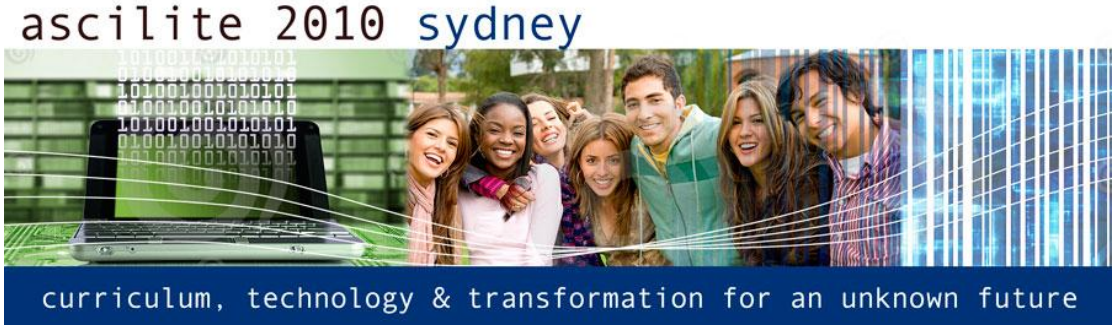

Facilitating change: Tablet PC trials across two distance education focused universities

Birgit Loch
Engineering and Science Education Research Group, Faculty of Engineering and Industrial Sciences
Swinburne University of Technology, Australia

Wendy Fisher
Technology and Education Research Group, The Faculty of Mathematics, Computing and Technology
The Open University, United Kingdom

This paper reports on initial findings in comparing two distance universities' approaches to trialling tablet technology to enhance communication between instructors and students. There were different reasons for initiating the trials and different approaches to each of the trials, but there were also some striking similarities. For instance both trials were led from the bottom up, however they were each conducted with no knowledge of the other. Funding for each of these trials was resourced from a university learning and teaching grant/fellowship and both projects used an action research approach. The emphasis for both trials was on pedagogical and technological staff development facilitated and administered through each project leader. The paper gives an overview of how the trials were conducted, what did and did not succeed and what could be improved. Longer lasting outcomes that have been achieved through these projects are described. This comparison is meant to guide and inform change agents and identify good practice in the management of technology trials.

Keywords: tablet technology, technology trial, pedagogical staff development

Introduction

Both the University of Southern Queensland (USQ; in Australia) and the Open University (OU; in the UK) are major distance education providers in their respective countries. As such, they were among the first universities to introduce web-based online learning (Reushle & McDonald, 2000; Weller & Robinson, 2002) to enhance the traditional distance education model, where the typical learning package consists of print-based materials sometimes supported by audio or video resources. This move opened up opportunities for providing study material online via the universities' learning management systems (LMS), and enabled asynchronous (via forums) and synchronous (via chat) communication between instructors and students. It also allowed for faster assignment feedback turnaround times through electronic submission, marking, and return of assignments.

However, while very successful in many disciplines, current standard electronic distance-learning environments can be seen as inadequate for learning and teaching in symbol-based courses from disciplines such as mathematical sciences, chemistry, biology, financial accounting, engineering and languages with non-Arabic letters. These subjects require extensive use of handwritten symbols and diagrams or complicated specialised typesetting software (Loch & McDonald, 2007; Smith & Ferguson, 2004). In fact, mathematics lecturers have not engaged in recording of lectures "which involve demonstrations of procedures that cannot be adequately captured" (Gosper et al., 2008, p.29).

To address this issue both USQ and the OU had experimented more or less successfully with pen input tools such as digital note pens and graphics tablets (see, for example, Loch & Donovan (2006); but reaching as far back as Harman & Dorman (1998)). At USQ, a Tablet PC had been available since 2005 to the first author, for teaching mathematics and computing courses. This Tablet PC was used to demonstrate the potential for communicating mathematics to distance students, a task that had previously been undertaken via telephone, asynchronous email and LMS forum posts. A successful bid for a university learning and teaching grant was submitted, which, together with in-kind support from other areas, provided 6 new Tablet PCs to the project, but no workload allocation to effectively facilitate their integration into the curriculum or online materials.

At the OU, although there had been institutional studies into the use of pen-based technologies since 2002, the Tablet PC was starting to be recognized in 2005 as a potential tool for marking assignments. This had come just in time as the university was moving to increasing online submission of assignments. It was considered that the functionality of Tablet PCs could help the university's Associate Lecturers (ALs; part time geographically dispersed staff, who provide a blend of face-to-face and on-line tuition) provide feedback at a relevant point in a student's electronic assignments. Project funding was granted for a study under a teaching fellowship scheme through the Centre for Open Learning in Mathematics, Science, Computing and Technology (COLMSCT), one of five nationally-funded Centres for Excellence in Teaching and Learning (CETL) at the OU. This project funded the purchase of 6 new Tablet PCs and in addition bought out 0.5 of the workload for the Fellow (the second author of this paper), from 2005 until 2008.

The primary aim of both Tablet PC evaluations was to establish whether this technology would allow teachers in quantitative disciplines to better communicate with their distance students. The trials commenced at around the same time in 2006, but were conducted independently from each other. While there were similarities in the methodology with which they were conducted and the pedagogical and technical support provided, the two trials differed in scope and in the issues to be addressed with the technology. Their outcomes were also quite different.

This paper draws from the experiences of conducting the two trials, by reporting on positive and negative outcomes and issues that had to be overcome. It also draws out some recommendations on how to run a successful technology trial in a higher education environment. The paper is a first report at the start of an in-depth comparison of these two trials, with a more thorough analysis of findings to be reported on elsewhere. The paper is structured as follows: the next section gives a brief overview of relevant literature on Tablet PCs for higher education and Tablet PC trials, on managing change in a tertiary environment, and on the importance of a pedagogical driver behind technology innovation; then the methodological frameworks that were used for the two trials are introduced, followed by a description of the outcomes from the trials, and a comparison of approaches sorted into the three phases of the trials – the pre-trial, trial, and post-trial phases. Recommendations are made at the end.

Literature review

Tablet hardware and software have been available since 2002. However despite predictions that they "should be a boon for distance educators" (McCloskey, 2002) their uptake has been slow due to the considerably higher purchasing costs of Tablet PCs compared to laptop computers, and a lack of understanding of how the Tablet PC may be used effectively in teaching and learning.

There is anecdotal evidence, that at least in mathematical disciplines in Australia, Tablet PCs now find much wider use than a few years ago. The benefits of capturing handwriting on the computer are beginning to be recognized, following a drive by university managers towards more cost efficient delivery of course material, including lecture screen recording which requires some form of capturing handwriting electronically in symbol-based disciplines. Most publications on tablet technology are individual accounts of lecturers experimenting with the technology and describing their experiences. Practice-based examples include: Logan et al. (2008) in teaching of biological sciences at Monash University; and Freake & Underwood (2008) and Brodie & Loch (2009) on how Tablet PCs have been used to mark paperless assessment in Physics and Engineering, respectively. At the other end of the spectrum is the research approach of Cromack (2008), linking educational framework and practice.

Cross-disciplinary investigations can also be found. For example, Mckenzie and Franke (2009) reviewed 144 papers on the use of Tablet PCs in education, in order to gain an overview of how tablets

are used in a university context and to explore the impact on the learning experience. In the UK, a series of case studies into the use of Tablet PCs in schools (Twining & Evans, 2005) showed that students were very enthusiastic about Tablet PC technology. Students develop a physical relationship with the tablet, since "size and shape of the Tablets encourage empathy with the machine". In the USA, Robinett, et al. (2005) report on a high school student tablet PC project which resulted in enhanced engagement with study, alongside high level ICT skills in students.

These studies give us insights into understanding some of the reasons for the children's enthusiasm towards the technology. On the other hand, there is literature that indicates that academics may not be prepared to engage with new technology in their teaching, thus missing out on opportunities in pedagogic innovation. Dede (2005), for example, stated that academic institutions need to prepare for neomillennial students (those born after 1982) because if "neomillennial learning styles are accurate, campuses that make strategic investments in physical plant, technical infrastructure, and professional development" will "gain a considerable competitive advantage in both recruiting top students and teaching them effectively". Laurillard (2009) states the need to "drive the technology towards what learners need" and although Tablet PC technology has not been specifically designed for an educational need, this should not stop practitioners carrying out significant scholarly work that above all, shows the potential tablet technology has for pedagogic innovation.

There appears to be a lack of literature on the management of tablet trials and the support provided to academics. However papers have been written on implementing other educational technologies, both at secondary and tertiary levels. For example, consideration has been given to the psychological point of view of how to alleviate computer anxiety in early childhood educators, whilst helping to increase knowledge and comfort with computer technology (Wood, 2002). It was found that through a computer training workshop the educators' anxiety was reduced; gains were also made towards more efficient and effective computer use in the classroom. Mainka (2007) records positive feedback from academics, where staff began to engage with educational technologies as a result of professional development that focused on their needs. These papers confirm that hands-on face-to-face support may reduce anxiety associated with new technology and can lead to educators using technology for pedagogic innovation.

In this brief review, we have but touched the surface of existing literature on small scale Tablet PC trials, the need for universities to move towards technology use and pedagogical and technical training for academics. This paper takes an innovative approach in comparing strategies taken in two university Tablet PC trials. It provides important practical advice from experience to guide tablet trials, which may equally be applied to trials of other educational technologies. This type of information is often unavailable in the literature as most trials do not go beyond individuals or simply not reported in scholarly publications. While both the OU and USQ are distance focused universities with specialized needs, experiences and recommendations from this study also apply to traditional university settings.

Methodological frameworks used in the two trials

We will describe the methodological frameworks and the research questions directing the trials in this section to present a complete view of the trials and to provide a structure for the comparison that follows. The design and conduct of both trials were framed by a qualitative action research approach, as displayed in Salmon's (2002) framework, and similar to that described by Webber (2010) to stimulate innovation and professional development in the use of information and learning technology.

USQ

At USQ, the action research took a participatory angle. The first author's role was that of collaborative practitioner researcher, with some elements of participative observation (Murphy & Torrance, 1987) and reflective practice (Schön, 1991), similar to that described in (Loch & Reushle, 2008). This was central to the research, as the author was interacting with all participants by providing training and support and bringing innovative ideas to the project, as well as moving the project forward.

Apart from its distance student population, USQ enrols about a quarter of its students in a more traditional on-campus mode, with lectures and tutorials offered to those students wishing to attend face to face classes. Starting with a specific research question for the trial, formulated from a demonstrated need to explore technologies further, participants received training from the project leader, encouragement to explore options, and chose with which of those to experiment.

The research question the project set out to answer was of a broad nature, and initially focused on mathematics but later extended to other quantitative disciplines that joined the trial:

- Can tablet technology facilitate improved communication and through this improve the learning experiences of students (especially remote or isolated students)?

The Tablet PCs were handed to academic staff actively involved in all components of teaching, including student consultations. Emphasis in the trial was placed on how to provide a similar study experience to distance students, looking at a range of uses for the Tablet PC, such as handwritten annotations for screen-recorded lectures or short explanations, providing fast feedback through electronic assignment marking, and offering synchronous online tutorials.

OU

In the OU case, the action research also included a participatory angle, with the second author part of a nine month virtual ethnographic study. She led an experiential staff development approach which built on the study of Bowskill et al. (2001) in supporting online collaborative work. She acted as a facilitator in supporting course team members' learning through action from a supported start: not as the expert, but as a guide for participants to develop their own practice. The OU research questions were phrased in response to an issue that had been identified when assignments went paperless in 1999. Since then, the markers' perceptions had been that they were no longer able to replicate the quality of feedback they had achieved using paper and pen technology. This was mainly attributed to the difficulties of placing feedback at an appropriate place in the assignment, and of adding feedback in mathematical notation. The research questions the project set out to answer were:

- Can tablet technology facilitate a near pen-and-paper experience for markers?
- What are the markers' and students' perceptions when feedback is provided with electronic handwriting?
- Is the quality of feedback higher when assignments are marked via electronic handwriting, compared to other electronic means?

In responding to the eleven conditions of supporting student learning (Gibbs & Simpson, 2004-5; Walker, 2009), this trial also sought to establish the relationship between technology and the quality and timing of feedback and quantity of feedback on paperless assignments. Tablet PCs were therefore handed out to those staff members who were marking assignments, the ALs. The study was narrow, as it focused on the task/use of the tablet for marking paperless assignments.

Both trials

In both trials, in the exploratory stage support was provided by the authors in the pedagogical as well as technical use of the equipment. Exchange of ideas and collaboration between participants was facilitated, via a community of practice approach. Participants and project leaders reflected on the impact the use of the technology had on their students' learning, based on observation, informal as well as formal feedback through surveys, and discussions of what could be improved for the next cycle (cycles were based on teaching periods).

The trials used a phased approach (Figure 1), with "an iterative, cyclical process to develop, implement, evaluate, and modify the trial process and make recommendations for future action" (Loch & Reushle, 2008).

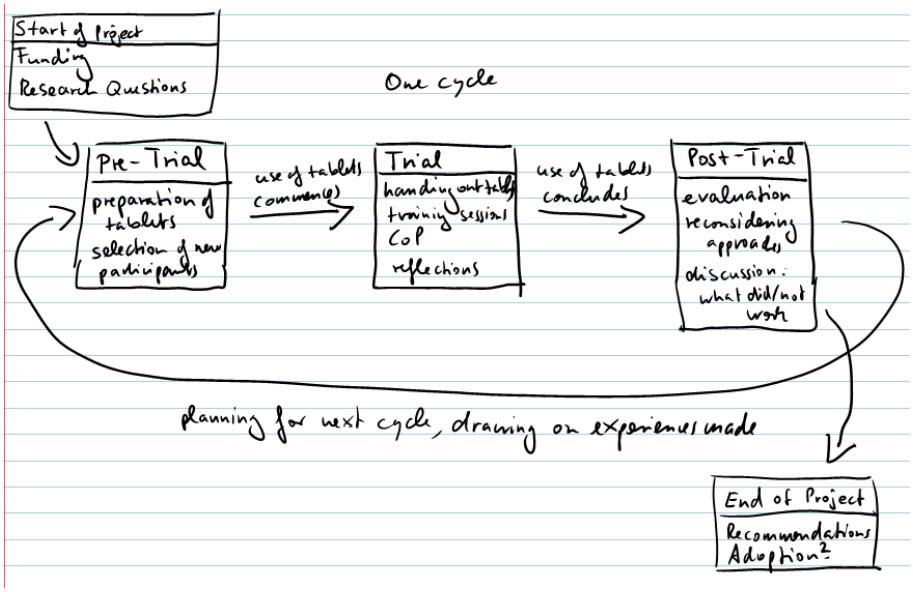

Figure 1: Action Research cycle for the two Tablet PC trials

In Phase 1, the pre-trial phase, Tablet PCs were set up and participants were selected. Phase 2 (the trial phase) was the actual technology trial. The trials were carefully planned, with both technological and pedagogical training developed, delivered and revised throughout the cycles (semesters). Phase 3 was the evaluation phase, where discussions took place about what did or did not improve teaching and learning, and where amended approaches were considered for the next cycle. The evaluation of the OU trial has concluded and results are published (Adams & Fisher, 2007; Fisher, 2008(a); Fisher 2008(b); Beechener & Fisher, 2009(a); Beechener & Fisher, 2009(b)). At USQ, together with data from a much larger university-wide trial conducted in 2009, the qualitative and quantitative data sets are currently being analysed. Data collected includes unsolicited emails, reflections, forum posts, feedback from face-to-face sessions, formal surveys and semi-structured interviews.

In the next sections, we will provide a comparison of approaches taken at the two universities, with focus on the quantifiable and visible outcomes of the trials, i.e. uptake and adoption of the technology beyond the trial participants, and engagement with, and support from, university management.

Comparison of approaches taken pre-trial, trial, post-trial

Pre-Trial

Workload and resource allocation
The funding for the projects included investment in resources from each of the universities and was of a similar magnitude in terms of hardware purchased (6 Tablet PCs each), however the OU project provided teaching relief for the second author. She also had access to educational researchers for support and advice, and was encouraged and supported to publish results, attend conferences and engage in scholarly activity.

For the USQ project, none of this was available, as all resources were spent on equipment. This was not perceived as an issue for completion as the project was small enough to manage within existing workloads. However, with no time allocation or research assistant, it was difficult to find the time to analyse results and report on them.

The workload and support availability is the reason why the OU project has been analysed and is completed, while a thorough analysis of USQ data is still in progress. Interestingly, the lack of hard evidence from the USQ trial was made up by the examples of good practice that were collected and could be demonstrated.

Scope of the trial and participant selection
In each project, participants were either nominated by faculty academics or they self-selected as a

result of having a specific need for the technology, and showing interest in trialling new technologies and investing time to find better approaches.

At USQ, four team members were involved in the successful learning and teaching grant bid, including the first author. Their teaching areas covered Mathematics, Statistics and Mathematics Learning Support. Three of the Tablet PCs were allocated to these team members, and one was kept for short term loan. The other two were loaned to lecturers from Biology, Chemistry, Physics, Mechanical Engineering, German Language and Statistics on a semester-long basis over the four cycles of this project. Participants were selected for their needs for the technology; for instance the German Language lecturer was teaching in a room where the computer projection screen covered the whiteboard. The Tablet PC enabled her to follow her preferred teaching style: to write in class, capture what she was writing, and also show prepared slides at the same time.

At the OU all ALs were recruited from one module on ICT, which was taught mainly via the Internet, including the electronic submission of assignments. Negotiations with teaching teams were required to seek permission for Associate Lecturers to participate in the trial of Tablet PCs for marking paperless assignments. Only one participant was known to the second author beforehand and was selected for that reason; the others were recommended by the course team. The Tablet PCs were sent in the post to the markers as they were geographically dispersed throughout the United Kingdom.

The OU funding was for specific evaluation of the technology for electronic marking in the Faculty of Technology, in contrast with the USQ project's investigation of a range of uses across several disciplines (with an initial focus on mathematical sciences). The narrower focus of the OU trial, on just one application of the technology, and with Tablet PCs used by ALs rather than central academic staff, had a strong impact on the low uptake of the technology at the OU following the trial. This is partly because there are few mechanisms for dissemination of outcomes by Associate Lectures to colleagues.

Hardware selection, ITS Support and technical issues
When investigating suitable models of Tablet PCs for the project at USQ, emphasis was placed on providing a computer that instructors were familiar with, limiting the choice to devices with rotating screen and keyboard (referred to as a clam), rather than a slate. Upon purchase of the six Tablet PCs, in-kind support from Toshiba was provided, in the form of upgraded hardware. ITS support was made available, on a "best effort" basis which meant immediate support may not always have been available.

At the OU, the Fellow researched several models of Tablet PCs already in use by OU colleagues before deciding on a clam HP Tablet PC. One of the main reasons for this decision was that ALs fulfil many repetitive administrative tasks associated with downloading and uploading electronic assignments, which are more efficiently done using a keyboard. The computers were fully supported by the local CETL ITS Support, although the chosen Tablet PC model was not among the hardware approved by the university's central ITS Support Section.

At both institutions, tablet technology was regarded as trial technology. The lack of full ITS support at USQ was not perceived as an issue, since the first author provided most technical support without involving ITS. This was helped by the fact that no severe technical issues occurred.

Trial

Technical and pedagogical training
At both universities it had been decided that it was crucial to provide technical and pedagogical training for each of the participants. A different approach to this was taken at each institution. At USQ, face-to-face training was carried out, often on a one-to-one basis. Apart from the project team, which met as a group, all other participants received an in-depth individual introduction into how to use the technology, demonstrating how it had been used previously in pedagogically sound ways, and this was followed by a discussion on how best to integrate the technology in the new context of the participant. This was meant to guide the lecturer, and encourage innovation rather than replication.

At the OU the technical training was handled by providing each of the instructors with an online training manual written during the pre-trial phase. During the trial, participants were encouraged to contribute to an online forum moderated by the Fellow over eighteen months. This was because unlike USQ, the instructors in the OU trial were not located in the same place, and staff development had to

be provided at a distance via electronic communication means.

Technical and pedagogical support
For both trials, a collegiate and experiential approach to staff development was taken, assuming that the instructors would share and communicate good practice over time, facilitated by the project leaders.

At USQ, the author was available for face-to-face support from the outset and was able to amend minor technical problems immediately. Frequent meetings occurred between the grant project team members to discuss new ideas and how they could be integrated into teaching.

At the OU, examples of good practice were shared between instructors and made openly available to the academic community. The forum provided a venue to discuss and build on experiences. It appeared that Associate Lecturers had very firm views about how to do the task, but showed innovation with implementation. During this initial part of the cycle, an understanding was reached with respect to the symbiotic relationship each Associate Lecturer has with either their desktop or Tablet PC. This issue is discussed in greater depth in Adams & Fisher (2007). The OU trial initially ran into issues when instructors were unable to use the Tablet PCs straight away as a result of permissions being set up incorrectly. One of the participants managed to resolve the issues for all and ensured in the second stage of the trial that computers were sent out correctly set up to the new group of instructors.

Post-Trial

Continuation
At USQ the project team members kept their Tablet PCs throughout the project and beyond as they had replaced their desktop computers, but other participants were asked to return the tablets or share with a new participant in the next semester. The rationale behind this approach was to encourage requests for additional tablet puchases and to involve more lecturers and disciplines in the trial.

At the OU, all Tablet PCs were returned to the CETL at the end of the trial, apart from the author's machine which was kept for dissemination events to show the benefits of the Tablet PC for marking. The original six Tablet PCs plus a further four used in another OU project have now been loaned out to the second author to investigate another cycle across two faculties.

Comparison of outcomes of the trials

Number of participants, post-trial use of Tablet PC technology

At USQ, ten academics used the Tablet PCs provided through the learning and teaching grant and the already existing Tablet PC in the four cycles of this trial until the end of 2008, including the first author. Out of those, one participant left the university to take up an administrative position in management and no longer had a need for the technology to support teaching; a second left the university sector altogether. The remaining eight are now enthusiastic Tablet PC users and have since either acquired funding to purchase their own Tablet PC, have access to a recently purchased shared departmental Tablet PC, or had their Tablet PC upgraded to the latest model. All project Tablet PCs are still in working order and in use by the next group of academics.

At the OU the COLMSCT CETL loaned five Tablet PCs to ten Associate Lecturers for the two separate cycles of the trial, with the sixth Tablet PC provided to the author. None of the ten ALs are currently using a university-funded tablet PC. A new cycle is about to commence in a cross-faculty project.

Dissemination

As an outcome of the USQ trial, the participants were able to collect a wide range of what was perceived as good practice examples, which were disseminated at university learning and teaching events, in seminars, and, to a more limited extent, at conferences. A good overview of the exploratory work undertaken can be found in Galligan et al. (2010).

At the OU, the wiki contains examples of good practice and is still open for public access. There was extensive dissemination of the project outcomes, at national and international conferences and local

Assessment Special Interest Groups during the time of the Fellowship. The work was disseminated to a wide range of central academic staff, ALs across different faculties, including hands-on interactive 'show and tell' workshops attended by members of university management.

Pedagogical change

At USQ, the emphasis for all participants was to change current methods of teaching and supporting students, which often meant moving out of the lecturer's comfort zone and taking risks. The technology enabled educators for the first time to communicate efficiently and effectively with their students. This freedom has led to a range of pedagogical innovations, many of which are described in Galligan et al. (2010) in a mathematical sciences context.

Innovation at the OU was only expected within the marking of online assignments, as this had been the initial remit. In the first cycle the participants shared pedagogical approaches. It was in the second cycle that innovations in using the Tablet PC technology became evident and were shared online (Fisher, 2008a). These ideas included highlighting text in an assignment and linking different colours to specific feedback (incorrect spelling, grammatical errors and learning outcomes). Asking ALs to use a Tablet PC for marking assignments instead of a desktop PC caused deep reflection on the task of providing marks and feedback (Adams & Fisher, 2007).

Attitude of university management and change following the trials

At USQ, the dissemination of pioneering work was the basis for an extension of the tablet trial through a university learning and teaching fellowship, awarded for 2009, to provide full teaching relief to the first author for one semester and fund more Tablet PCs. Support from the Deans of all five faculties was secured at application stage, in the form of Tablet PC purchases for the project, and this led to the acquisition of 18 more Tablet PCs. The Division of ICT Services provided funding, and the vice-chancellor supported the purchase of student Tablet PCs to investigate a new direction. This shows that university management were interested in promoting this technology, and willing to invest further to identify the value for student learning. One main outcome of the project is the additional purchase of 40 Tablet PCs within a year following the commencement of the Fellowship, and inclusion of the technology as supported hardware. Tablet PCs at USQ have now been adopted as key technology to support distance and on campus students. Key driver behind this uptake of tablet PCs were the academics involved in this follow-on trial, as they could see benefits for their teaching and requested additional Tablet PCs from management.

At the OU, despite extensive dissemination of outcomes from the Tablet PC project, it has not been possible to convince management to take a proactive lead in supporting Tablet PC technology. This is partly due to scale and cost, of firstly providing Tablet PCs to ALs and extra resources that would be needed to develop the ICT support infrastructure at the OU. The narrow focus taken in the trial limited the perceived usefulness of Tablet PCs to marking. All dissemination occurred through the fellow, rather than spreading the load over a number of central academics. Recently there has been progress at the OU on a Science module, where the course team are trialling inexpensive electronic pens for their ALs to mark assignments. Tablet technology has not moved beyond trial status at the OU.

Recommendations

When comparing the two trials, a number of similar strategies were identified, and shown to be effective. Other strategies were different, and were key to different outcomes. The following recommendations draw from experiences during the two trials, and from this comparison. They are meant to guide others who are considering embarking on a trial of educational technologies, from a bottom up approach, driven by a "champion".

- *Choose the participants carefully:* It is not the number but the type of participants selected that will make a difference. Choose those who have the ability and drive to take a trial further, e.g. enthusiastic lecturers and those who are regarded highly for their teaching excellence.
- *Ensure at least "best effort" ITS support:* This is vital for a successful trial and needs to be established before commencement. The technology needs to be approved by ITS before widespread adoption can occur.
- *Train the participants:* It is crucial to provide both technological and pedagogical training, with a

focus on the needs of an instructor. This includes the provision of a pedagogical guide and examples. In the ideal case, the champion will be a participant or at least directly involved in the use of the technology, which will give them credibility as they are talking from experience. Training can be done remotely, but should include an initial face-to-face session and/or be followed up by a face-to-face session.

- *Foster collegial support:* Encourage "corridor chats", provide a supportive environment, in which everyone shares good practice and it is safe to experiment.
- *Take a sustainable approach:* Plan the use of equipment after the trial has finished, and the provision of technical and pedagogical support. Choose a wide scope to allow participants the freedom to pursue individual innovative approaches. Keep the focus on the future.
- *Share the load:* While it may take only one person to manage a trial, the change will be sustainable when other academics are on side, who will then drive the trial to adoption. Sharing the load among several champions will increase the momentum.
- *Focus on dissemination*: Provide a workload allocation for a research assistant, other than the project leader, who will analyse data and support dissemination and report writing. Collect best practice examples, communicate upwards and sideways. Create a mechanism for tapping into the enthusiasm of participants for dissemination of outcomes.
- *Overcome fear of change:* Disseminate best practice examples to ITS, management and administration.

Conclusions

In this paper we have described first outcomes of a comparison of two Tablet PC trials. We have highlighted differences and commonalities of the two trials, and given recommendations on how to run a successful technology trial based on our experiences. While the list of recommendations is not exhaustive, it may help other academics in higher education environments with the planning of a larger scale trial of tablet or other educational technology in their institution.

Most champions by definition will be enthusiastic and highly motivated individuals, however these characteristics alone do not guarantee a successful trial. Careful planning of the trial is vital, and this includes consideration of staff development in technological and pedagogical directions. It also means making maximum use of informal and formal networks and peer support, and ensuring that outcomes are disseminated by showcasing innovative practice. Evidence of impact gives champions the ability to sustain and inspire long after the initial trial has been completed.

Acknowledgements

The USQ author would like to thank the members of the tablet project team for their trust and courage to trial the unknown, and for their support of new ideas: Christine McDonald, Linda Galligan and Janet Taylor. The USQ tablet trial was undertaken when the first author was employed at USQ. This paper was written when this author was visiting the Open University and Loughborough University, UK.

The OU author wishes to thank the lecturers and students who participated in the initial trial, and the COLMST CETL and the Technology and Education Research Group in the Department of Communication and Systems for funding the research project and a subsequent new project.

References

Adams, A. & Fisher, W. (2007). *Interface Modalities that enhance or inhibit lecturers' assessment 'flow' experiences'.* COLMSCT Web Site. http://www.open.ac.uk/colmsct/resources/details/detail.php?itemId=489b09d4cc848

Beechener, K. & Fisher, W. (2009b). Blending Technology with Pedagogy. *Proceedings of the 4th International Blended Learning Conference 2009 "Engaging Students in the Curriculum"*. University of Hertfordshire. 17 – 18 June, 2009. Editors E.B. Terry, A.L. Jefferies and A. Bracq, 63-68. http://oro.open.ac.uk/17172

Beechener, K. & Fisher, W. (2009a). Making the Technology fit the Pedagogy. *HEA/ICS workshop in 'eTeaching and Learning'*. University of Greenwich. 34-38. http://oro.open.ac.uk/17171/

Bowskill, N., Foster, J., Lally, V. and McConnell, D. (2001). Experiential Professional Development for Networked Learning. *Staff and Educational Development International*, 5(1), 27-43.

Brodie, L. and Loch, B. (2009). *Annotations with a Tablet PC or typed feedback: does it make a difference? In: AaeE 2009: 20th Annual Conference for the Australasian Association for Engineering Education: Engineering the Curriculum*, 6-9 Dec 2009, Adelaide, Australia.

Cromack, J. (2008). Technology and learning-centred education: Research-based support for how the tablet PC embodies the seven principles of good practice in undergraduate education. *In 38TH Annual Frontiers in Education Conference*, pages T2A-1-T2A-4. IEEE, October 2008.

Dede, C. (2005). Planning for neomillennial learning styles. *EDUCAUSE Quarterly*, 28(1). http://www.educause.edu/eq/eqm05/eqm0511.asp

Fisher, W. (2008a). Digital ink Technology for e-assessment. *Proceedings of the 6th International Conference on Education and Information Systems, Technologies and Applications (EISTA 2008)*, 29 June – 2 July 2008, Orlando, Florida, USA. 4-5. http://oro.open.ac.uk/12256/.

Fisher, W. (2008b). Do we engage the student in e-assessment by personalising lecturers' feedback interventions? *In Novel Approaches to Promoting Student Engagement, University of Ulster's Coleraine Campus in Conjunction with the Higher Education Academy Subject Centre, Information for Information and Computer Sciences*. http://oro.open.ac.uk/17112254/

Freake, S. & Underwood, J. (2008). Electronic marking of physics assignments using a Tablet PC. *In New Directions in the teaching of the Physical Sciences In Conjunction with the Higher Education Academy Subject Centre, Physical Sciences Centre* Vol.4. ISSN 1740-9888.

Galligan L., Loch B., McDonald C. & Taylor J. (2010). The use of Tablet and related technologies in mathematics teaching. *Australian Senior Mathematics Journal* 24(1).

Gibbs, G., Simpson, C. (2004-5) Conditions under which assessment supports students' learning. *Learning and Teaching in Higher Education*, 1(1), 3-31. http://www.open.ac.uk/fast/pdfs/Gibbs%20and%20Simpson%202004-05.pdf

Gosper, M., Green, D., McNeill, M., Phillips, R., Preston, G. & Woo, K. (2008). The impact of Web-Based lecture Technologies on Current and Future Practices in Learning and Teaching. *ALTC report*. http://www.cpd.mq.edu.au/teaching/wblt/docs/report/ce6-22_final2.pdf

Harman, C. & Dorman, M. (1998). Enriching distance teaching and learning of undergraduate mathematics using videoconferencing and audiographics, *Distance Education*, 19(2), 299-318.

Laurillard, D. (2009). The pedagogical challenges to collaborative technologies. *Computer-Supported Collaborative Learning*, 4:5-20.

Loch, B. & McDonald, C. (2007). Synchronous chat and electronic ink for distance support in mathematics. *Innovate* 3(3).

Loch, B. & Donovan, D. (2006). Progressive Teaching of Mathematics with Tablet Technology. *e-JIST, e-Journal of Instructional Science and Technology*, 9(2).

Loch, B. & Reushle, S. (2008). The practice of web conferencing: Where are we now? *In Hello! Where are you in the landscape of educational technology? Proceedings ascilite Melbourne 2008*. http://www.ascilite.org.au/conferences/melbourne08/procs/loch.pdf

Logan, M., Franke, K., Sanson, G. & Bailey, N. (2009) Patterns of Tablet Usage across Multiple Learning Domains: a Tablet Comparison Program. *Presentation at WIPTE 2009.*

Mainka, C. (2007). Putting staff first in staff development for the effective use of technology in teaching. *British Journal of Educational Technology*, 38(1), 158-160.

McCloskey, P. (2002). Tablet PCs Stake Out Higher Ed. *Syllabus*, 16(5), (also at: http://campustechnology.com/articles/2002/11/tablet-pcs-stake-out-higher-ed.aspx?sc_lang=en)

Mckenzie, W. & Franke, K. (2009). Active, Constructive, Interactive: How are Tablet PCs Transforming the Learning Experience in Higher Education? *Presentation at the 2009 Australasian Tablets in Education Conference*, Monash University, Melbourne, 3-4 December 2009. http://www.monash.edu/eeducation/assets/documents/atiec/2009atiec-wendymckenzie.pdf

Murphy, R. & Torrance, H. (1987). (Eds.). *Evaluating education: Issues and methods*. Milton Keynes: Open University Press.

Reushle, S., & McDonald, J. (2000). Moving an Australian dual mode university to the online environment: A case study. *Proceedings of ED-MEDIA2000*, June 26-July 1, Montreal, 907-12.

Robinett, C., Leight, M., Malinowski, C. & Butler, J. (2005). *K-12 One-to-one Computing Handbook* http://www.convergemag.com/paper/K-12-One-To-One-Computing-Handbook.html#anchor_eloqua_iframe

Salmon, G. (2002). Approaches to Researching Teaching and Learning Online. In *Networked Learning: Perspectives and Issues*. 195-212. Springer Verlag.

Schön, D. (1991). *The reflective practitioner: How professionals think in action*. England: Ashgate Publishing Ltd.

Smith G. & Ferguson D. (2004). Diagrams and math notation in e-learning: growing pains of a new generation. *Int. Journal of Mathematical Education in Science and Technology*, 35(5), 681-695.

Twining, P. & Evans, D. (2005). Should there be a future for Tablet PCs in schools? *Journal of Interactive Media in Education* (Portable Learning: Experiences with Mobile Devices. Special Issue, eds. Ann Jones, Agnes Kukulska-Hulme and Daisy Mwanza), 2005/20. ISSN:1365-893X http://jime.open.ac.uk/2005/20

Walker, M. (2009). An investigation into written comments on assignments: do students find them usable? *Assessment and Evaluation in Higher Education*, 34 (1), 67-78.

Webber, J. (2010). Action Research as a key to stimulating Innovation and Professional Development in ILT. *Online Newsletter of the Association for Learning Technology*, Issue 19, May 2010. http://newsletter.alt.ac.uk/1ht0p9ctrl1

Weller, M. & Robinson, L. (2002). Scaling up an online course to deal with 12000 students. *Education, Communication and Information*, Apr 2002, 1(3), 307-323.

Wood, E., Willoughby, J., Stern-Cavalcante, W. & Child, C. (2002). Developing a computer workshop to facilitate computer skills and minimise anxiety for early childhood educators. *Journal of Educational Psychology*, 94(1), 164-170.

Author contact details:
Dr Birgit Loch, Engineering and Science Education Research Group, Faculty of Engineering and Industrial Sciences, Swinburne University of Technology, Hawthorn VIC 3122.
Email: bloch@swin.edu.au

Wendy Fisher, Technology and Education Research Group, The Faculty of Mathematics, Computing and Technology, The Open University.
Email: W.A.Fisher@open.ac.uk

Please cite as: Loch, B. & Fisher, W. (2010). Facilitating change: Tablet PC trials across two distance education focused universities. In C.H. Steel, M.J. Keppell, P. Gerbic & S. Housego (Eds.), *Curriculum, technology & transformation for an unknown future. Proceedings ascilite Sydney 2010* (pp.548-558). http://ascilite.org.au/conferences/sydney10/procs/Loch-full.pdf