Designing Twenty-first Century Teaching and Learning Spaces for a Teacher Education Program

Petrea Redmond
Learning Futures Institute, Faculty of Education, University of Southern Queensland, Australia
redmond@usq.edu.au

Peter R Albion
Learning Futures Institute, Faculty of Education, University of Southern Queensland, Australia
albion@usq.edu.au

Louise Alexander
Learning Futures Institute, Faculty of Education, University of Southern Queensland, Australia
alexande@usq.edu.au

Abstract: Although the technologies and practices associated with teacher education are subject to constant evolution and occasional dramatic change, changes in program structures and implementation are seldom accompanied by opportunities to redesign the teaching and learning spaces. This paper discusses the conceptualization of twenty-first century teaching and learning spaces in a faculty that had the good fortune for a significant change in the teacher education program to be accompanied by funding for building refurbishment. Despite a strong imperative to incorporate information and communication technologies, the design approach was based on foregrounding pedagogy rather than technology through specifying required functionality before adopting technological solutions.

Background

The Greek philosopher, Heraclitus, is credited with being the first person to observe that the only constant is change. That maxim might be the motto of our age and is as true of teacher education as any other field. The teacher education program at the University of Southern Queensland (USQ) was substantially revised in 2000 (Albion 2000). However, following recent government initiatives and changes to registration requirements, perceived deficiencies in the program prompted a further major revision during 2003 with the new program set for introduction in 2004.

In the previous revision of the Bachelor of Education (BEd) program, information and communication technologies (ICT) were to be addressed through two required courses and by integration across other courses with an emphasis on modelling of ICT use for teaching and learning (Albion 2000). One of the required courses was offered early in the program and dealt with basic ICT skills. The second dealt with pedagogical use of ICT and was located in the third year of the four year BEd program. Integration across other courses was supported by the introduction of mini-labs of four networked computers in six selected teaching spaces and by specific modification of some courses.

The required skills course was taught by the Faculty of Sciences and had limited direct application for teacher education students. Moreover, it was difficult to pitch a single course at a level appropriate to both experienced ICT users and those, mostly mature age, students with limited or no prior experience of ICT. The second required course appeared to meet genuine needs for most students, although it also presented some challenges associated with widely differing skill levels among students. Integration of ICT into other courses and modelling by faculty members was patchy. The reasons for the relative lack of success with integration varied, but included limited skills base among some faculty and students, absence of explicit plans for integration in specific courses and the difficulty of finding time to add new elements to already crowded courses.

During 2003 the team charged with reviewing and revising the BEd program determined that the two required courses should be dropped in favour of a fully integrated approach. The BEd accreditation document (Faculty of Education 2003) indirectly identifies several sources of influence for this change. One is the *New Basics* curriculum reform project (Education Queensland 2000) which promotes inter-disciplinary approaches rather than traditional subjects. Others include the proposition that "technology will become central to all learning" (Australian Council of Deans of Education 2001) and relevant professional standards (Board of Teacher Registration 2002; Education Queensland 2001b, 2002). These influences are synthesized in the statement that the "program reflects the view that effective learning and a greater predisposition to utilize understandings in the ICT area occurs through authentic engagement rather than by separate specialized course offerings" (Faculty of Education 2003, Section C p 26).

The importance of modeling effective teaching practice as an aspect of teacher education is widely accepted. Kennedy (1991) commented that "often, despite their intentions to do otherwise, new teachers teach as they were taught" (p 16) and suggested that the reasons are bound up with the "apprenticeship of observation" that occurs during schooling. Others have suggested that beliefs about the nature of teaching and learning are developed through experience and later applied to new problems that arise in the ill-structured domain of teachers' work (Nespor 1987; Pajares 1992). If graduates of teacher education programs are to adopt new approaches to teaching, then it is important that they experience those approaches in order to establish them in their repertoire. The need for modeling in relation to integration of ICT has been argued previously (Parker 1997; Zachariades & Roberts 1995) and seems likely to be particularly important because of the limited experience of learning with ICT that most teacher education students will have had during their own schooling.

Challenges and Opportunities for Design

Adopting integration and modeling as the sole approach to treating ICT in a teacher education program will require some challenging changes to past practice. For most of the past 20 years teacher preparation programs at USQ have included some treatment of ICT taught mainly in separate courses conducted in computer laboratories (Albion 2000). Over the past 12 years faculty members have made increasing use of ICT, predominantly in the form of word processing, electronic mail and presentation software. The general level of skills has been steadily increasing but is still limited in many cases. The new approach will require many faculty members to develop both new ICT skills and appropriate pedagogical approaches. This will be in sharp contrast to the present situation in which specialists have most often represented ICT with occasional contributions from the more adventurous among the remaining faculty members.

Processes for course design and for professional development and support of faculty members are being worked out but are not treated further in this paper, which deals with the design of teaching and learning spaces. By a fortunate coincidence, funds have been made available for commencement of long overdue refurbishment of the principal building used by the Faculty of Education. First priority has been given to the creation of teaching and learning spaces that will facilitate the integration of ICT. An initial pilot space is to be ready for the 2004 teaching year and will provide a basis for assessing the suitability of various design features for wider implementation.

The Faculty of Education at USQ does not have its own technical services section. Instead it relies upon central university service units. Although this arrangement has economies of scale and generally works well, it is sometimes limiting in its capacity to address the specific needs of the Faculty. Not surprisingly there is a tendency to respond to needs with solutions that have been developed for other purposes and which partially, but often not completely, meet the faculty needs.

In the present project an early decision was taken to seek solutions that were designed to meet faculty needs rather than adopt the less assertive approach of adapting faculty practice to use standard solutions already implemented elsewhere on campus and replicated in the faculty building. Hence the first step in the design process is to identify the pedagogical needs of faculty members from a consideration of the teaching and learning functions to be performed in the refurbished spaces. ICT will surely play a significant part in achieving the desired functionality for the teaching and learning spaces but should not be allowed to drive the design process.

The driving force must be pedagogy rather than technology although it will be important to begin by recognizing the need to model effective integration of ICT for teaching and learning.

Other developments in faculty practices will also bear on the changes. In recent years many faculty members have been responsible for the conduct of classes with sections at a remote campus, about four hours away by car. In some cases this has been achieved by employing appropriate full-time or sessional faculty members at the remote campus. Many such classes have necessitated increased use of ICT for distribution of materials via WebCT, and, where faculty members have not been available at the other campus, simultaneous and/or recorded lectures using PowerPoint with audio or direct interaction between campuses using video conferencing over IP. Although classes have been taught successfully using these techniques, the experience has often been less than satisfactory. In part this has resulted from instructors' lack of ICT skills and familiarity with the facilities, but limitations in the design of the facilities have also contributed to the difficulties experienced in some classes. These limitations included the frequent loss of transmission between rooms with no direct and immediate means of contact, the use of a cabled rather than wireless microphone, the use of a single, remote controlled camera with slow panning speed and the limited maneuverability of the television monitor. Levels of interaction across the campuses were impeded and the students often reacted with frustration that tended to compound the effects of distance rather than bring people closer together.

This paper describes the development of design requirements for the refurbished teaching and learning spaces and discusses some of the key issues faced in creating spaces that respond to the immediate needs of the teacher education program while retaining a high degree of flexibility for accommodation of future needs. Because of the imperative to model effective integration of ICT for teaching and learning, an appropriate base for design of the facility should be derived from consideration of current directions in technology and pedagogy.

Technology

Although there seems to be agreement from many sources that the educational potential of ICT has not been fulfilled (Cuban 2001; Moursund 2002), the precise nature of that potential is less than clear. Part of that potential is to amplify existing practice (first order change), allowing the same things to be done better or more quickly, but there are also possibilities for second order change, doing different things or the same things differently (Moursund 2002).

Compared to previous generations of ICT, such as books and the postal system, the current generation offers more rapid, effectively instantaneous, access to substantially greater amounts of information whether held in local storage or across the network. Similarly it provides for more rapid and information-rich communication with distant persons both synchronously and asynchronously. It also offers a variety of tools for locating, selecting, retrieving, transforming and presenting information. Occasionally ICT may become intrusive and require management strategies to preserve privacy or time for other purposes. Potential advantages for education may include capacity to meet diverse individual needs, convenient access to abundant information, opportunities for more active learning, collaboration at a distance and learning anywhere at anytime (Australian Council of Deans of Education 2001).

A recent study of 174 cases of innovative technology use for teaching and learning in 28 countries described seven identifiable patterns of classroom practice using ICT (Kozma 2003). Clusters were formed around a pattern of interlocking practices but several practices were common to a number of clusters. Practices occurring across multiple clusters included obtaining information, collaborating with others, creating products and publishing results. These practices match the characteristics of ICT described in the previous paragraph and are indicative of the types of educational activities that ICT can support. Teaching and learning spaces for the twenty-first century should support access to ICT in ways that facilitate uses such as those identified here.

Pedagogy

As ICT makes it easier to locate and retrieve current information on demand there is little need to remember any but the most personally significant or frequently used information. As a consequence, traditional pedagogies that

are focused on transmission of knowledge from teacher to learner are less relevant. Instead, education should be less about developing command of a body of knowledge and more about developing persons who are able to work collaboratively to respond to change through problem solving and lifelong learning (Australian Council of Deans of Education 2001). A shift is needed, away from pedagogies designed for transmission of knowledge and towards more constructivist pedagogies that focus on knowledge building.

The *New Basics* project (Education Queensland 2000) incorporates the notion of *Productive Pedagogies* (Education Queensland 2001a), a suite of twenty effective classroom practices grouped in four dimensions: intellectual quality, connectedness, supportive classroom environment and recognition of difference. The productive pedagogies are based on research and practice. They include higher order thinking, substantive conversation, metalanguage, knowledge integration, problem-based curriculum, academic engagement, social support and active citizenship. Assessment is built upon a suite of *Rich Tasks*, which are intended to allow students to demonstrate the outcomes of their learning through performance on transdisciplinary tasks that have obvious connection to the real world.

Because graduates from the BEd program will mostly seek employment in Queensland, it is important to ensure that they are familiar with and able to implement the pedagogical approaches described in the preceding paragraph. However, it is also important to ensure that they have the flexibility to work in other environments. A recent study developed pedagogic benchmarks for ICT in teacher education based on twenty-six examples of good practice from five regions of the world (Kirschner & Davis 2003). The six benchmarks identified from the examples were that "teachers become:

1. competent personal users of ICT;
2. competent to make use of ICT as a mindtool;
3. master a range of educational paradigms that make use of ICT;
4. competent to make use of ICT as a tool for teaching;
5. master a range of assessment paradigms which make use of ICT;
6. understand the policy dimension of the use of ICT for teaching and learning" (p 145).

These benchmarks do not conflict with the directions of the Queensland documents but may imply some additional requirements for graduates of the program to enjoy the widest possible opportunities for employment.

Functional Specification

The relationship between technology and pedagogy is an evolving one. Over the past thirty years our rhetoric has encompassed teaching and learning *about* technology in relation to computer literacy with more recent emphasis on teaching and learning *with* and *through* technology. Recent thinking acknowledges both the potential for learning *through* technology and the importance of learning *about* technology as a tool for living (Australian Council of Deans of Education 2001). Kirschner and Davis (2003) acknowledge the need for teacher education to include both learning how to use ICT and learning via ICT.

Because having ICT in schools is an essential condition for its use there has been a natural inclination to focus efforts on provision of equipment and infrastructure without adequate evidence about practices that work (Roblyer & Knezek 2003) but that emphasis is changing and "we are entering a new phase of technology implementation that is more intensely focused on curriculum, state standards and pedagogy" (McKenzie 2003). McKenzie argues that current developments represent a move away from ICT driving pedagogy and towards pedagogy driving the use of ICT, such that educators create tasks where the use of ICT is integral to the learning process, is connected to the current curriculum and student-centred. The clusters of practices described by Kozma (2003) are indicative of ways that sometimes modest ICT resources can support new approaches to pedagogy.

Because both ICT and pedagogy will continue to evolve it is not possible to predict precise requirements for a teaching and learning space that will serve the needs of the BEd program beyond the immediate future. Nevertheless, it is possible to identify some key design functionality based on the ideas discussed in the previous pages. Describing required functionality rather than specific facilities or equipment should result in a design that responds more to pedagogical needs than to technological possibility and which may be more adaptable to future changes in technology and pedagogy.

Conventional teaching spaces assume that most information flow is associated with transmission from teacher to learner. Education at all levels is increasingly about the networked learning community (Carroll 2000) and spaces need to provide mechanisms for opening the pedagogical process to engagement with a diverse range of participants. As described above, emerging pedagogies engage learners in tasks that involve acquiring information from a variety of sources and transforming it for presentation to a variety of audiences. Much of this activity is accomplished collaboratively in groups of varying sizes. Sources, collaborators and audiences may be within the classroom or connected by network, either synchronously or asynchronously. A teaching and learning space must provide infrastructure that will support the necessary connectivity among people and technologies. The most essential tools for acquiring, transforming and presenting information should be provided, in the room or across the network, but there should also be adequate provision for teacher or learner to connect personally provided tools to the systems in the teaching and learning space.

Although the requirements for working with classes at the remote campus are not specifically mentioned in the description above, the necessary functionality for collaborating across the network is included. In principle at least, links to a class at the remote campus would require equivalent functionality to links with a teacher in a school or any other remote collaborator who could arrange appropriate equipment and a connection with the necessary bandwidth. Depending upon circumstances, collaboration with remote sites might entail text chat over a dialup connection, telephone conversations or full audio/video conferencing.

According to this line of reasoning, the key characteristic of a teaching and learning space for the twenty-first century is connectivity. It seems likely that the particularities of what is to be connected will continue to change rapidly in the foreseeable future. Hence the most important aspect of planning is likely to be providing infrastructure to support connectivity for the widest possible variety of devices.

Practical Planning

First priority is to ensure high bandwidth access to the campus network and beyond. The faculty building is thirty years old and is of reinforced concrete and brick construction. Original cabling provision was for limited electrical wiring. Some network cable was laid in the early 1990s and there have been some upgrades and additions since. Most spaces currently have 10 Mb Ethernet connections. That should be upgraded to 100 Mb and the cabling to the building communications infrastructure should be laid in such a way as to facilitate future upgrades, replacement or additions. In effect that will require the use of accessible conduit or channel with spare capacity.

Most teaching spaces currently have a single network port linked directly to the building communications cabinet. Network connections to each teaching space should be routed to a local cabinet and control centre and from there to multiple ports around the perimeter of the space. They should be configured to allow connection of equipment located in the room and additional devices brought in by faculty members or students. Each teaching and learning space should also have wireless networking and at least one telephone connection cable of initiating or receiving calls on the public telephone network.

The space should support convenient presentation of a variety of sources including (electronic) whiteboard, display boards, overhead projector, computer output, audio and video. The system should allow simple connection of equipment brought into the space and should support the presentation of material from multiple points within the room or remotely across the network. Equally it should be possible to share presentations generated in the space with remote sites.

At least two video cameras should be installed to allow vision of both a presenter at the front of the room and the audience to be shared with a remote location. A suitable combination of fixed, wireless and directional microphones should be provided, together with mixer/amplifier, to allow contributions from all participants to be shared with a remote location.

In addition to a presenter station, the room should be equipped with four to six networked computers with access to common software, media editing capabilities and printer. At least some of the computers should be fitted with video cameras to enable individuals or small groups to conference with similarly equipped remote sites.

Basic furniture, tables and chairs, should support flexible reconfiguration for large and small group activities with access to fixed or portable computing equipment. For some spaces it will be appropriate to provide operable walls or similar facilities to allow the size of the space to be varied to suit different numbers of participants.

Above all the refurbished spaces must retain the flexibility to embrace further changes in pedagogy and technology. Opportunities for redesigning the spaces in which we teach and learn occur infrequently. If past experience is any guide, design decisions made now will impact upon practice twenty years and more in the future.

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