



What, no lectures!?: experiences from a blended tablet PC classroom

Barbara White and **Jodi Tutty**, School of Information Technology, Charles Darwin University
barbara.white@cdu.edu.au jodi.tutty@cdu.edu.au

Like many other institutions, teaching information technology at Charles Darwin University is still focused on transmissive rather than interactive strategies with the traditional model consisting of 6 hours contact time: a 2 hour lecture; a 2 hour tutorial; and a 2 hour practical. In subjects which require students to understand and apply concepts and principles of coding, the separation of the formal delivery of the information (lecture) with opportunities to explore, apply and practice these concepts and principles (tutorials and practicals) often means that significant re-teaching has to be done as many students are simply not able to understand and complete the tutorial or practical tasks. As Laurillard (1993) notes, lectures while possibly inspirational for some students, may also provide many opportunities for student errors in getting information and making sense of it. Similarly Ramsden (1992) observes that while lectures enable the teacher to 'cover the ground', they are not effective for deep learning outcomes needing activity, responsibility, or interaction as students are often passive and dependent.

This case study reports on two variations of a blended learning approach to teaching first year Information Technology (IT) subjects that was an outcome of two successful infrastructure projects that originated two years earlier. In 2003, two School of Information Technology initiatives enabled a significant rethinking of how the teaching of some subjects could be restructured. As part of a broader strategy to attract and retain more students, three units were converted to a flexible online delivery mode (Evans, Tutty and White 2004). At the same time the school was the successful recipient of a Hewlett Packard competitive philanthropic grant receiving equipment that would enable the establishment of a mobile classroom that included 45 tablet PCs and associated wireless technology (Tutty, White and Pascoe 2005). These almost simultaneous developments led to the implementation of a blended learning teaching approach which integrated wireless enabled, mobile tablet PCs, interactive multimedia content web sites, an online learning management system with students learning in 3 hour face to face workshops.

Flexible/distance learning resources

The flexible learning initiative decided to create resources that would enable a blended learning approach combining face to face instruction with computer mediated instruction (Graham 2005). The online units were planned to provide students with greater flexibility in their study options, improve pedagogy through more interactive experiences and potentially realise significant cost savings (Aycock, Garnham, and Kaleta 2002; Boyle, Bradley, Chalk, Jones, and Pickard 2003; Harley, Henke, and Maher 2004). The resources were to be flexible in three ways:

- **Blended:** To encourage more students into the degree program, flexible meant learning resources that would be used by two groups of students: those learning at a distance from the University and those learning in a face to face situation on campus. Computer mediation was provided in two ways – through web-based interactive multimedia content organised into a series of learning activities and through the use of a learning management system (*Blackboard*). This learning management system provided access to asynchronous discussion forums and an area for general information distribution for both face to face and students studying at a distance. Students were to be encouraged to work together irrespective of their location.
- **Reusable:** The ability to extend the initial set of undergraduate learning resources for use in professional upgrade or development courses, offering new business opportunities for a school struggling with a student downturn and enabling a better return on investment, given the high

development costs in time and money of online materials was important (Luca, Wilson and Sinclair 1999; Morville and Rosenfeld 2002).

- **Graduate outcomes:** In the last decade, the ICT job market has undergone continuous change with graduates needing not only job-specific or technical skills but also more generic skills such as communication, initiative, planning, team building and life long learning skills (DEWA 2004). To meet this demand, in the redevelopment of the online learning materials, resources were developed in modular components so that academics could use them to teach flexibly, to facilitate group learning skills, to be able to source important information from the World Wide Web and to demonstrate significant processes.

Mobile wireless technologies

The intent of the wireless mobile technology grant, was to ‘fuzz out the boundaries’ of traditional teaching blurring the distinction between lectures, tutorials and practicals allowing educational considerations rather than the physical infrastructure to drive the teaching and learning process (Pascoe, Tutty and White 2003). The aim was to create an environment that focused on the student being active and responsible within a collaborative learning process. After receiving the hardware, spot deployments of the tablet PCs and the associated wireless technologies were undertaken to better understand the affordances these new technologies offered for teaching and learning (Conole and Dyke 2004; Ryder and Wilson 1996) in comparison to the affordances available in traditional computer laboratories used for tutorial and practical teaching.

Affordance, a term coined by psychologist Gibson (1977), describes the action possibilities posed by objects in the real world. With the wireless enabled tablet PC the size, portability, connectivity and new digital ink features were explored with a range of students (current IT students, humanities students, early childhood classes, University of the 3rd age members) to understand how our intent of active, responsible collaborative learning environments could be realised. While quite diverse groups were used to explore the new technologies, two experiences were common: the technology readily enabled active engagement (pen input as opposed to keyboard input was important) for all groups and collaboration was readily achieved because of the ubiquitous size and portability of the computer.

As a result of these experiences, it was decided to change our traditional structure to facilitate the integration of the online resources being developed and effectively use the features of the tablet PCs that had been identified to enhance learning opportunities. An integrated 3 hour workshop would replace lectures, tutorials and practicals. Time in the workshops would be used flexibly to include some direct teaching (lecture style), hands on practice in collaborative groups, and problem solving discussions. Each session would have at most 25 face to face students. The layout of the learning space was changed with rows of desks all facing the front of the room replaced with groups of tables for six students. The learning sequences used would follow the online content web site. Three semesters later, this approach has now been used to teach six different IT subjects.

Communities of practice

Communities of practice (COP), a concept first described by Lave and Wenger (1991), describe groups of people who come together to share and to learn from one another face to face and virtually. Used initially in the school to analyse the online development activities, tracking the cultural changes that occurred as academic staff worked in teams to develop the first set of units, it seemed appropriate to also use the COP framework to describe two snapshots of the blended tablet classroom as this approach recognises learning both as a social and a cognitive process. Wenger (1998; p.6) contends, ‘...we all belong to communities of practice. At home, at work at school, in our hobbies...’. Lave and Wenger (1991; p.53) note that:

learning involves the whole person; it implies not only a relation to specific activities, but a relation to social communities – it implies becoming a full participant, a member, a kind of



person. In this view, learning only partly – and often incidentally – implies becoming able to be involved in new activities, to perform new tasks and functions, to master new understandings. Activities, tasks, functions, and understandings do not exist in isolation; they are part of broader systems of relations in which they have meaning.

This wide definition of learning leaves room to consider that students may actually learn something from each other when participating in the social practices that exist in less formal blended classrooms.

Within a community of practice perspective, social interaction in learning is seen as critical. Wenger (1998) argues that the negotiation of meaning is the process by which we experience the world and our engagement in it as meaningful. He writes, ‘By living in the world, we do not make meanings up independently of the world, but neither does the world simply impose meanings on us’ (ibid.; p.53). We negotiate because ‘meaning exists neither in us, nor in the world, but in the dynamic relation of living in the world’ (ibid.; p.54). Wenger (1998) explains that this negotiation of meaning involves the interaction of two constituent processes, participation and reification. Participation predominantly refers to the process while reification is more concerned with the product. Participation is taking part in the meaning making process and also includes the relations with others that reflect this involvement. Reification is ‘giving form to our experience by producing objects that congeal this experience into ‘thingness’ (ibid.; p.58). The more students actively participate and create reifications, the greater the negotiation of meaning or learning that occurs.

Snapshot 1: First year programming subject

A core subject in the Bachelor of Information Technology, this unit is the first in a sequence of programming units. Students taking the unit are predominantly male (over 90%) and all are studying IT.

Workshop organisation

Inheriting the structure of this subject from another lecturer, a one-hour lecture was included and this was adapted to introduce, concepts and major ideas. The workshops covered the detail, such as syntax. With this just in time approach, material was only introduced when it was needed.

Within the workshop, extensive use was made of the unit web site. The site contained clearly laid out activities, with worked examples. A detailed five step process for developing programs was used to scaffold student learning initially. As students’ programming skills improved the structure became less rigid and less detail was provided. Having the five step process explicitly stated allowed students to work at their own pace through the materials. Rather than relying on the lecturer to solve syntax problems, by working through the materials many students solved many of these issues for themselves. In an introductory course with a range of student skills and backgrounds this was a clear advantage. The lecturer was then free to value-add, discussing the finer points of code, suggesting improvements to students’ code and spending time with those students who were struggling.

Anecdotally, the lecturer’s overwhelming impression was how much student and lecturer time, frustration and effort this blended learning approach saved. Before the creation of the online materials, practical classes of around 15 had been hard to manage as students were dependant upon the lecturer for help and became frustrated waiting for that help to arrive. The downside of the web site was that the sequence and pace of instruction was to some extent predetermined and changing material to suit some students was difficult.

Even though the unit contained no planned group work, the level of interaction between students and between the lecturer and students was higher than that observed in a traditional lecture/computer laboratory structure. 74% of students believed that the level of interaction was greater than in a traditional classroom. The informality of the workshops, the active learning students were involved in and the constant rotation of the lecturer around the students probably contributed to this.

The outcomes in this unit have also been pleasing as the discontinued and fail absent rate has dropped from 52% in 2004 to 33% in 2005. A corresponding increase of 11% has also occurred in the pass rate.

Communities of practice

Even though the unit is based strongly on individual work and assessment, the community of practice framework can still be used to analyse the learning environment. For students the community of practice ‘sustains ability to do work’ (Wenger 1998; p.46). For learning to occur an appropriate mix of participation and reification is needed. For example, with programming the reification may be the source code produced, programming standards followed or references used while participation refers to the process of creating the code, understanding the requirements and discussing the design.

In this programming unit, students were constantly involved in reification in the form of producing computer programs. Reification gives form to their understanding and becomes a focus for their negotiation of meaning. As Wenger (1998) explains reification is a two edged sword: labelling helps communication but can also blur real meaning. The 5 step process helped students get started with programming but by providing such a structured process is it really negotiation of meaning by students or simply reproduction without any real understanding? No reification is perfect in capturing practices and understanding but the more restrictive the less chance for students to participate (i.e., express themselves). Conversely limited structure (reification) can limit constructive participation and thus the basis for the negotiation of meaning.

The indication of the proper balance may be if ‘participation and reification transform their relation ... to create new meaning’ (Wenger 1998: p.68). So when students program are they simply reproducing the example or are variations, questions, comments being raised? For example are there different algorithms used to work out problems, variations in the interface design, alternate use of events, questions asked to extend the ideas further and interest in other solutions? Encouraging these and discussion about what constitutes ‘good programming’ or providing a rationale why one approach is better than another are important to ensure negotiation of meaning is occurring.

Participation is the ‘recognition of ourselves in others’ and in the workshop as students struggle they see others struggle. Students’ problems and solutions are often similar and so they participate by recognising this in others. They compare their solutions to others; they compare themselves to other students: ‘everyone else is getting it’, ‘Luis is so good’. As a lecturer we affirm/identify with their struggle and so encourage participation: ‘yes this can be confusing at the beginning’, ‘remember that a lot of these guys have studied programming before – it will be more difficult for them in a few weeks’.

Snapshot 2: First year web development subject

Another core subject in the Bachelor of Information Technology, this unit is designed for a broader audience to introduce a range of IT concepts integrating web page markup, usability, ethics, and project management. Students taking this unit often come from a range of degree programs as well as IT. The gender balance of this unit is not so male oriented with at least 40% of students being female. Many students who take this unit are beginning users of IT so there is great diversity of IT skills and experience.

Workshop organisation

This class was usually divided into three, one-hour blocks with a learning task/focus for each. Initially the tasks involved interrogating information in the content web site, requiring students to share prior knowledge, establishing some shared understandings of the basic concepts of web page delivery and mark-up. The hour block sometimes included a fifteen to twenty minute PowerPoint orientation that demonstrated particular aspects to be learned and a task would then be set for



students to work on individually initially and then in pairs encouraging discussion and sharing. Even when the task didn't involve explicit sharing, it happened anyway.

While students were working on their tasks, the lecturer was free to circulate among students, providing feedback, answering questions and generally ascertaining students' level of mastery with the content/concepts. Catering for a very diverse student group (commonly 40% female; 60% mature age; 65% English as a first language) was then possible directing students to topics in the online resources for practice or similarly extending knowledge and skills through the resource links in the web site. As the semester progressed, students had to take greater responsibility for their own learning, with structured tasks only comprising one hour of the workshop and students responsible for working on their group project for the rest of the time. As the innovation continues, all students (mature age, non English speaking, International) who used the tablets in Semester 1 2005 agreed or strongly agreed that they were satisfied with the quality of this unit.

Communities of practice

In the second case study, a conscious effort was made by the academic to create conditions in the tablet classroom that would be favourable to forming a community of practice where the learning focused on becoming a member of a global community of web developers that were interested in standards based, accessible delivery of web content. Using Wenger's (1998) framework the lecturer explicitly set out to:

- assist students to develop an awareness of the artefacts and practices of the broader global web standards community;
- develop tacit and explicit classroom practices that would emphasise the benefits of team approaches to development consistent with the broader IT/web community; and
- generate a set of practices that would enable students to successfully work on a 'real' web project with an actual client to build a web site to their specifications and needs.

Wenger (1998; p.45) argues that collective learning results in practices that reflect both the pursuit of our enterprises and the attendant social relations. Working with others who share the same conditions is thus a central factor in defining the enterprise they engage in. People 'act as resources to each other, exchanging information making sense of situations and sharing new tricks and ideas as well as keeping each other company and spicing up each others working days' (Wenger 1998; p.47).

Using these notions, the first semester web development classes were facilitated so that 'collective learning' was practiced, valued and explicitly used. Conditions created to achieve this included:

- exchanging information/making sense of situations:
 - creating learning tasks that required students to work together to find a solution in a variety of situations in the first four workshops using the web content site as the starting point for each task and the discussion forum in the learning management system as a means of documenting the group outcomes (reification); and
 - explicitly valuing group solutions discussing how many more ideas/views will be generated providing a richer range of solutions through collaboration;
- acting as a resource to each other:
 - asking students to check and fix one another's markup as a specific legitimate task;
 - getting students to complete checklists on one another's first assignment attempts; and
 - encouraging more experienced student to help students for whom the content of the learning process was a new experience.

Tacit outcomes of this focus was students got to know one another more quickly than normal in a first year, first semester tertiary classroom with a greater sharing of collective prior knowledge of the subject matter as it was a valued enterprise. A further outcome was in the success of the major assessment task for this subject that requires students to work with a real client and build a web site to meet the client needs. In the past this task has been challenging and somewhat problematic for

some groups. This semester for the first time, all groups collaborated to successfully complete the task and delivered a working web site to their client.

Implications for practice

This case study of blending learning occurs at the activity and subject level (as opposed to program or institutional level) where subject activities include both face to face and computer mediated elements (Graham 2005). Initially intended as an enabling blend with the development of the online learning materials addressing issues of access and convenience, the addition of the wireless mobile Tablet PCs, has become what Graham (2005; p.15) categorises as a transforming model of blended learning enabling a

radical transformation of the pedagogy, changing from a model where learners are just receivers of information to a model where learners actively construct knowledge through dynamic interactions

Often seen as barriers to innovation in higher education, environmental issues such as class duration, size, location, and availability of technology have been combined to enable this transformative change. These issues need to be addressed when implementing new technologies and innovative pedagogical practices in a traditional teaching space.

With these changes to pedagogy, there is also a need to understand how the dynamic and complex nature of learning is impacted. A communities of practice model is one method that provides a more holistic framework to consider not only the cognitive aspects of learning in these new environments, but places the learning firmly in the context of the community in which it occurs. As the snapshots show two very different approaches to blended learning (one co-operative and the other individual in focus) can be described using aspects of Wenger's (1998) communities of practice framework.

On a final note, and probably the most important, is how the students perceive this approach to learning. Each semester, the student cohort has been given an opportunity to provide feedback to the lecturers in the form of an online Satisfaction Survey. Students have been positive in their feedback. Only 10% students (n=127) in three semesters of using the blended learning workshop approach have indicated that they would prefer the traditional classroom approach.

References

- Aycock, A., Garnham, C. and Kaleta, R. (2002) *Lessons Learned from the Hybrid Course Project*. [Online] Available: <http://www.uwsa.edu/ttt/articles/garnham2.htm>, [2004, December 6].
- Boyle, T., Bradley, C., Chalk, P., Jones, R. and Pickard, P. (2003) Using blended learning to improve student success rates in learning to program. *Journal of Educational Media*, **28**(2/3), 165-179.
- Conole, G. and Dyke, M. (2004) Understanding and using technological affordances: A response to Boyle and Cook. *ALT-J, Research in Learning Technology*, **12**(3), 301-308.
- Department of Employment and Workplace Relations (DEWR). (2004) DEWR job outlook. [Online] Available: <http://www.workplace.gov.au/WP/Content/Files/WP/EmploymentPublications/JOMain2004.pdf> [2004, December 6].
- Evans, J., Tutty, J. and White, B. (2004) Taking IT online: building a community of practice as a flexible learning strategy. Paper presented at World Conference on Educational Multimedia, Hypermedia and Telecommunications, Lugano, Switzerland.
- Gibson, J.J. (1977) The theory of affordances. In R. Shaw and J. Bransford (Eds), *Perceiving, Acting and Knowing*. Hillsdale, NJ: Erlbaum.
- Graham, C.R. (in press). Chapter 1: Blended learning systems: Definition, current trends, future directions. In C.J. Bonk and C.R. Graham (Eds.). *Handbook of blended learning: Global Perspectives, local designs*. San Francisco, CA: Pfeiffer Publishing [Online] Available: [http://www.publicationsshare.com/graham_intro.pdf](http://www.publicationshare.com/graham_intro.pdf) [2005, June 27].
- Harley, D., Henke, J. and Maher, M. (2004) Rethinking Space and Time: The Role of Internet Technology in a Large Lecture Course. *Innovate: Journal of Online Education*, **1**(1).
- Lave, J. and Wenger, E. (1991) *Situated learning – legitimate peripheral participation*. Cambridge: Cambridge University Press.
- Luca, J., Wilson, D. and Sinclair, A. (1999) Content, Cultural and Client Issues: A CD-ROM Case Study. *CD-ROM Proceedings of Educational Multimedia/Hypermedia and Telecommunications*. Association for the Advancement of Computing in Education, Seattle, Washington, USA.
- Laurillard, D. (1993) *Rethinking University Education*, London: Routledge.



- Morville, P. and Rosenfeld, L. (2002) *Information Architecture for the World Wide Web* (2nd ed.). Tokyo: O'Reilly and Associates Inc.
- Pascoe, R., Tutty, J. and White, B. (2003) *Application for Hewlett Packard Applied Mobile Technology Solutions in Learning Environments: Grant Initiative*. Darwin: NT University.
- Ramsden, P. (1992) *Learning to Teach in Higher Education*. London: Routledge.
- Ryder, M. (1996) Affordances and Constraints of the Internet for Learning and Instruction, Paper presented to a joint session of the *Association for Educational Communications Technology*. Indianapolis, [Online] Available: http://carbon.cudenver.edu/~mryder/aect_96.html [2005 April 14].
- Tutty, J., White, B. and Pascoe, R. (2005) *Experiences from a wireless enabled tablet classroom*. Paper presented at the Seventh Australasian Computing Education Conference, Newcastle.
- Wenger, E. (1998) *Communities of Practice: Learning meaning and identity*. Cambridge: Cambridge University Press.

© 2005 Barbara White and Jodi Tutty.

The authors assign to UniServe Science and educational non-profit institutions a non-exclusive licence to use this document for personal use and in courses of instruction provided that the article is used in full and this copyright statement is reproduced. The authors also grant a non-exclusive licence to UniServe Science to publish this document on the Web (prime sites and mirrors) and in printed form within the UniServe Science 2005 Conference proceedings. Any other usage is prohibited without the express permission of the authors. UniServe Science reserved the right to undertake editorial changes in regard to formatting, length of paper and consistency.