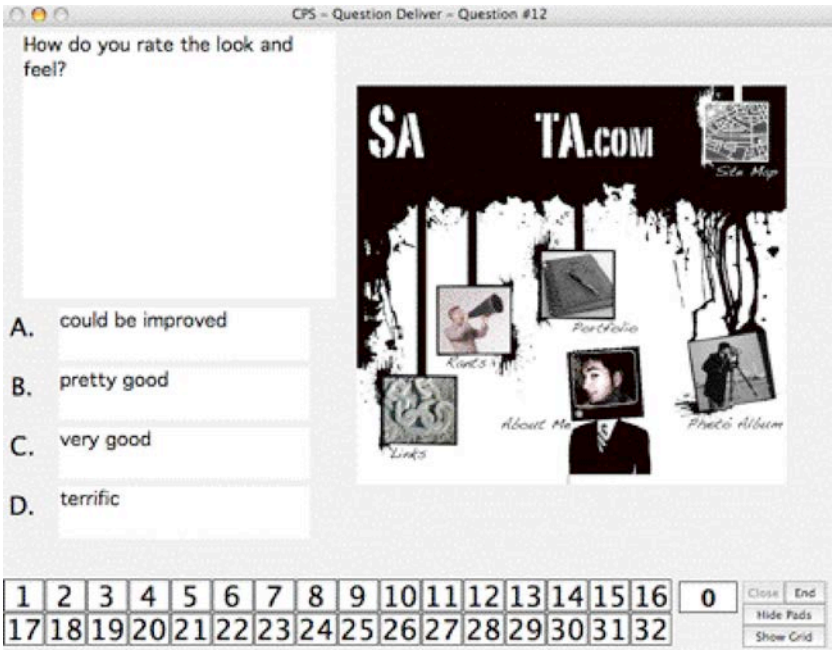

Figure 1: An interactive activity using an audience response system in a large class

Figure 1 shows a typical audience response activity. The teacher displays a question or prompt using an overhead system with a series of options provided for students' responses. As the students respond using the clickers, the number of responses displays and the actual response is recorded. At any stage the teacher can display the aggregated responses for the class to view and for the teacher to discuss and reflect upon.

There is a wide range of audience response systems on the market. Several book publishers provide interactive materials that employ audience responses with their textbook resource sets and bundle the clickers with the textbooks at a small additional cost, in the vicinity of $A10 (eg. Pearson Education Australia, 2005). Students in groups are able to use the handheld clickers to respond to questions and problems posed on the large screen. The individual responses are received through a receiver and recorded on my computer and can then be displayed for all to see and discuss.

Audience response systems can be used to support a variety of contexts for engagement and reflection in large classes. In instances where students have their own clickers, the activity can involve all students. In instances where a teacher may have a set of clickers, they can be distributed among groups to enable group responses. Audience response systems provide many useful learning opportunities in a large class. Their use can prompt learner engagement and attention. The activities themselves can be used to stimulate analysis and reflection, and the systems support interactions between learners and teachers that are typically very difficult to achieve in large class setting.

Audience response system applications

Audience response systems have been used at Edith Cowan University in large classes for several years. In the large first year unit, Communications and Digital Technology, use of the system provides many learning opportunities. In lecture settings where the presentation of concepts and ideas is through teacher presentation, the audience response system provides the means to create interactive sessions. Questions are displayed requiring student feedback. Groups of students use a single clicker to discuss and respond. The teacher presentation can then take into consideration the responses and high degrees of interactivity are achieved.

Figure 2: A Web-based audience response activity

Less common, but equally useful, are Web-based forms of audience response systems that use wireless enabled computers and links to the Web. In such systems, the teacher displays a Web page that presents a question or activity requiring audience response. Students in a large lecture setting use their wireless enabled laptops to respond and when the teacher refreshes the screen, the student responses show. Figure 2 shows an activity using a Web-based system and wireless laptops from a large lecture setting in a first

year unit where students were asked to reflect on the visual design elements of 5 logos. The audience response shows that one logo is seen as more effective than others and the students' responses provide a fertile setting for analysis and discussion. The Logo Design activity shown in Figure 2 used such slides and involved students with wireless enabled laptops. The activity created several learning opportunities for the large class in that it was used through the enhanced engagement it generated and the analysis and discussion that it facilitated as the differing responses of the students were noted and explored.

Web-based audience responses systems offer several advantages over the clicker systems. Whilst clickers tend to require synchronous interactions, Web-based activities can support asynchronous interactivity and can have a life beyond the immediate classroom setting enabling students who may not have attended the class to participate at a later time. This aspect can provide the flexibility to provide supports for large remote classes as well as large classes in a face-to-face mode.

Mobile technologies extending student learning in large classes

Another example where we have explored the use of mobile learning for students in large classes was in The Extension Project (Oliver, 2006). This activity was conducted in a large first year undergraduate class studying a unit in communications and digital technology. This first year unit aimed to develop students' skills in visual design and communication. The unit centred around learning to use various productivity tools, ie. a word processor, a presentation tool and a tool for building Web pages. With these tools students were required to demonstrate an ability to apply visual design elements and principles in the design and development of documents and pages. The conventional course was delivered around a series of topics that students completed on a weekly basis.

The Extension Project was designed as an alternative and independent learning activity for the more advanced students in the cohort. The project required selected students to explore and develop a Visual Design Guide for Dummies, in a setting of their choice. Among the range of suggested settings were landscape gardening, interior design, fashion and graphic design. Whilst the project was planned to be independent, some scaffolding and support was built in. Across a 6 week period, the students were required to choose a topic and to share their ideas virtually with other members of the Extension Project. Students followed a weekly schedule involving: research and exploration of their topic; investigation of contemporary practice; the development of some guiding design principles in generic and then in contextual forms, and finally the development of the Dummies booklet. A series of bulletin boards were to be used to enable students to post their work and it was a requirement that Project members also reviewed the work of other members and provided brief peer feedback in the form of public online postings.

Students in the Extension Project were provided with a wireless enabled laptop and digital camera. The students worked outside the conventional laboratories and the mobile device provided them with access to the technology and software they needed to complete the requirements of the project. The wireless enabled laptop provided them with access to the university network and facilities and enabled them to develop their project whilst communicating and sharing their ideas and products with other group members.

Outcomes from the extension project

A number of indicators were used to gauge the success of the project as a means to provide a meaningful and alternative learning setting for the advanced students in a large class. This included an evaluation of the work submitted by the participants and students' responses in questionnaires seeking feedback describing their actions and perceptions of learning outcomes. The Extension Project showed itself to have been very successful in terms of providing a meaningful and effective alternative learning environment for the advanced students in the class. The participants all indicated that they enjoyed the project, and would consider volunteering again if given the chance. In terms of the learning outcomes, the Visual Design books that were produced were of a very high quality both in terms of the topics researched and the presentation of the material. Whilst there were varying levels of higher-order thinking demonstrated by the students in the development of their booklets, the students were all judged to have completed a successful inquiry and able to demonstrate well-developed visual design skills and understanding.

In relation to the factors that were seen to influence the learning outcomes, the inquiry revealed strong drivers for success were the authentic nature of the inquiry and the tasks, the mobile technology and supports used to scaffold and guide student activity, and structured timeframe and schedule. The inquiry

demonstrated strong learning supports being provided by the online posting and feedback elements of the course and the encouragement and motivation it provided all students to fully participate in these activities. It was apparent that some students would have benefited from more assistance in the choice and refinement of their topic. There appeared overall a need for students to be a little more focussed in their inquiry and this needed to be made more specific in the directions. Whilst the structured schedule was tight and students would have appreciated more time, the tight timeframe was not seen to limit the learning.

In terms of return on investment of the instructor's time, the small number of participants who volunteered for the project was a limiting factor. It is not readily apparent how more students might be encouraged to participate in such a project. Such a project does have a higher workload overhead for students but is likely be more beneficial in terms of learning quantity and quality than the mainstream program designed to cater broadly for a very large cohort. Whilst such a setting can provide increased learning opportunities, students must consider these against practical factors including time commitments, the need for flexibility and convenience, and for many workload versus grades achieved. The mainstream class may have made it easier for the advanced students to achieve higher grades with less work.

The overall outcomes from the Extension Project demonstrated that advanced students in large cohorts can gain considerably from being able to undertake self-directed independent projects in pace of structured class activities. The project demonstrated the value of mobile technologies as supports for such activities in terms of providing not only the tools for undertaking the tasks, but strong learning supports to enable the activities to be monitored by the teacher, to facilitate collaboration and interaction between the students as motivators and encouragements for learning activity and success.

Mobile technologies scaffolding and supporting learning in large classes

In many large classes especially those at first year level, there are often students who could reasonably be considered at risk as a consequence of their background, limited pre-requisite knowledge, time away from study and poorly developed skills for monitoring and managing their own learning. In a recent project, we explored the use of mobile technologies as supports for these students and investigated how such technologies and appropriate support might be used to assist the students in their studies and encourage and maintain their enthusiasm in a large class setting in the first units of their university course.

Students in a large first year class studying communications and digital technology, were invited to nominate for inclusion in a support project that would see them provided with a wireless enabled laptop and being given an extra workshop each week to develop their ICT skills and expertise. The Support Project was designed for those students with minimal ICT skills and experience and who would like to receive extra instruction and activity. Students self-nominated and indicated why they wanted to join the Project. Twenty five students chose to participate in the semester long project.

The students attended an extra workshop session during which time they were given instruction in how to use the wireless enabled laptop and how to use the productivity software it contained eg. Word, PowerPoint, Excel. Photoshop. The students were asked to maintain a weekly blog to record their experiences and perceptions as they undertook the unit and also completed questionnaires before and after the Project to enable us to gather some insights into changes in attitude and perception concerning learning in university settings.

Outcomes from the support project

There were many outcomes to report on from the Support Project. Of the twenty five students who commenced, five students ultimately dropped out along the way and returned their laptops before the project had formally finished. The remaining twenty made varying levels of use of the opportunities but all were very appreciative of the technology they had been loaned for the semester. The extra weekly workshops were regularly attended by over 80% of the group and much of the time in the initial sessions was spent helping the students to make the most use of their laptops. The majority of the students needed help to use the Internet and wireless connectivity but soon developed high degrees of self-sufficiency.

The students all started off keeping their online blogs but after a few weeks, the levels of posting dropped off as the students started to see the laptops as integral parts of their learning tools and not as additional and special devices worthy of extra interest. The majority of the students used their computers for many purposes other than their university work and they installed music, email and instant messaging software and made extensive use of these facilities.

Feedback revealed several elements attributable to the mobile learning devices as being seen as significant contributors to their progress and achievement. These included:

- Being able to take the laptops to classes and to enter their notes and information directly;
- being able to continue working on tasks commenced in various locations in other settings eg. carrying over work from university to home, taking work from home to the library etc.
- having access to the Internet at all times. The University wireless network enabled the students to access the Internet and email etc. from any location eg. coffee shop, classrooms, gardens.

One of the more promising outcomes from the project was the students' perceptions of the value of technology as a support for their learning. Many expressed disappointment when the laptops had to be returned and indicated that they would be actively seeking to purchase a machine of their own so that the opportunities they had developed in the project would be retained for future classes. The outcomes provide strong support for our expectation and intentions concerning the value of mobile technology for supporting the learning of these special members of the large class setting. The targeted use of the mobile technology among students with special needs appeared to provide the context for the strong outcomes often not found in other studies where the technology is applied to all learners (eg. Newhouse, Williams & Pearson, 2006).

Mobile technologies and lecture delivery on large classes

Large classes often use lectures as a means for organising and presenting course material and content. The lecture also provides a mean to organise and administer the learning setting. But for many students, the lecture is an inflexible and inconvenient learning strategy for several reasons. Some students can find the lecture time inconvenient. The lecture itself can be very constraining in terms of what is presented and how it is presented and important points can be missed by students due to inattention and distraction. Lectures are dynamic events, and students who miss lectures can never really be sure what important information they may have missed.

It is quite common in large classes for lectures to be videotaped and stored on unit Websites to enable students to access the lectures after they have been delivered. Students have been found to appreciate this use of technology because it enables them to view lectures they may have been unable to attend and to revisit lectures as part of their examination preparation. Recently we have been experimenting with other mobile technologies in the form of podcasts and vodcasts as alternative strategies for lecture delivery. Podcasting describes a technology where the lecture sound track is recorded and stored as an mp3 file that students can playback on their mobile music devices. Using mp3 players to listen to lectures provides students with the capacity to attend lectures in their own time and in their own place, such as driving to work and on public transport.

Figure 3: A vodcast of a lecture being accessed on a portable mp3 player

Another more powerful form of this technology is vodcasting, where the movies can be accessed in a similar fashion. The vodcast adds a visual element to the sound track and enables students to view the PowerPoint slides, or even a video of the teacher presenting, as they listen to the lecture presentation. Students have demonstrated very strong support for these digital resources and have been very positive about the enhanced flexibility and learning opportunities they provide. Our experiments suggest that we should look to deliver these resources in formats compatible to mp3 players as more and more students take ownership of these mobile devices (Luca &Oliver, 2007).

The use of podcasts and vodcasts offers many learning opportunities as a delivery strategy in large classes. In the first instance the technologies provide the forms of flexible delivery that are often needed by the diversity of the large class cohort. They provide choices for many students that can overcome some of the problems and inflexibilities usually associated with delivering lectures to large classes. As well as this, there are many potential learning enhancements. Podcasts and vodcasts are often better recorded by lecturers in their offices and away from the actual lecture setting. A raft of technologies can be used to achieve this which will often see a much better recording than is possible in the real life lecture. When students all start to access lectures ahead of the presentation, lecturers will be able to spend the actual presentation session in more engaging ways other than content presentation. It is likely that increased use of podcasts and vodcasts will lead to considerable improvements in the ways lectures are used as teaching and learning strategies. In large classes, teachers are encouraged to experiment with such technologies because there is so much potential return on their time investment. So many students seek to gain from this work.

Discussion

The range of different mobile technologies available today for use in large classes, and the varying needs of teachers across disciplines, can make it difficult to choose appropriate applications for classrooms and students. Among the many different applications of mobile learning technologies, there are always consistent elements by which the suitability and merit of potential of applications can be judged. Five dimensions by which the efficacy and utility of mobile learning applications can be judged and compared are:

- *accessibility*; a measure of the extent to which the application is readily accessed by learners. A mobile application with high accessibility can typically be undertaken by the entire body of students with whom it is used. A low accessibility represents an application where many students would typically not be expected to be engaged. This would usually come as a consequence of a lack of access to the technology being used.
- *learning level;* This dimension recognises the levels of engagement and higher-order thinking a mobile application can support. Well designed applications that make meaningful use of the mobile technology will usually involve high levels of interactivity and engagement.
- *reusability*; As with any strong learning idea and application, an important measure of its efficacy and utility is its ability to be used in alternative settings and by other teachers. Strong applications are reusable and adaptable and maintain their learning potential in many learning settings.
- *individual support*: Strong mobile learning applications provide strong supports for individual learners. The applications enable the diverse range of learners to benefit from the experience in ways that reflect their individual needs. Some applications will be less able to provide different forms of support and as such may be less effective for different cohorts within a class.
- *scalability*: With more and more students accessing mobile technologies, teachers need to be able to develop learning applications that work equally well for small numbers of participants as well as large numbers of participants. Mobile learning applications that require access to special technologies will have lower scalability options than others.

Table 1 shows how the various mobile applications used in the large classes and described in this paper compare when evaluated using the five dimensions described above. It is interesting to note that none of the mobile learning applications are judged to have high accessibility. This reflects growing levels of student ownership of mobile technologies but the fact that many students are still without. In considering the learning levels, it is evident that the applications that involve the use of mobile laptops and independent project work are those that provide the opportunities for the high levels of learning.

In terms of reusability, the applications that use the least sophisticated technologies, for example the clickers and mp3 players, appear to be the most reusable. Typically these technologies are used in learning applications that are quite straightforward and limited in the levels of structure and organisation

of the learning activity itself. The applications using the laptops tend to require considerably more effort of the part of the teachers to realise the full success of the activity. In terms of individual support, the highest levels are derived form the laptop and mp3 activities where students have the highest levels of ownership and discretion in the learning setting. And with regards to the scalability of applications, those with the least scalability are those with the greatest technology demands. Laptop activities require individual learner access to mobile computers and this means that it can be difficult to scale this application for large numbers of students. At the same time, the audience response and the vodcast activities are highly scalable because the technologies can be shared and the same effects achieved by large numbers of students.

Table 1: Comparing mobile learning applications

Mobile learning dimension	Audience response	Web-polling system	Laptop extension	Laptop support	Lecture vodcast
Accessibility	medium	low	low	low	medium
Learning Level	medium	medium	high	high	medium
Reusability	high	high	medium	medium	high
Individual Support	medium	medium	high	high	high
Scalability	high	med	low	low	high

When the dimensions are considered across the five mobile applications discussed in this paper, the results suggest that the mobile learning applications that had the greatest potential to support learning in large classes were the audience response system and the lecture vodcast. Whilst these applications tended to support lower levels of learning than others, their reusability and scalability were high, and they also provided medium levels accessibility and individual support. As more and more mobile technologies become available to teachers, it will be important for teachers of large classes to recognise the optimal elements for designing effective learning environments. Table 1 suggests that some technologies can provide more balanced achievement of the five dimensions by which the efficacy and utility of mobile learning applications can be shared. The more effective learning settings appear to be those where accessibility and scalability are best achieved. It is clear that strong learning settings can be designed for all the mobile learning applications but the scope and extent of the learning achieved by all students in a large class is dependent on access to the technology and the scalability of the learning applications.

Summary and conclusions

Both teachers and learners in large university classes face challenges that can limit the achievement of intended learning outcomes. From a teacher's perspective, large classes provide challenges in relation to the provision of an equitable learning experience across a cohort that can include students with widely varying background knowledge, previous experience, needs and expectations. From the students' perspective learning in a large class often means being faced with a learning program where one size needs to fit all. It can mean having to work at a pace way beyond one's ability or alternatively, at a pace and level way within one's capability. The learning settings can be isolating spaces with minimal levels of interaction and engagement and limited opportunities for flexible and independent learning.

This paper has provided descriptions of applications of mobile technologies that have been found to provide opportunities to reduce some of the limitations within large classes. It has demonstrated how:

- the use of mobile learning involving audience response systems provided engaging and interactive learning opportunities for students in a large lecture setting;
- laptops were used to provide meaningful and supportive contexts for advanced students to undertake scaffolded and supported extension activities in place of conventional structured programs;
- laptops were used to support at-risk students in a large first year class through training and support for self-sufficiency and learner independence; and
- vodcasts and podcasts were used to provide flexible options for learners in a large class supporting any time and any place learning.

The learning opportunities for students in large classes that have been demonstrated by these examples of mobile learning stem mainly from the increased flexibility, learning support and forms of learner engagement that can be derived from the informed use of mobile technologies. As the form and function of mobile technologies continue to advance and their ownership and access increases, it is likely that teachers of large classes will find more and more innovative ways to use these technologies to improve students' learning. This paper suggests that the more effective learning settings will not necessarily be those settings that use the most expensive applications and the most powerful learning designs, but more

those that use technologies in ways that recognise the need for accessibility and scalability. As with any innovation and application, there are still many issues associated with cultural change that will need to be overcome before mobile technologies can become an integral and natural component of large class university settings in general (eg. Freeman, Bell, Comerton-Forde, Pickering & Blayney, 2007).

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Please cite as: Oliver, R. (2007). Using mobile technologies to support learning in large on campus university classes. In *ICT: Providing choices for learners and learning. Proceedings ascilite Singapore 2007*. https://doi.org/10.65106/apubs.2007.2602