

## Building the momentum for m-learning via the ECU Advantage project

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### Abstract

*Edith Cowan University (ECU) has been exploring the implications of m-learning through the ECU Advantage project. In the pilot phase of this project selected class groups were provided with a personal laptop computer on loan for the duration of a semester. The intention of the project was to improve student learning outcomes by using mobile computing to enhance collaboration, flexibility and information access. This paper reports on the issues encountered and solutions developed throughout the pilot project including a number of pedagogical experiences and perspectives which may shape future m-learning teaching and learning initiatives at ECU. In addition, a number of infrastructure issues have been addressed and their implications for change are recorded. Finally, the paper identifies institutional outcomes, mostly of a continuing nature, that are being addressed following the pilot project.*

### Keywords

*m-learning, laptops, ubiquitous computing, mobile computing, wireless networks*

## Introduction

The ECU Advantage project described in this paper was innovative in terms of seeking new models of learning and teaching, and a logical extension of previous developments at Edith Cowan University (ECU). The University had set itself an online strategy in 2001 and, as a result, had been exploring a number of online projects. Learning management systems (LMS) were being designed and developed in two of the technologically advanced Schools and the Blackboard system was chosen as the centrally supported enterprise LMS. In the years to follow there was an accelerating use of these LMSs for making resources available to students. Figure 1 illustrates the growth in the number of unit enrolments with resources available via Blackboard from the early stages of deployment in Semester 1, 2002 through to Semester 1, 2005.

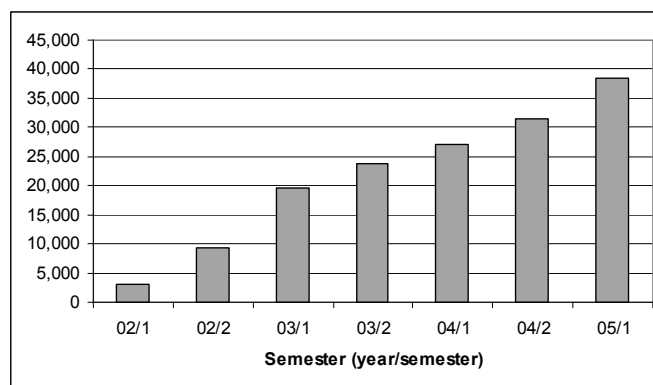


Figure 1: Sum total of enrolments in units with Blackboard components 2002–2005

A visionary document entitled “Flexible Learning @ ECU” (ECU, 2003) explored the future directions for flexible teaching and learning at ECU. One impetus for change was the strategic priority of “Enhancing Teaching and Learning” in the Strategic Plan adopted by ECU for 2003–2007 where one of the stated objectives was to “Enhance the flexibility of student choice of units, courses and mode of delivery”. Fully online units and courses were experimented with as part of the response to this objective. Learning and Development Services Centre (LDS) embarked on a strategy of supporting online resource development and training for academic staff in the use of the centrally supported Blackboard LMS and online teaching generally. As a result, there was a growing body of blended online units and academics with experience in using these tools. Blackboard was not the only LMS in use at ECU as other school-based systems continue to

be supported. Offshore mirror sites of one of the 'homegrown' LMSs gave one School an innovative edge whilst another School was very creative by way of offering an extensive range of interactive tools that were developed and integrated in their LMS.

By 2004 there was an opportunity to take the pedagogy into the next technological development phase, namely piloting the use of mobile laptop computers connected to a wireless network. Ideally this would allow students to access a range of online learning resources anywhere on campus. They could access LMSs and utilise a range of communication tools, both asynchronous and synchronous whilst in informal areas such as cafes or outdoor spaces. Overseas, such use of laptops in tertiary education had been pioneered by the IBM Thinkpad Universities and ECU's strategic alliance with IBM offered an opportunity to explore how laptops could add value to the ECU student learning experience.

From the start of the project, there were issues to be settled relating to infrastructure and pedagogy. The infrastructure issues revolved around the wireless network, and the configuring and supply of laptops to students. The pedagogical challenges related to identifying ways that the technology could be effectively deployed in and out of class.

## **Background**

### ***Ubiquitous and mobile computing***

In the Observatory Report on Ubiquitous Computing in Higher Education Smith (2003) describes the widely accepted definition of ubiquitous computing as "a situation where all students and all academic staff have access to a networked computer at any time to undertake their work." This original definition of ubiquitous computing is evolving and changing as ubiquitous access in its basic form is being achieved in many institutions (Smith, 2003). In Smith's (2003) view, ubiquitous computing is enhanced by introducing a combination of laptops and campus-wide wireless networking. Wireless mobile computing environments are now frequently referred to as 'ubiquitous computing' environments.

Brown and Petitto (2003), in discussing the status of ubiquitous computing, identify a hierarchy of ubiquity ranging from 'teaching with an assumption of access to the internet' through to students owning laptops and handheld devices with access to campus-wide wireless networking. The goal then moves to a higher level in the hierarchy of ubiquity (Brown & Petitto, 2003) with greater network accessibility and the introduction of more mobile devices.

Although the use of laptops and wireless networks in teaching and learning is often referred to in the literature as ubiquitous computing, in the context of this paper the authors refer to a pilot project where only a defined group of students and staff have access to wireless laptops and a wireless network. Whilst the wider institutional aim is to achieve ubiquity in the use of wireless networking, laptops and other mobile learning devices at ECU, in this paper we refer to mobile computing and m-learning to describe the use of laptops, wireless networking and mobile devices in teaching and learning within the context of pilot project.

### ***Links with IBM Thinkpad projects***

Edith Cowan University established a strong link and working relationship with the IBM Thinkpad University team at Acadia University in Nova Scotia, Canada, whilst planning the ECU Advantage project. In 1996 Acadia University became one of just a few universities in North America to embrace laptop based m-learning. The Acadia mobile computing initiative, known as the Acadia Advantage, provides laptop computers to staff and all undergraduate students. At the outset of the ECU Advantage project visiting academics, Craig Place and Conor Vibert, from Acadia University, were invited to ECU and presented a series of workshops and lectures for the ECU community and the ECU Advantage project teams. Their presentations highlighted some of the issues associated with mobile computing: challenges of implementing a campus-wide laptop project, changes to the learning environment, staff and student support requirements, and examples of teaching with technology. The project organisers and participants also gained valuable information from similar laptop projects undertaken at The University of Strathclyde in Glasgow, Scotland (Smith, 2003), Wake Forest University (Smith, Telford, & Womack, 1999), and The State University of New York at Morrisville (Drew, 2002) to assist in establishing the project.

### ***Learning spaces and mobile technologies***

The introduction of wireless enabled mobile devices and the increase in wireless network coverage necessitates a rethink of the concept of learning spaces, both physical and virtual. Leidner (1995) described a vision of continuous virtual learning spaces whereby technology is utilised to redraw the physical boundaries of the classroom, allowing learning to be a continuous time-independent process enabling multi-level, multispeed knowledge creation. At the time it was envisaged that the advantage of virtual learning spaces is in linking geographically dispersed students, allowing for teamwork at a distance. The same principles apply today, however, the concept of virtual learning spaces has widened to include communication and interactivity taking place in the virtual domain, regardless of whether students are situated in the same room or separated by distance. The emerging trend is for learners to multitask, moving back and forth between real and virtual spaces working in more than one virtual space at a time (Brown, 2005, p. 12.3). The physical learning space is no longer limited to a classroom and may be any space where learning occurs, areas such as cafes, libraries, common areas, wherever wireless networking is supported and learning takes place. Oblinger (2005, p. 14) states that "learning spaces are no longer defined by 'the class' but by 'learning'".

Alexander (2004) describes the concept of the 'nomadic student', equipped with mobile technologies, working alone or in groups wherever connectivity is supported. Students congregate in student lounges and cafes to work on group projects. They then move on virtually or physically to other locations where they work independently. There is a need to rethink and redesign university learning spaces to support the requirements of 'nomadic' learners. Functional virtual and physical learning spaces are also required to support multiple types of learning activities, and accommodate information technology needs, such as, connectivity and access to power (Brown & Lippincott, 2003; Oblinger, 2005).

### ***Laptops, wireless networking and pedagogy***

Integrating laptops and wireless networking into teaching and learning practice poses a range of challenges. As with most new technologies, there is the danger that the laptops will become the focus of the class. Therefore there is a need to develop effective strategies and techniques for integrating laptops into classroom practice, equipping teaching staff with laptops, and ensuring that laptops are used to facilitate learning (Demb, Erickson, & Hawkins-Wilding, 2004; Efaw, Hampton, Martinez, & Smith, 2004; Thompson, Olson, Grooters, & Tykwinski, 2004). Bridgland & Blanchard (2005) stress the need for a close alignment of objectives with implementation to help embed the use of technology into teaching and learning. A sustainable m-learning environment can be developed if it is supported by policies, plans and strategies that are aligned with the institutional strategic aims.

### **The ECU Advantage project described**

The ECU Advantage laptop project was established in 2004 as a strategic institutional wide initiative to encourage the uptake of mobile computing by the Edith Cowan University community. One of the key aims was to improve student learning outcomes by using mobile computing to enhance collaboration, flexibility and information access. The initial pilot phase of the project was conducted in 2004 with the view to inform decision-making for the implementation and mainstreaming phases to follow.

The expected outcomes of the ECU Advantage project were the integration of new technologies into mainstream teaching and learning practices. The plan was to support the use of laptop and wireless connectivity to assist students in achieving successful learning outcomes and developing students' confidence, knowledge and skills in the selection and application of technology appropriate to their field of scholarship. The project also intended to expand students' use of online resources and information at ECU (ie learning management systems, library). Integrating technology into the university experience for academic staff by providing educational design opportunities, infrastructure and support in developing new teaching and learning models utilising mobile computing technologies were also aims of the project.

A number of critical success factors were identified for the project (such as student and staff satisfaction) and these were evaluated by consultants at the conclusion of the project. They are reported on in the conclusion of this paper. To explore the opportunities offered by mobile computing the project established a series of faculty-based pilot projects where wireless laptops were supplied to all students enrolled in selected units. In the 2004 pilot 89 students were participating in the project. In the 2005 extension of the pilot, this number increased to 137. In conjunction with the faculty-based pilots, a longer term strategy was developed to enable wider access to laptops to the university community by offering students and staff the opportunity to purchase IBM laptops at a competitive price. The purchasing scheme phase of the ECU Advantage project commenced in Semester 1, 2005.

Mainstreaming of student laptops at ECU and support of m-learning will continue over time with increasing accessibility to hardware, wireless networks and support infrastructure for ECU students.

### ***Project governance***

The project was championed by the Pro-Vice-Chancellor Teaching and Learning and managed by a Steering Committee and Project Committee which included the Vice-Chancellor and Pro-Vice-Chancellors, the Director of Information Technology, the Director of Learning and Development Services (LDS) and key teaching and learning staff. A project manager was appointed from the central teaching and learning group LDS, to manage the project and coordinate information exchanges between the committees and groups. Two operational teams were established, a management team within IT and a support team. The support team brought together IT project participants and academic team members within a forum where issues could be tabled and resolved. Both the teaching and learning, and support needs of academics and students were addressed in this forum.

The 2004 pilot phase involved representatives from three faculties in 2004, with an additional faculty joining the pilot in 2005. Faculties were invited to put forward project proposals for their involvement in this pilot and were selected based on the likelihood of success. The teaching and learning selection criteria included:

- Supporting the use of notebook and wireless connectivity to empower students to achieve successful outcomes in an exciting and stimulating fashion.
- Developing students' confidence, knowledge and skills in the selection and application of technology appropriate to their field of scholarship.
- Improving students' use of online resources and information at ECU.
- Developing new teaching and learning models utilising mobile computing technologies.

### ***Project funding and support***

The ECU Advantage pilot project provided funding for 100 laptops allocated to the project and funding for time release to a maximum of \$3,000 per project, and the option to hire students to provide assistance, support and feedback. Learning Development Services provided Instructional Designers to support project teams in the development of learning designs and Blackboard units, and to provide academic development assistance where required. Research funding was awarded to teams who applied for the ECU Advantage project 'small grants' detailed below.

### **Pedagogical outcomes**

At ECU both students and staff in the project were provided with identical laptops and were given access to the same level of wireless network services, ensuring that all participants were on common ground. The project's small grants provided research support of up to \$5,000 for each of the teams involved in the pilot project. The purpose of the grants was to support research and scholarship on teaching and learning to ensure that the outcomes of the pilot projects are shared in the local and international scholarly community. Three distinct research projects emerged.

In the Faculty of Business and Public Management the pilot project focussed on assessing the impact of wireless internet communication on learning in a postgraduate (MBA) environment. The project team set out to develop a model of teaching with laptops that 'combines established principles of collaborative and authentic learning with teaching and learning activities supported by wireless computing'. The MBA students engaged in group work that was supported by data gathering and analysis in class, utilising web-based resources and accessing live real-time data in class. This component of the overall ECU Advantage project thus engaged 30 students in a limited exercise in reconceptualising students' awareness of learning spaces, both physical and virtual. These students were not laptop novices as most regularly used laptops as part of their work tools; however their class-based activities were enlivened by the use of laptops for active problem solving and rapid responses involving current data, with follow up online activities in virtual groups. The lecturer's task then was to design problems that would engage the class in the learning activities of the unit being studied and which would be amenable to live research on the Internet.

The Faculty of Communications and Creative Industries project team focused on the 'digital lifestyle' of students to establish how students use mobile laptop technologies as part of their work, study and social lives. The study explored patterns of use of the laptops throughout the semester to ascertain the extent to which students integrate laptops into their lives. The purpose was to depict the 'digital lifestyle' made possible by the technologies and how this impacted on their studies (McMahon & Pospisil, 2005). This component of the project thus engaged 15 students in a ubiquitous computing approach where the direct activities of the class,

and the students' other studies and social activities were all part of the intended purpose of providing the laptops to students. The lecturers' task was to facilitate in-class focused work and encourage out-of-class wider laptop usage. These students did not need much encouragement to become Alexander's (2004) nomadic students.

The Faculty of Community Services, Education and Social Sciences conducted a research project titled 'Evaluation of learning in the Technology and Enterprise Laptop project'. The goals of the project included engaging students with new technology to maximise learning, promoting collaborative group work and encouraging online learning. The students in this group were primarily novice computer users and in this class were given an opportunity to learn how to use mainstream software programs and experiment with software used in schools to develop media rich learning resources (Pearson & Williams, 2004). In many ways, these 50 students were the pilot projects greatest challenge. They were the least experienced in the use of computers and more directed activities were required in class to raise their skill levels. Several students opted out of the project at the early stages. One strong outcome here was the confidence shown by several students in taking their laptops into schools when on teaching practicum and using their laptop skills gained at university to develop resources to engage their pupils. In this case the concept of learning space gathered an interesting extra dimension.

In 2005, the School of Computing and Information Systems joined the project with a class of 67 Master of IT students. This class focussed on utilising the laptops both in and out of class within the context of learning about project management. No formal research project was conducted in this semester, however, a number of the mostly international students, commented enthusiastically in the end of pilot survey on how the laptops were invaluable in providing them with the opportunity to study anywhere and anytime without being limited to using university computer labs.

The Faculty-based teams were supported by instructional designers to assist in the development of learning designs that exploit the advantages afforded by mobile technologies and the wireless network. The emphasis was on utilising the technologies to add value to the learning experience, to encourage student centred learning and encourage seamless use of the available technologies for learning in and out of class.

### ***Formal project evaluation***

The University employed the services of an external team from Queensland University of Technology (QUT) to evaluate the effectiveness of the trial. The team gathered information on the pilot project progress at regular intervals by interviewing students and staff and conducting focus groups. An online survey of all students participating in the project was carried out at the end of the Semester 2, 2004. A comprehensive report provided insight into how project aims and critical success factors of the ECU Advantage pilot project were met. A follow-up survey was conducted by ECU at the end of Semester 1, 2005 to gather comparative data.

### ***Researching the students' perceptions***

The project had a key aim of improving student learning outcomes by using mobile computing to enhance collaboration, flexibility and information access. In order to gain an insight into what had been achieved, students were asked to complete surveys at the end of each semester for the pilots run in Semester 2, 2004 and Semester 1, 2005 that provided for qualitative and quantitative responses. The qualitative responses were positive and some examples are shown below:

This unit enhanced my participation in class through the class activities that were posted on the web. Being able to actually analyse a website in class, was helpful, made learning more interesting and as a result promoted better learning.

There was much more effective learning especially that it is at the post graduate level where a lot of research is required and laptop came in handy.

The bonus point is that this unit was part of the ECU advantage program where the students were given laptops for the whole semester. We the students didn't have to print out lectures during class but enabled us to do note taking while the lecturer is talking. Also since the laptop is equipped with wireless, you don't have to fight for a computer in any labs. You can do your work at your own comfort zone. You get all the resources you can and you still have your personal space. At the end of the semester, you will learn the beauty of independent learning.

Benefits are (1) i can just sit on the couch comfortably and do my work (2) i got to do more work at home since i didnt own a computer on my own, this laptop made my semester easy, i dont have to fight with my cousins to use the computer (3) i don't have to bring notes with me, everything is saved in the laptop.

The quantitative questions in the survey are shown below:

Table 1: Quantitative survey items

Item	Quantitative survey items Students responding 'Agree' or 'Strongly Agree'	Semester 2, 2004 N=65	Semester 1, 2005 N=87
1	The laptop has assisted me in my learning.	85%	95%
2	The staff members teaching this unit were able to integrate activities, using the wireless network, into the teaching and learning program.	97%	76%
3	Compared to other similar units, this unit resulted in a greater workload due to participation in the laptop project.	49%	50%
4	The laptop enabled me to become better organised as a student in this unit.	79%	88%
5	The laptop facilitated communication between staff and students.	75%	77%
6	The laptop enabled meaningful communication with other students.	58%	69%
7	The laptop enabled me to complete learning tasks as an independent learner.	93%	94%
8	I have experienced frustration in using the laptop for tasks set by the lecturer.	59%	39%
9	The laptop increased the resources available to me as a learner in this unit.	91%	86%
10	Access to the wireless network increased my use of web-based resources.	77%	77%
11	Use of the laptop in lectures/tutorials assisted my learning in this unit.	81%	83%
12	The laptop supported learning activities that reflected the way knowledge is used in real-life settings.	82%	82%
13	The learning activities involving the use of the laptop, were usually exciting and stimulating.	95%	82%
25	After the experience of using a laptop, I would now like to purchase my own laptop.	79%	65%

Generally, the responses were positive across all teams but some results were noteworthy. For example, in the responses to Question 1 in Semester 1, 2005 illustrated in Figure 2, students clearly felt that the laptops had assisted their learning. Figure 3 indicates that the approaches employed to integration of the technology into the teaching and learning activities had also been seen as effective (Question 2, Semester 1, 2005).

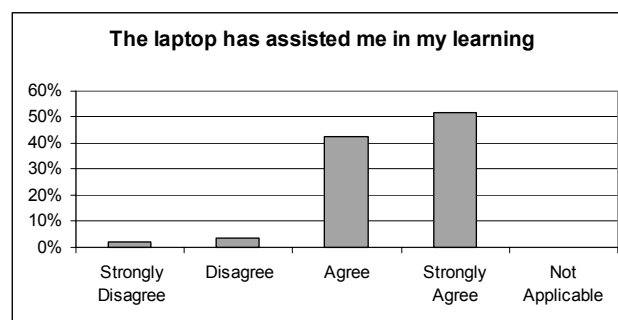


Figure 2: Student evaluation of the usefulness of laptops (Semester 1, 2005)

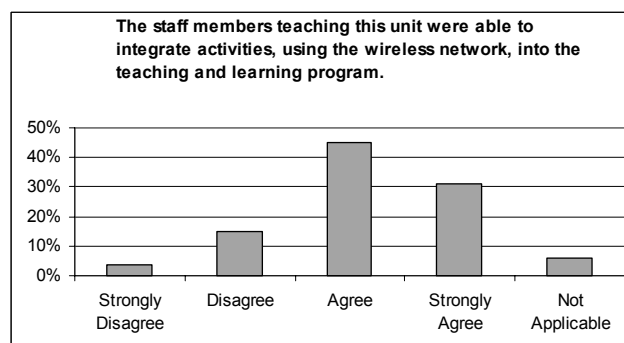


Figure 3: Student evaluation of pedagogy used in the pilot (Semester 1, 2005)

In the 2005 pilot project survey 76% of the 87 students who responded to the survey agreed that the lecturers were able to integrate activities using the wireless network into the teaching and learning program. 95% believed that the pilot project laptops assisted their learning and 82% found the learning activities were exciting and stimulating.

Approximately the same proportion of students (49%; 50%) in 2004 and 2005 survey results believed that participation in the laptop trial increased their workload (Question 3), however, fewer students (59%; 39%) reported experiencing frustration in using the laptop for tasks set by the lecturer (Question 8).

## **Infrastructure outcomes**

### ***Wireless networking***

The success of the pilot project was dependent on the wireless network infrastructure and the related support services. Initially, a temporary network was installed for ECU Advantage project pilot classes running in Semester 2, 2004, whilst a large scale project to implement comprehensive campus wide wireless coverage with a Nortel Networks MESH Network commenced in October, 2004.

The Nortel Networks Adaptive Network implementation is taking place on all four ECU campuses with approximately 36 access points installed at Joondalup and Mount Lawley campuses. The Nortel wireless network provides coverage using the IEEE 802.11a/b/g standard and is accessible by all staff, not only by the ECU Advantage project participants.

The Nortel MESH network differs from standard wireless network installations in that access points are located outside buildings providing a wider zone of seamless wireless coverage, incorporating both buildings and surrounds. Following installation of the external access points of the MESH network, black-spots, areas with limited coverage due to physical barriers such as metal screens, will be identified and rectified by installing additional access points. Wireless access is currently (July 2005) available in most teaching areas on the three metropolitan campuses. Coverage is being expanded to provide wireless networking on campus in informal study zones including Megalabs (student access computer labs with support staff on call), libraries, cafes, and other student common areas. Voice and video services are supported on the wireless network offering a range of real-time across-campus communication opportunities not previously experienced by students and staff.

### ***Helpdesk and other support***

The ECU Advantage project prompted the rapid development of support infrastructure for laptop computer users. This included access to advice via the telephone Helpdesk, a range of online resources, including a comprehensive manual, The Student Technology Guide. This guide was given to all students participating in the project in print-based format upon receipt of their laptop. It included essential information and instructions for use of the laptops, software details, policies and information on how and where students would be able to get technical support. Students were also able to bring their laptops into any of the on campus Megalabs for on site support and assistance with both hardware and software issues.

The student survey responses indicated that although students were provided with a printed *Technology Guide*, support services at Megalabs and a website, these resources were underutilised by students. However, students who used the available services reported higher levels of satisfaction compared to students who chose to leave computer hardware and software issues unresolved.

In the initial pilot phase a range of issues emerged, particularly in relation to the practical aspects of managing 100 laptops. The time, resources and effort required by IT services to deliver solutions was much greater than estimated. Each laptop was imaged with a software profile specific to the requirements of the unit it would be used in and personalised for each individual student with their own profile. The laptops also passed through a university asset management process, which proved to be time consuming. Systems for tracking returns and exchanges of laptops were established and arrangements had to be made for facilities for secure storage of laptops. Customised orientation sessions were run for each class involved in the project, providing students with critical technical and support information. The movement of students in and out of pilot classes at the time of laptop allocation and handover at the start of semester further complicated the process. Improvements for 2005 pilot included more flexible 'on the spot' personalising of laptops to cope with the level of change required.

## Institutional outcomes

The institutional outcomes might be seen as those changes that can be observed in the university between the conceptualization of the project and its conclusion. This simple differential overstates the outcomes in that some may well have occurred even without the project; however this is a difficult distinction to make and this section simply records the changes.

The matter of how to bring mobile computing devices into the teaching program is now being actively addressed. There were alternatives available, notably laptops or personal digital assistants (PDAs); however, at the outset the project determined that it would be oriented toward laptops. Students were already using them in classes as convenient note-taking tools or in more specialised roles, such as computer programming, where the appropriate software was available. The concept of the free provision of laptops for a select group of students has by degrees been modified to a clear signal that students are encouraged to purchase a laptop and that teaching staff should consider how to effectively utilise their presence in classes.

The positive feedback from students in the project clearly indicated how much they valued having access to a free laptop for both study and other aspects of life. The fact that the university is now entering into a preferred supplier arrangement is clearly encouraging students to buy laptops and bring them to class. Teaching staff are being encouraged in a variety of ways to develop learning activities that engage students via information technology, rather than simply ruling out their use in class.

The matter of if, or how, the students' laptops will be supported is being addressed. Appropriately configured suites of software will be available to students who purchase preferred laptops. Levels of service that will be provided to those laptops are being established and reduced levels of service for other brands or configurations will evolve. As time passes and preferred models and configurations of hardware and software change, there will be a need for a change management process to occur.

The matter of raising awareness and skills amongst teaching staff on how this new technology might be used is being addressed. This is taking the form of professional development of such staff in "How to teach and engage student in learning 'wirelessly'". The immediately apparent problem is that many staff have little confidence in their abilities to handle technical queries. The problem of having to deal with technological dramas in class (e.g. cannot connect to the wireless network which might be due to network problems or related systems failures, or problems associated with the laptops) before engaging the students in the intended learning task can be a rapid destroyer of confidence in student and staff member alike.

At this point, the momentum toward increased usage of laptops in classes can be seen in new schools expressing interest in conducting trials using the supply of laptops purchased for the initial pilots.

The matter of the design of teaching and other spaces has received a higher priority than previously. The university campuses have a range of legacy and quite new facilities. If learning 'wirelessly' is to progress, there need to be a range of considerations applied to scheduled teaching spaces and to unscheduled learning spaces. Primarily, the needs relate to provision of access to data networks, power points and flexible arrangements of fittings such as desks and benches. The provision of the wireless network should cover the first of these; however, the battery life of laptops is limited and probably reducing with battery age. The question of how to provide for power sources, flexible furniture arrangements and standard media and other teaching resources has resulted in the request for interaction between Facilities and Services staff on the one hand and the leaders in the teaching and learning activities of the University including the Associate Deans Teaching and Learning on the other.

The matter of the quality of resources on the university's learning management systems and the robustness of those systems were also addressed. The Blackboard system in particular was unstable during the first semester of the pilot. It was determined that the system was under-resourced for the number of students using it. As a consequence, there was considerable expenditure of time and money in designing and implementing a system that was robust and reliable. A single server-based architecture has been replaced by a multi-server system that has appropriate fail-over features and capacity for growth in student usage. The result has been a semester with a greatly diminished disruption factor and a growth in confidence by staff and student users.



## Conclusion

The ECU Advantage project pilot has provided the university with feedback on both the pedagogical and infrastructure aspects of developing a ubiquitous mobile learning environment. The pilot project evaluation and surveys have provided a rich dataset of information gathered from both students and staff. Generally, this data is extremely positive. The Evaluation Report generated by the QUT evaluation team indicated that this project has resulted in a strong foundation for the future, including the student laptop purchasing model and mainstreaming wireless computing into existing frameworks. In addressing the critical success factors of the project the QUT evaluation team concluded (Tower & Hearn, 2005) that: ‘Strong learning outcomes across a number of dimensions were achieved with the key enabling processes being access to learning resources, immediacy and enhancement of group processes’.

In commenting on the critical success factors for the project, the evaluation team (Towers & Hearn, 2005) concluded that:

- A strong base for strategic long term commitment has been developed by stakeholders.
- Management buy-in was seen to be of a high level, with significant commitment to the project committees and the changes that were required.
- Student and staff satisfaction were evidenced in surveys.
- Maintenance of a technology enabled learning environment was seen to be “increasingly reliable”.
- Financial commitment to the technology, content and process in the pilot phase was adequate and future commitments were seen to be critical.
- Planning and standardisation as well as the coordinated support strategy were seen to be exemplary with a need for all these factors to be mainstreamed in the longer term.
- Strategic long-term partner IBM and local supplier W. J. Moncrieff Pty Ltd were seen to have been active participants with an opportunity to add value in the longer term.

The project has generated some lessons learned and a number of ongoing questions to tackle. These include an understanding of the importance of preparation of learning designs for m-learning, including supporting the lectures with appropriate training on how the technology operates and how to use it to good effect. At ECU this involves lecturers and instructional designers from the Learning and Development Services Centre working together. Support schemes and well informed support staff are critical factors for future success.

Collaboration with other universities is continuing with ongoing links and visits from other universities with laptop programs (Strathclyde and Acadia). The team from the Faculty of Business and Public Management are continuing to work collaboratively towards developing innovative uses of laptop and wireless technologies in the MBA course at ECU and related courses at Acadia University, Canada. The Knowledge and Information Technology Service Centre has been working on consolidating its support of the technology involved whilst the Learning and Development Services Centre is looking to expand its expertise in the pedagogy through collaboration with other institutions undertaking similar projects.

## References

- Alexander, B. (2004). Going nomadic: Mobile learning in higher education. *EDUCAUSE Review*, 35(5), 29–35.
- Bridgland, A., & Blanchard, P. (2005). *Powerful, portable, personal computing: Is m-learning an opportunity in e-learning*. Paper presented at the EDUCAUSE Australasia 2005: The next wave of collaboration, SKYCITY Auckland Convention Centre.
- Brown, D. G., & Petitto, K. R. (2003, May/June). The status of ubiquitous computing. *EDUCAUSE Review*, 25–33.
- Brown, M. (2005). Learning spaces. In D. G. Oblinger & J. L. Oblinger (Eds.), *Educating the net generation* (pp. 12.11–12.21). (n.p.): EDUCAUSE.
- Brown, M. B., & Lippincott, J. K. (2003). Learning spaces: More than meets the eye. *EDUCAUSE Quarterly*, 1.
- Demb, A., Erickson, D., & Hawkins-Wilding, S. (2004). The laptop alternative: Student reactions and strategic implications. *Computers & Education*, 43, 383–401.
- Drew, B. (2002, Summer). The wireless student & the library. *Library Journal*, 16–17.

- Efaw, J., Hampton, S., Martinez, S., & Smith, S. (2004). Miracle or menace: Teaching and learning with laptop computers in the classroom. *EDUCAUSE Quarterly*, 3, 10–18.
- Leidner, D. E., & Jarvenpaa, S. L. (1995, September). The use of information technology to enhance management school education: A theoretical view. *MIS Quarterly*, 265–291.
- McMahon, M., & Pospisil, R. (2005). *Laptops for a digital lifestyle: The role of ubiquitous mobile technology in supporting the needs of millennial students*. Paper presented at the EDUCAUSE Australasia 2005: The next wave of collaboration, SKYCITY Auckland Convention Centre.
- Oblinger, D. (2005). Leading the transition from classrooms to learning spaces. *EDUCAUSE Quarterly*, 1, 14–18.
- Smith, S. S., Telford, R. L., & Womack, H. D. (1999). *Planning and implementing computer orientation for a laptop campus: The Wake Forest University Thinkpad project*. Retrieved from <http://www.educause.edu/ir/library/html/cmr9906/cmr9906.html>
- Smith, T. (2003). Ubiquitous computing in higher education. *The observatory on borderless higher education*. (n.p.).
- Thompson, G., Olson, A., Grooters, L., & Tykwinski, J. (2004). Ubiquitous mobile computing: A foundation in the academic infrastructure. *Society for Information Technology and Teacher Education International Conference 2004*, 1, 1877–1878. Retrieved June 22, 2005, from <http://0-dl.aace.org.library.ecu.edu.au:80/14603>
- Towers, S., & Hearn, G. (2005). *ECU Advantage evaluation report*. Report presented to Edith Cowan University.

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