PREREQUISITE PRINCIPLES FOR INTEGRATING (NOT JUST 'TACKING-ON') NEW TECHNOLOGIES IN THE CURRICULA OF TERTIARY EDUCATION LARGE CLASSES

[1.]Richards, C. and [2.]Nason, R.

Faculty of Education
Queensland University of Technology

[1.]Email: c.richards@qut.edu.au

[2.]Email: r.nason@qut.edu.au

Abstract

The recent and growing emphasis on flexible modes of educational delivery involving new communication and information technologies (CITs) is perhaps as much a reaction to, as an anticipation of, increasingly large class contexts of teaching and learning in Australian educational institutions. The obvious convenience and cost efficiencies of developing online and related "distance education" practices of teaching and learning involving new technologies perhaps tends to obscure the practical difficulties as well as underlying cultural and methodological conflicts associated with attempts to integrate new technologies into education. This paper will identify and also address some of the main problems to do with integrating new technologies into the curricula of tertiary educational large classes. It will discuss some of the prerequisite principles identified in on-going action research of efforts over several years to develop an across the curriculum framework for integrating new technologies in a Faculty of Education foundation large-class unit. It will attempt to sketch out an integrated framework for engaging with a range of practical issues and dilemmas involved if one wants to go beyond merely "putting content up on the internet" or "tacking on" new technologies in education.

Keywords

communication and information technologies (CITs) in education; teaching in tertiary education large classes; computer-assisted and online learning; new literacies across-the-curriculum; assessment and an integrated curriculum.

Introduction

Teaching can no longer be conceived as merely the hierarchical transmission of compartmentalised or specialised information into the passive minds of students. Such an approach is increasingly at odds with the practical requirements, generic skills, and applied literacies represented by the communication and information technologies (CITs) of electronic and networked media. As Salomon (1998:8) puts it, the most effective uses of CITs as tools of information gathering, communication, and knowledge construction involve the creation and maintenance of learning environments which scaffold the personal and social construction of knowledge, encourage collaborative learning and promote the investigation of authentic interdisciplinary problems. For CITs to be used as 'normal' practice in education rather than a specialism to be evaded by the generalist (Whiteman, 1998), computer and related electronic media literacies have to be seen as more than just discrete skills for accessing online or computer-mediated content. They have to be integrated into the very processes of teaching, learning and assessment (Oliver, 1996).

In this paper, we describe our efforts to reconstruct through the integrated use of CITs a foundation unit in the Queensland University of Technology's preservice secondary

teacher education program: *Language, Technology and Education*. Between 300-500 students per year with a combined background of over twenty different curriculum specialisations have enrolled in this unit during the past three years. Equivalent to two separate 'language' and 'technology' foundation units, the unit in its earlier incarnations tended to focus on the language and technology components of the unit as discrete items. No formal student evaluations of the unit were undertaken during the first few years it was implemented, but student levels of satisfaction clearly were rather low. One of the most common complaints received from students was the lack of integration between the language and technology components of the unit. In order to address the students' low levels of satisfaction and also to reflect the recent Education Queensland's policies and projections about 'learning technology' (e.g., the *Schooling 2001* initiative), the unit has been going through the process of reconstruction since 1997.

In the first part of the paper, the design-experiment methodology (Brown, 1992; Collins, 1990; Hawkins & Collins, 1992) utilised during the reconstruction of the unit is described. The second part of the paper focuses on the *practical issues and dilemmas* encountered during the reconstruction of the unit and on how we have attempted to resolve these issues and dilemmas. The third part of the paper focuses on a set of *prerequisite principles* required to develop and maintain a learning program involving applied strategies of technological or electronic literacy which we have derived from our experiences in reconstructing the unit. Thus, in this paper, we consider both the theoretical and practical requirements for framing the educational uses of CIT (and their related technological literacies) as "operationalised" learning and reflective practice, and attempt to come up with some general principles of effective practice transferable to other contexts.

Methodology

The study utilized a design-experiment approach which allowed for successive design and refinement of technology-mediated educational innovations. Brown (1992) and Hawkins and Collins (1992) have suggested that such a hermeneutic approach provides a more efficacious means for investigating the use of information technology in educational reform (such as that being conducted in this study) than traditional research designs. Brown also has suggested that the design-experiment methodology has the added advantage of contributing not only to the issues at hand, but also leads to the development and evaluation of theoretical insights which have application beyond the context of a particular study.

In design-experiments, research is conducted through iterative cycles of design, implementation, and evaluation. This is reflected in Phases 2-5 of the present research study which is presented in Figure 1 below. We have completed two iterations of Phases 2-5 since 1997: one in Semester One 1998 and one in Semester One 1999.

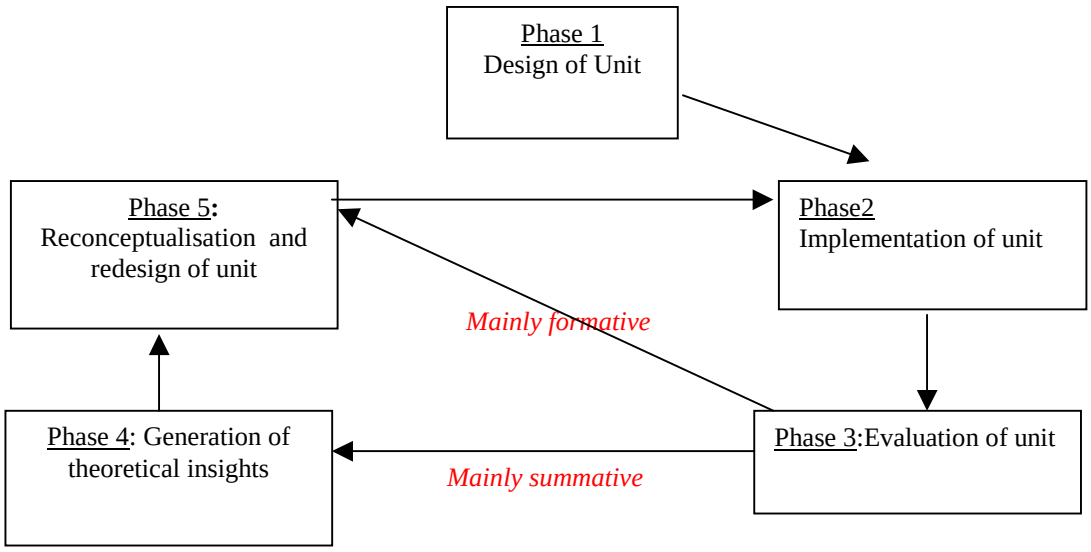

Figure 1: Design of study

Phase 1: Design of unit

In the initial design of the reconstructed unit, the framework of the unit was modified so that:

1. The notion of literacy was extended beyond print-based models of language to take cognisance of new communication and information technologies;

2. The study of new literacies and technologies-across-the-curriculum was integrated; and

3. The notion of computer literacy was extended to include not only generic computer skills (such as wordprocessing and emailing), but also skills in accessing, evaluating and creating hypertext materials within the context of applied language study.

The changes to the framework were reflected in the organisation of the lectures, tutorials and computer workshops. For example, during the planning of the unit, more overt connections were made between the language tutorials and the computer workshops.

Phase 2: Implementation of unit

Prior to the implementation of the initial reconstruction of the unit, the teaching team was briefed about the new revised framework of the unit. Each week during the implementation of the unit, the teaching team met at least once a week to reflect on what had occurred during the current week and to detail the plans for the following week's lecture, tutorial and computer workshop.

Phase3: Evaluation of unit

Feedback from the teaching team at the weekly meetings provided formative evaluation data which enabled the teaching team to make on-the-run modifications to the unit during the semester. Many of the practical issues and dilemmas were identified and resolved in this manner.
At the end of the semester, the unit was summatively evaluated. Data for the summative evaluation was provided from the following sources:

1. The formal QUT Student Evaluation of Unit (SEU);
2. Student artefacts such as assignment work; and
3. The end-of-semester meeting of the teaching team.

This data was analysed in order to ascertain how well the reconstructed unit was meeting its overall aims. Whereas the formative, on-the-run evaluation tended to identify the practical issues and dilemmas, the summative part of the evaluation tended to focus more on the deep-level theoretical issues such as those about curriculum and pedagogy, and learning and assessment.

Phase 4: Generation of theoretical insights

After all the evaluation data had been collected and analysed, sets of theoretical principles which could be used to inform the reconceptualisation and redesign of the unit were generated. One of the major outcomes of this phase of the design-experiment has been the generation of a set of principles for framing a more integrated use of CITs within tertiary education units such as *Language, Technology and Education*.

Phase 5: Reconceptualisation and redesign of the unit

Both the theoretical and practical requirements for framing the educational uses of CIT (and their related technological literacies) as "operationalised" learning and reflective practice were considered during the reconceptualisation and redesign of the unit.

Practical issues and dilemmas

The practical issues and dilemmas encountered during the reconstruction of the unit will be discussed in terms of the relation between *resources* (i.e. the human as well as physical resource requirements for fundamental rather than superficial 'integration'), *curriculum and pedagogy* (i.e., what is taught, and how it is taught in terms of the learner-centred implications of CITs in education), and *learning and assessment* (i.e., in terms of integrating the processes and generic skills of learning using CITs into activities, assignments and assessment criteria).

Resources

Although the issue of having sufficient physical resources such as adequate access to stand-alone computer and network facilities were important factors in the

reconstruction of the unit, we found that the human resources were the factors which required most thought and effort. Based on our experiences and others who have tried to implement similar types of highly integrated CITs and education preservice teacher education units (Cf. Somekh, 1998), no unit or CIT coordinator should ever underestimate the suspicion, resistance and even sheer terror which grips many students (and even lecturers) when confronted with CITs - and especially when attempting more advanced or applied uses of CITs. Therefore, much of our efforts of reconstruction were based around strategies for anticipating and redressing such fears and general 'technology refusal'.

Since our initial efforts to reconstruct the unit in 1997, the number of students has increased from about two hundred to over five hundred students last semester. In terms of CIT knowledge, the students range from complete novices with little experience or knowledge of computers to those with advanced skills. The increased number of students also meant recruiting more teaching staff from different schools – some with little or no experience in using learning technology. The resourcing of the teaching team involved regular workshop sessions to familiarise staff with the activities to be demonstrated and the workshop sheets to be given to students.
A three-pronged approach was taken to the issues of a wide-ranging student skill base and the various pressures on the teaching staff. First, capable past students were employed at nominal rates as laboratory assistants. These student laboratory assistants have transformed the computer laboratory sessions from a situation where lecturers previously struggled alone to supervise and assist around thirty students (many of them fearful and frustrated) at computers into workable, productive sessions. Feedback from the students also indicates that many feel more comfortable being tutored by former students: they perceive it as an extended form of peer teaching. Second, we extended laboratory workshops from one hour to one and half hour sessions. In previous years, many students found that much of their time in the first few weeks of semester especially was taken up with password problems and issues of basic familiarisation. The extra half an hour made a big difference by allowing students to be more relaxed, to take a more applied focus, and provided for discrepancies between slower and more advanced learners. Third, we scheduled weekly help sessions throughout the semester which functioned as catch-up sessions as well as a safety net for struggling students. Dropout rates (which were initially quite high) have been greatly reduced.

Curriculum and pedagogy

Much effort has gone into redesigning the unit so that the curriculum and pedagogy also reflect an integrated approach. As a foundation unit for technology in education, amongst other things, the unit has increasingly developed an applied as well as hands-on learner-centred pedagogy for using CITs over the last few years. Notions of computer literacy and internet literacy are recognised to be a matter of habitual practice and not just the learning of discrete skills. Thus, for instance, efforts have been made to integrate email communications, web conferencing, and web searches into regular unit activities. As well as lecturers modelling student learning activities using a projector before laboratory sessions, students are provided with weekly workshop activity sheets which they can follow at their own pace. Such an approach has improved student learning as it caters for different styles and stages of learning. As Robertson (1996) suggests, the effective integration of CITs in education requires

a progressive framework of coherence to frame as well as complement the 'permeation' effect of applied and habitual learning. Such a framework should therefore correspond with, and relate to, the stages of learning using new technologies described by Somekh (1998): *orientation, preparation, routine, refinement, integration, creative integration*.

The changing nature of the unit as a foundation course has meant that there has been an increasing focus on hands-on activities in tutorials and workshops rather than lectures. Weekly lectures which once primarily focused on content have been replaced by fortnightly lectures which mainly serve to frame the applied purposes of the unit. Also, earlier experiments in putting up full lectures on the internet have given way to posting the structural overviews with Powerpoint slides and additional online resources and links. Lecture attendance has improved significantly and been seen by students as more relevant to unit learning objectives. While the internet offers great possibilities for the 'flexible delivery' of course content for large classes, our experience is that undergraduates resent this if online delivery becomes a mere substitute instead of complement for interaction with lecturers and other students. Online interaction by email and web-conferencing have been usefully integrated into student learning to complement face-to-face interactions.

The move from a discrete skills approach to a more applied emphasis on learning as collaboration, problem-solving and knowledge construction has reinforced notions that new electronic or digital technologies involve media for accessing information, for communicating and for interactive learning which extend traditional notions of literacy (Snyder, 1996). The need to focus on the use of CITs as generic skills of literacy and learning has thus had across-the-curriculum implications which have coincided with the growing recognition that each specialist domain of knowledge has its own 'literacy' - its own jargon or forms of discourse, and typical genres of visual as well as verbal literacy (Cambourne, 1997).

As a unit which involves lecturers from a number of different departments within the Faculty of Education, not all were immediately receptive to the idea that technology across the curriculum might be seen as an extension of 'literacy across the curriculum'. As Somekh (1998) has pointed out, CIT innovations cut across the established patterns of discourse which give members of each department a sense of meaning and identity. However, there has increasingly been general acceptance of the idea that an 'across the curriculum' approach is able to reconcile an emphasis on generic skills with the particular requirements and literacies of different curriculum areas (Fogarty, 1992).

The unit was reconstructed to allow students to reflect on and develop the literacy and learning implications of CITs for different areas of curricular specialisation. A central emphasis of the unit's learner-centred pedagogy is a requirement that each student develops a web page folio of activities and learning resources relevant to a chosen curriculum area. The workshop program has been designed to introduce students to some key generic programs (including web editors and databases) and a range of different basic skills from using network files through to a rudimentary use of graphics. It is a requirement of the unit that students demonstrate a basic familiarisation and competency in a range of computer and internet skills. However, the teaching and learning focus is always more on strategies or ideas of application than the mere demonstration of a particular skill. In short, the students' use of CITs is

framed in terms of the application of generic skills and processes of learning and literacy relevant to specific curriculum areas of knowledge.

Learning and assessment

Obviously, we have had to contend with issues of learning and assessment which have very much overlapped with those of curriculum and pedagogy. Efforts to reconstruct the unit have centred around the premise that applied (i.e. habitual and hands-on) computer and internet literacies using CITs should be integrated into student learning and assessment. This has meant having to directly engage with several difficult issues which have relevance for any large class trying to integrate CITs. The unit emphasis on collaborative learning in 'communities of practice' may have helped to reduce student anxiety in using CITs (Davis, 1993), but perhaps also reinforced the inherent facility of CITs for plagiarism and mere data retrieval. Some lecturers as well as students were initially uncomfortable with the notion that learning with CITs may be approached as a matter of process and not just product. In short, the very purpose and functions of assessment in general needed to be reconsidered.

The applied focus of learning in the unit provided a natural short-circuit for notions of learning as simply a matter of acquiring either discrete skills or content information in a vacuum. Rather, the assessment of learning in this unit has concentrated more on the related abilities of students to put ideas into their own words and to be able to practice skills relevant to a required or chosen context of application. This approach has gone a long way towards counteracting the threat of plagiarism. Students are encouraged to research information and then required to adapt it to their own specific purposes in relation to a chosen curriculum area. Lecturers are therefore able to focus on assessing students' 'constructions' of knowledge and 'operationalised' learning - or, as Salomon (1998:5) puts it, on student knowledge as 'practice' and not just 'possession' (Cf. Also Scardamalia & Bereiter, 1994; Jonassen, 1995). Assessment criteria have increasingly emphasised the element of 'design' involved in applying CIT skills to practical contexts of applications. As well as a term which has application to knowledge as both process and product, the concept of design is undergoing an extension of meaning to include verbal as well as visual notions of literacy and composition across-the-curriculum (Kress, 1997).

The main challenge of assessment in this unit has been one of reconciling both lower-order and higher-order learning - in other words, criteria of competency-based learning on one hand, and criteria of both applied and critical learning on the other. A large cohort of lecturers involved in the unit has meant that the assessment criteria and breakdown of marks have had to be made as explicit as possible. This challenge has to some extent been overcome by the main assignment vehicle for integrating CITs directly into the unit, but it has also required more flexible and multi-dimensional approaches by lecturers. Student motivation to acquire a range of discrete skills as well general literacies relevant to specific curriculum areas has been provided in part by a required folio assignment which progressively integrates weekly student learning activities and responses. The overall assessment of this assignment combines component activities and a range of criteria that cover elements of basic competency and applied or critical application. Reasonable consensus and consistency in marking by the teaching team is achieved through moderation sessions.

Principles for an integrated framework

An analysis of our efforts to reconstruct a large class unit lead to the identification of some basic principles for framing a more integrated use of CITs. A distinction was made between some general framing principles and more specific principles of application. The general principles reflect a view that CITs mediate and extend processes of literacy and learning in terms of a range of generic skills that have particular applications to different curriculum areas. The specific principles of application reflect an integrated and strategic approach to the relation between resources, curriculum and pedagogy, and learning and assessment.

General framing principles

An integrated use of CITs in education presupposes:

- that students are provided with a context for viewing CITs as an extended *media* of their literacy and an everyday *tool* of their learning;
- that teachers model flexible, adaptable and transferable *attitudes* about the use of CITs in education as well as the process of learning across the curriculum;
- that strategic rather than *ad hoc* consideration be given to the relation between *resources, curriculum and pedagogy*, and *learning and assessment*.

Specific principles of application

In order for these general principles to be achieved, the following specific principles need to be considered and implemented. The development and maintenance of a large class learning program involving new CITs will likely be more effective where:

- the latent fears and resistances of teachers and students alike are anticipated and catered for as far as possible (e.g., through additional help or catch-up sessions, and the provision of 'emergency' assistance if needed);
- appropriate consideration is given to the wide ranges of students' computer literacies, learning styles and access to computers and the internet outside class times;
- peer-based teaching and collaborative learning are used to reduce anxiety and to complement the modelling efforts of teachers;
- online means of delivering course 'content' and the use of workshop sheets complement rather than substitute for interaction with teachers and other students;
- students' use of CITs are framed in terms of the application of generic skills and processes of learning and literacy relevant to specific curriculum areas;
- the learning focus is on applied uses of CITs and not on discrete skills or information in a vacuum;
- the process of learning using CITs is integrated into the assessment program;

- assessment criteria reconcile basic competencies and more applied or critical constructions of knowledge (i.e. lower and higher order modes of learning) using CITs.

Conclusion

Limited perceptions of the use of CITs in education tend to focus on the facility of computers and the internet to store information alone. Such 'tacked-on' or ad hoc perceptions of the use of CITs reinforce traditional transmission models of education which imply a hierarchical pedagogy and the passive learning of students. This paper has argued that a more integrated constructivist approach is needed to effectively utilize the educational possibilities of CITs in education especially, but especially in large class contexts. It has further suggested that an integrated approach which focuses on the application of CITs as generic skills and not just a discrete skills or information alone has across-the-curriculum application to the specific needs and requirements of different areas of knowledge. On this basis, and in relation to practical issues and dilemmas encountered when attempting to reconstruct a Faculty of Education large class foundation unit, the paper has thus attempted to identify some key principles of effective practice for attempting to systematically integrate CITs into tertiary education large classes. Conversely, we conclude that an integrated use of CITs presupposes more applied and leaner-centred contexts of teaching and learning, and more strategic consideration of the relation between resources, curriculum and assessment.

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